FARWELL ROAD LANDFILL

CATTARAUGUS COUNTY

TOWN OF ISCHUA , NEW YORK

SITE MANAGEMENT PLAN

NYSDEC Site Number: [905024]

Prepared for:

Cattaraugus County Department of Public Works
Jack Ellis Drive
8810 Route 242
Little Valley, NY 14755

Prepared by:

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Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date
1	4-21-23	Initial Submittal	

APRIL 2023

CERTIFICATION STATEMENT

I, ELIZABETH DONNER, certify that I am currently a NYS registered professional engineer as in defined in 6 NYCRR Part 375 and that this Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

E. Donner [P.E.]

4/23/2023 DATE

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List of Acronyms

AS	Air Sparging
ASP	Analytical Services Protocol
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CAMP	Community Air Monitoring Plan
C/D	Construction and Demolition
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COC	Certificate of Completion
CO2	Carbon Dioxide
CP	Commissioner Policy
DER	Division of Environmental Remediation
EC	Engineering Control
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
ERP	Environmental Restoration Program
EWP	Excavation Work Plan
GHG	Green House Gas
GWE&T	Groundwater Extraction and Treatment
HASP	Health and Safety Plan
IC	Institutional Control
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYCRR	New York Codes, Rules and Regulations
O&M	Operation and Maintenance
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PID	Photoionization Detector
PRP	Potentially Responsible Party
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RP	Remedial Party
RSO	Remedial System Optimization
SAC	State Assistance Contract
SCG	Standards, Criteria and Guidelines

SCO	Soil Cleanup Objective
SMP	Site Management Plan
SOP	Standard Operating Procedures
SOW	Statement of Work
SPDES	State Pollutant Discharge Elimination System
SSD	Sub-slab Depressurization
SVE	Soil Vapor Extraction
SVI	Soil Vapor Intrusion
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VCA	Voluntary Cleanup Agreement
VCP	Voluntary Cleanup Program

ES EXECUTIVE SUMMARY

The following provides a brief summary of the controls implemented for the Site, as well as the inspections, monitoring, maintenance and reporting activities required by this Site Management Plan:

Site Identification:	NYSDEC Site No. 905024, Farwell Road Landfill - 1430 Farwell Road, Town of Ischua, NY
Institutional Controls:	1. The property is zoned for commercial use and the majority of the site is currently a closed landfill. The Site contains two buildings located south of the landfill. One of the buildings is used by the County DPW for storage of County owned equipment and the other is used as a for transfer station for aluminum and metal can recyclables.
	2. The IC boundaries are shown on Figures 1A- 1C. These ICs are: • Compliance with the Deed Restriction filed with the Cattaraugus County Clerk's Office (February 2023) under Instrument No. 202302210 by Cattaraugus County and the County's successors and assigns; • Operation and maintenance of all IC's and ECs in accordance with the SMP (previously the FLCD); • Inspection of all ECs at the Site in accordance with the SMP; • No person shall engage in any activity that will, or that reasonably is anticipated to prevent or interfere significantly with any proposed, ongoing or completed program at the Site or that will or is reasonably foreseeable to expose the public health or the environment to a significantly increased threat of harm or damage; • Reporting of all required monitoring data in accordance with the SMP; • The Site may only be used for solid waste management facilities and may not ever be used for other purposes without the express written waiver of such prohibition by the NYSDEC; • The use of the groundwater underlying the Site is prohibited without: treatment rendering it safe for intended use; and permission from the NYSDEC; • The Deed Restrictions shall run with the land and shall be binding upon all future owners of the Site; and • The NYSDEC shall retain the right to access the Site at any time in order to evaluate any and all controls.
	3. All ECs must be inspected at a frequency and in a manner defined in the SMP.

Site Identification:	NYSDEC Site No. 905024, Farwell Road Landfill - 1430 Farwell Road, Town of Ischua, NY

Engineering Controls:	1. Soil Cover	
	2. Landfill Cap	
	3. Leachate Collection System	
	4. Groundwater Monitoring Wells	
Inspections:		Frequency
1. Site-wide inspections		April through November
Monitoring:		
1. Groundwater Monitoring Wells: MW-14S, MW-14I, MW-15S, MW-15I, MW-16S, MW-16I, MW-17I, MW-17S, MW-21, MW-22, and MW-23		Annually (May of each year)
2. Groundwater Monitoring Wells: MW-6, MW-9D, MW-10S, MW-10D, MW-11S, MW-11D and MW-13D		Biennially (May of every other year)
3. Leachate Sampling Point: Leachate storage tank (L-1).		Annually (May of each year)
Maintenance:		
1. Swale maintenance		As needed
2. Mowing the Landfill Cap		Annually
Reporting:		
1. Water Quality Monitoring		Annually
2. Periodic Review Report		Annually

Further descriptions of the above requirements are provided in detail in the latter sections of this Site Management Plan.

1.0 INTRODUCTION

1.1 General

This Site Management Plan (SMP) is a required element of the remedial program for the Farwell Road Landfill located in Town of Ischua, New York (hereinafter referred to as the "Site"). See Figure 1. The Site is currently in the New York State (NYS) Inactive Hazardous Waste Disposal Site Remedial Program Site No. [905024] which is administered by New York State Department of Environmental Conservation (NYSDEC).

Cattaraugus County entered into an Order on Consent (B9-0489-96-02), on July 23, 1998 with the NYSDEC to remediate the site. A figure showing the site location and boundaries of this site is provided in Figure 1. Figure 1A depicts the general outline of the County owned property. The Site is comprised of two individual adjoining tax parcels (i.e. 68.001-1-18 and 68.003-1-1), which are depicted on Figures 1B and 1C. The boundaries of the site are more fully described in the metes and bounds site description that is part of the Deed Restrictions included in Appendix C.

After completion of the remedial work, some contamination was left at this site, which is hereafter referred to as "remaining contamination". Institutional and Engineering Controls (ICs and ECs) have been incorporated into the site remedy to control exposure to remaining contamination to ensure protection of public health and the environment. A Deed Restriction granted to the NYSDEC, and recorded with the Cattaraugus County Clerk, requires compliance with this SMP and all ECs and ICs placed on the site.

This SMP was prepared to manage remaining contamination at the site until the Deed Restriction is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Deed Restriction and the grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This SMP details the site-specific implementation procedures that are required by the Deed Restriction. Failure to properly implement the SMP is a violation of the Deed Restriction, which is grounds for revocation of the Certificate of Completion (COC);
- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6NYCRR Part 375, and the Order on Consent (Index B9-0489-96-02 Site # 905024) for the site, and thereby subject to applicable penalties.

All reports associated with the site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State. A list of contacts for persons involved with the site is provided in Appendix A of this SMP.

This SMP was prepared by Greenman-Pedersen Inc., on behalf of Cattaraugus County, in general in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010, and the guidelines provided by the NYSDEC. This SMP serves as an update to the *Farwell Landfill Comprehensive Document (Work Plan, OM&M Manual and EMP), Cattaraugus County, NY August 2001*, prepared by Stearns & Wheler, LLC Environmental Engineers & Scientists. This SMP has also been updated to reflect the *Farwell Road Landfill, Site No.: 905024 Ischua, Cattaraugus County, Post-Closure Monitoring Reduction Request*, dated July 20, 2020, prepared by the Cattaraugus Department of Public Works which was subsequently accepted by the NYSDEC September 14, 2020. This SMP addresses the means for implementing the ICs and/or ECs that are required by the Deed Restriction for the site.

1.2 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, upgrades to or shut-down of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the site conditions. In accordance with the Deed Restriction for the site, the NYSDEC will provide a notice of any approved changes to the SMP, and append these notices to the SMP that is retained in its files.

1.3 Notifications

Notifications will be submitted by the property owner to the NYSDEC, as needed, in accordance with NYSDEC's DER – 10 for the following reasons:

- 60-day advance notice of any proposed changes in site use that are required under the terms of the Order on Consent, 6NYCRR Part 375 and/or Environmental Conservation Law.
- 7-day advance notice of any field activity associated with the remedial program.
- 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan.
- Notice within 48-hours of any damage or defect to the foundation, structures or EC that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
- Verbal notice by noon of the following day of any emergency, such as a fire; flood; or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

Any change in the ownership of the site or the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser/Remedial Party has been provided with a copy of the Order on Consent, and all approved work plans and reports, including this SMP.

- Within 15 days after the transfer of all or part of the site, the new owner's name, contact representative, and contact information will be confirmed in writing to the NYSDEC.

Table 1 on the following page includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix A.

Table 1: Notifications*

Name	**Contact Information**
Benjamin McPherson (NYSDEC PM)	716-851-7220; benjamin.mcpherson@dec.ny.us
Andrea Caprio (NYSDEC Region 9 HW Remediation Engineer)	716-851-7220; andrea.caprio@dec.ny.us
Kelly Lewandowski [NYSDEC Site Control]	518-402-9553; kelly.lewandowski@dec.ny.us

* Note: Notifications are subject to change and will be updated as necessary.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Site Location and Description

The site is located on Farwell Road west of NYS Route 16 in the Town of Ischua, Cattaraugus County, New York. The landfill occupies approximately 16 acres of the northern portion of a 205-acre property owned by the County. The area surrounding the landfill is primarily rural and agricultural. The landfill is bounded to the south by Farwell Road, to the west by a narrow strip of trees and fields and to the north and east by an active Buffalo & Pittsburgh Railroad line and Ischua Creek. At its closest point, the creek is approximately 400 feet from the landfill. Figure 1 shows the location of the Site and Figure 1A depicts the general outline of the County owned property. The 16-acre site is encompassed within two individual adjoining tax parcels (i.e. 68.001-1-18 and 68.003-1-1), which are depicted on Figures 1B and 1C. The boundaries of the site are more fully described in Appendix C – Deed Restriction. The owner of the site parcel(s) at the time of issuance of this SMP is: Cattaraugus County

2.2 Physical Setting

2.2.1 Land Use

The Site contains two buildings located south of the landfill. One of the buildings is used by the County DPW for storage of County owned equipment and the other is used as a transfer station for aluminum and metal can recyclables. The Site is zoned commercial, and the majority of the site is currently a closed landfill. A yard waste drop off facility is located south Farwell Road opposite the landfill. On a biennial basis the County solicits quotes from landscaping and contracting companies to grind the yard waste and haul the materials for disposal and/or reuse. Many County residents as well as businesses take wood chips, mulch and topsoil from the site at no charge. County residents have open access to the processed materials and if they make arrangements with the County's recycling truck driver in advance, he will load it for them with the loader the County has on site.

The properties adjoining the Site and in the neighborhood surrounding the Site primarily include rural and agricultural properties. The properties immediately south of the Site include undeveloped forested properties; the properties immediately north and east of the Site include an active Buffalo & Pittsburgh Railroad line and Ischua Creek beyond which are undeveloped forested properties; and the properties to the west of the Site include undeveloped forested properties. Southwest of the site are unimproved roads that lead to seasonal residences.

2.2.2 Geology

The surficial geology of the Site consists of a layered assortment of glacial deposits from the advance and retreat of glacial ice during the last ice age. The uppermost stratigraphic unit is a layer of glacial till containing silts, clays, sand and gravel, which is underlain by a coarser-grained deposit of silty sand and gravel (glaciofluvial layer). Below the silty sand and gravel is another layer of till.

The upper till layer is reported to be greater than 70 to 80 feet thick in the western portion of the site and thins to approximately 30 feet thick along the eastern portion of the site eventually being replaced by alluvial deposits of silt adjacent to Ischua Creek. The glaciofluvial layer is approximately 10 to 15 feet thick. The lower till layer is estimated to be 40 to 70 feet thick. These overburden layers rest on sedimentary bedrock consisting of highly fractured, fine-grained sandstone interbedded with thin layers of shale. A hydrogeological cross section is shown in Figure 4. Monitoring well boring logs are provided in Appendix H.

2.2.3 Hydrogeology

Groundwater generally flows from northwest to the southeast on the Site where it converges into Ischua Creek. Historical data reports that there is vertical groundwater flow between the overburden layers. The average groundwater seepage velocity across the Site was estimated to be 0.2 feet per day based on hydraulic conductivity tests in site wells. The flow direction of groundwater is contoured at least annually as part of the long-term water quality monitoring program. Groundwater contour maps are included in the fourth quarter/annual water quality reports prepared at the end of each year.

A groundwater contour map from the 2022 Annual Water Quality Monitoring Report is shown in Figure 3. A hydrogeologic cross section developed during the Remedial Investigation is included as Figure 4. Groundwater elevation data is from the 2022 Annual Water Quality sampling event and is provided in Table 2. Groundwater monitoring well construction logs are provided in Appendix H.

2.3 Investigation and Remedial History

The following narrative provides a remedial history timeline and a brief summary of the available project records to document key investigative and remedial milestones for the Site. Full titles for each of the reports referenced below are provided in Section 8.0 – References.

2.3.1 Site History

Disposal operations at the landfill began in 1975. The landfill was constructed in three phases to form a contiguous landfill. The Phase I and Phase II areas of the landfill are unlined. The disposal of municipal solid wastes, resource recovery (incinerator) ash, sewage treatment sludge and NYSDEC approved non-hazardous industrial wastes took place in these two areas until 1985, when they reached capacity. In 1984 the NYSDEC issued an Order on Consent (File #84-106) to the County to bring the landfill into compliance with New York State regulations (6NYCRR Part 363) for solid waste management facilities. The order required the County to begin hydrogeological studies, install a groundwater monitoring system and properly close the landfill. Also, in 1984 in response to a Community Right to Know Survey, the Alcas Cutlery Corporation stated that it disposed of approximately 8.5 tons of trichloroethene (TCE) sludge mixed with sawdust at the landfill between 1975 and 1980. The disposal time period indicates that the TCE wastes were disposed of in the unlined portions of the landfill (i.e. Phases I and II). In 1987 monitoring for USEPA priority pollutants was added to the groundwater monitoring program and results showed the presence of volatile organic compounds (VOCs), primarily chlorinated solvents, including TCE.

The Phase III area of the landfill was constructed with a compacted soil liner and a leachate collection system. This area of the landfill accepted only commercial, permitted industrial, C&D waste and incinerator ash. The ash was used primarily as daily cover. In 1988 the landfill stopped accepting waste at the end of the year and a closure plan and a quarterly groundwater monitoring plan was established. This area of the landfill reached capacity and was closed in 1989. Landfill closure included the capping of the entire landfill with 18 inches of compacted low permeability soil followed by a vegetated six-inch topsoil layer. Two former leachate collection ponds at the southeastern corner of the landfill were dredged and the sediments were disposed of in the landfill. One of the ponds was backfilled with clean soils while the other was lined with a low permeability compacted soil to receive surface water runoff from the landfill. Also, during closure, leachate collection piping was also added to the southeastern, eastern and western sides of the landfill where leachate outbreaks had been historically observed. Currently leachate from the landfill is collected and combined in two 10,000-gallon underground storage tanks located south of the landfill, near the transfer station. The stored leachate is pumped from the USTs as needed and transported off-site to a permitted wastewater treatment plant. A construction monitoring report was prepared in early 1990, certifying the landfill was closed in accordance with the approved closure plan. In 1989, an Order on Consent (File #89-71) was issued to the County to up-hold a 30-year post closure maintenance and monitoring program in compliance with NYS solid waste regulations.

Underlying soils in the disposal areas consist of glacial till containing coarse sand and gravel. The porous nature of these soils has allowed TCE contamination to migrate to the confined principal aquifer below this disposal area. TCE levels in this aquifer were historically detected at concentrations as high as 10 to 25 times the applicable groundwater standard. As a result, in 1996, the NYSDEC classified the landfill as a Class 2 inactive hazardous waste site. Contamination has been found in wells as far as 550 feet south of the landfill.

An Order on Consent (File # B-0489-96-02) was issued to the County in 1989 to complete a focused Remedial Investigation and Feasibility Study (RI/FS), which was completed in 1999 to compile the site information necessary to develop a strategy for addressing the chlorinated VOCs migrating from the landfill. Based on the findings of the RI/FS, the NYSDEC and the New York State Department of Health (NYSDOH) selected a remedy and issued a Record of Decision in March 2000. The ROD indicated that the chlorinated VOCs would be addressed via natural attenuation. In order to monitor the effectiveness of the natural attenuation, the ROD required the installation of compliance monitoring wells (MW-21, MW-22 and MW-23) at locations approximately one-quarter mile downgradient of the landfill and long-term water quality monitoring at the landfill. Additionally, the ROD required cap repairs, which were completed in 2002. VOCs have since been detected in two (MW-21 and MW-22) of the three downgradient compliance wells. The CCDPW installed two additional compliance wells (MW-24 and MW-25) at locations approximately 500 feet and 1,000 feet, respectively, downgradient of the existing compliance wells.

Water quality monitoring has been performed at the FL since the late 1970s. The permanent monitoring program for the FL includes Operation, Maintenance & Monitoring (OM&M) monitoring locations and Part 360 monitoring locations. The monitoring network currently consists of 23 groundwater monitoring wells (15 groundwater monitoring wells part of OM&M monitoring program and eight groundwater monitoring wells part of the Part 360 monitoring program), one on-site and three off-site surface water monitoring locations (previously part of the Part 360 program), three piezometer/off-site water level monitoring locations and one leachate collection system point (sampled quarterly as part of the Part 360 program).

In January 2008, the NYSDEC sent a letter to the County indicating that the ROD objectives had been successfully met and therefore it was appropriate to reclassify the Site from Class 2 to Class 4. Class 4 means the site is properly closed but requires continued management. In light this reclassification as well as the results of previous sampling events that shows the VOC plume to be static and continuing evidence that natural attenuation of the VOC plume is ongoing, the County proposed modifications to the sampling plan, which were subsequently approved by the NYSDEC. These changes were limited to the OM&M program wells, no changes to the Part 360 program wells, the leachate samples or the surface water samples were made. Changes to the sampling program for the OM&M wells included the following:

- The analysis of the samples from the OM&M program wells changed from quarterly analysis for Part 360 Baseline Parameters to analysis of Baseline VOCs only.
- The analysis of dissolved gases in the OM&M program was changed from quarterly collection and analysis to annual collection and analysis.

The Cattaraugus County Department of Public Works submitted the *Post-Closure Landfill Monitoring Reduction Request* in July 2020 to the NYSDEC in accordance with 6NYCRR Part 360-10. The basis for the proposed analytical list modifications and proposed reduction in monitoring location and frequency is based on historical groundwater data exhibiting generally static or decreasing trends since 2003. This monitoring reduction request specifically requested modifications to the requirements for each of the groundwater monitoring programs occurring at the site, the Part 360 monitoring program and the OM&M monitoring program. The changes Part 360 monitoring program included the following:

- Reduction in the frequency of groundwater sampling analysis from annual to biennially (May every other year);
- Removal of surface water sampling locations SW-1, SW-2, SW-3, and SW-4;

- A reduction in the laboratory analytical list for groundwater samples to a modified Part 360 baseline list. The proposed monitoring will include sampling and analysis for a modified baseline parameter analytical list that will include the following for all Part 360 monitoring points:

    - Removal of metals analysis

    - Maintaining analysis for the VOCs included on the Part 360 Baseline Parameters analytical list;

    - Maintaining analysis of the leachate indicators included on the Part 360 Baseline Parameters analytical list.

- Reduction in the frequency of the leachate collection system to be analyzed for the Part 360 Expanded Parameters list from a quarterly to an annual basis.

Changes to the sampling program for OM&M wells include the following changes:

- Reduction in monitoring frequency at all OM&M program wells from quarterly to annual;

- Reduction in groundwater elevation monitoring of the piezometer to annually;

- Removal of downgradient sampling locations MW-19, MW-20, MW-24, and MW-25 (wells to be left in place and to be used for measuring groundwater elevations during sampling events);

- Removal of dissolved gas analytical requirement from all OM&M program groundwater samples, with the exception of dissolved oxygen which will continue to be monitored and recorded as a field parameter at each OM&M program well sampled during each monitoring event.

2.3.2 Summary of Remedial Investigation Findings

A Remedial Investigation (RI) was performed to define the nature and extent of any contamination resulting from previous activities at the Site. The RI was conducted in two phases, supplementing the information gathered during previous hydrogeological studies and the groundwater monitoring program which were conducted as part of the landfill closure/post-closure activities. The first phase of the RI was conducted between August and September 1998 and the second phase between August and September 1999. A report entitled *Remedial Investigation-Farwell Landfill* (February 1999) was prepared to describe the field activities and findings of the RI in detail.

The RI included the following activities:

- Installation of four additional groundwater monitoring wells to further define hydrogeological conditions;
- Sampling and analysis of groundwater from twenty of the site monitoring wells to determine the extent of contamination;
- Sampling of surface water and sediment from Ischua Creek, the pond located on the eastern edge of the landfill and the pond located near the railroad track;
- Sampling of the leachate from the landfill collection system;
- Conducting a survey to identify private drinking water wells in the area;
- Performing a qualitative Health Risk Assessment; and
- Completing a Fish and Wildlife Impact Analysis.

To determine which media are contaminated at levels of concern, the RI analytical data were compared to environmental Standards, Criteria and Guidance values (SCGs). Groundwater, drinking water and surface water SCGs identified for the landfill were based on NYSDEC Ambient Water Quality Standards and Guidance Values and Part V of the NYS Sanitary Code. Guidance values for evaluation contamination in sediments were obtained from NYSDEC's *Technical Guidance for Screening Contaminated Sediments*. Since the landfill cap effectively eliminated exposure to contaminated soils, the RI focused on the groundwater, surface water and sediments.

The RI essentially determined that based on the detected concentrations of the contaminated media and the potential human health and environmental exposure routes, certain media and areas of the Site required remediation.

Below is a summary from the ROD of site conditions when the RI was performed in 1999. Chemical concentrations are reported in parts per billion (ppb) and parts per million (ppm). For comparison purposes, where applicable, SCGs are provided for each medium.

Groundwater

Groundwater monitoring wells have been installed at the landfill in various phases since the 1970s. Figure 2 depicts the on-site monitoring network as well as the locations of the five off-site compliance monitoring wells. Since 1988, when quarterly groundwater monitoring for VOCs began, a number of VOCs were detected, including trichloroethene (TCE), 1,1,1-trichloroethane (1,1,1 TCA); and benzene. Other VOCs detected include compounds that may have been produced from the chemical and/or biological degradation of TCE and 1,1,1 TCA; degradation daughter products such as chloroethane, 1,1-dichloroethane (1,1 DCA), cis-1,2-dichloroethene (1,2 DCE), 1,1-dichloroethene (1,1 DCE) and vinyl chloride were detected in site groundwater. Table 1 from NYSDEC's 2000 ROD summarizes the extent of contamination for the contaminants of concern in groundwater and compares the data with the SCGs for the site.

Eleven of the 19 monitoring wells sampled in the first phase of the RI contained at least one of the VOCs of concern at a concentration exceeding its SCG. It appeared that the majority of the landfill related impacts to groundwater were confined to the immediate downgradient vicinity of the landfill. Only 2 of the 19 monitoring wells sampled are installed in the bedrock, MW-6 upgradient of the landfill and MW-18D located east of Ischua Creek. The other monitoring wells were installed in overburden: the upper till, the glaciofluvial layer and the lower till/bedrock interface. Contaminated groundwater was found in all of the overburden units at the site, including the lower till at the overburden/bedrock interface. This reflects the degree of vertical flow of groundwater between the overburden units.

The second phase of the RI included follow-up sampling of the monitoring well MW-19S and bedrock well MW-20D, which had recently been installed. Both monitoring wells are located south (downgradient) of the landfill and were placed near the anticipated edge of the area of impacted groundwater. In this second groundwater sample from MW-

19S, 1,1 DCA was the only VOC detected; the 0.3 ppb found was well below the 5 ppb groundwater quality standard. In contrast, the first sample collected from MW-19S contained 20 ppb of 1,1 DCA as well as chloroethane (9 ppb) and l,1,1 TCA (12 ppb).

Acetone and 2-butanone were the only two VOCs detected in the bedrock monitoring well MW-20D, but these two VOCs were also found in similar concentrations in the method blanks, indicating that they were likely due to laboratory contamination. Monitoring well MW-20D was installed below the fractured surface of the bedrock. The findings from the bedrock monitoring well MW-20D suggests that the groundwater contamination is confined to the overburden.

Metals detected above SCGs in one or more the unfiltered samples of groundwater included: iron, manganese, sodium, magnesium, arsenic, lead, antimony, barium, cadmium and zinc. In the one background/upgradient well sampled (MW-6), the concentrations of iron (1,830 ppb), manganese (515 ppb) and sodium (21,700 ppb) detected were above groundwater SCGs, suggesting that these substances are naturally elevated. Similarly, the concentration of magnesium (22,500 ppb) in the background well, while below the 35,000 ppb SCG, also suggests naturally elevated levels. The only instances of elevated arsenic concentrations were found in monitoring wells MW-l8S and MW-18D located on the opposite side of Ischua Creek, and therefore unlikely attributable to the landfill. Lead exceeded the groundwater SCG in only the unfiltered samples of groundwater; it was not detected in filtered samples. The instances of elevated concentrations of antimony, barium, cadmium and zinc were generally few; the geometric mean concentrations of these metals were all below their respective groundwater SCGs.

In general, there was little correlation found between the occurrence of metals and the frequency of detection for VOCs in the site monitoring wells. For example, monitoring wells MW-18S and MW-18D, located east of Ischua Creek and hydraulically separated from the landfill, contained five metals above SCGs which were comparable to the six metals found in monitoring well MW-9D located west of the creek and immediately downgradient of the landfill. It was suggested that proximity to the landfill evidently has little influence over the concentrations of metals found and that the concentrations are perhaps a consequence of the natural mineralogy.

As part of the RI, the historical groundwater monitoring data were examined for trends in contaminant concentrations. In a number of the monitoring wells it was found that the concentrations of certain VOCs had been declining or attenuating over the last several years. It was also found that certain geochemical indicators of natural attenuation reactions, such as dissolved oxygen, carbon dioxide, pH, and alkalinity were present in ways that support the likelihood that biological and chemical attenuation reactions are occurring.

The concentrations of certain chlorinated VOCs were also found to decline from upgradient to downgradient locations at rates that exceeded the decline in chloride concentration. Chloride is a conservative tracer; it is a contaminant that cannot be degraded or readily removed from solution. A declining chloride concentration is indicative of the rate of groundwater dilution. Contaminants that decline faster than this rate are not only being diluted but are also being destroyed. The historical decline in concentrations, the presence of TCE degradation daughters, and the chloride tracer assessment all support the conclusion that natural attenuation of the groundwater contamination is occurring. The RI stated that estimates of the natural attenuation half-life, together with estimated groundwater velocities, suggest that average concentrations for individual contaminants would be reduced to groundwater quality standards at a point approximately 1,500 feet downgradient of the landfill which is within the limits of the County-owned property.

Surface Water

VOCs were not detected in any of the water samples collected from Ischua Creek or the landfill pond. Only two VOCs, traces of 2-butanone (26 ppb) and carbon disulfide (4 ppb), were detected in the water sample collected from the railroad pond. The concentrations found were below surface water SCGs. Neither of these two compounds was detected in any of the groundwater samples; their presence in the pond was not from the seepage of groundwater to the pond. Carbon disulfide is a common metabolic breakdown product found in organic-rich sediments such as occurs in ponds and wetlands. The absence of VOCs in the landfill pond suggests that runoff from the landfill is not conveying the VOCs to the railroad pond; the railroad tracks themselves may be the source of the 2-butanone.

Iron and aluminum were the only metals found in the water sampled from Ischua Creek at concentrations exceeding surface water quality standards. The presence of similarly elevated concentrations of iron and aluminum in the upstream sample suggests that the landfill is not the contributor and that the concentrations found might be naturally occurring. Water in the landfill pond did not contain any metals above surface water quality standards. The railroad pond contained several metals above water quality standards, including aluminum, antimony, cobalt, iron, manganese, vanadium, and zinc. With the exception of iron and manganese, none of these metals were found in the groundwater at significantly elevated concentrations and none were found in the landfill pond, so it is unlikely that their presence in the railroad pond is attributable to the landfill, but may be from the railroad tracks themselves.

Sediments

Ischua Creek sediment samples generally contained only a few organic compounds and none of the specific chlorinated compounds of concern related to the landfill. The concentrations of those organic compounds found were below levels of concern. The upstream sediment sample contained traces of bromomethane (0.5 ppb) and acetone (3 ppb), while the sample at the Farwell Road bridge adjacent to the landfill contained only a trace level of acetone (4 ppb). The downstream sediment sample contained 15 ppb of 2-butanone and a trace of toluene (2 ppb). No other VOCs were detected in the creek sediments. Sediments in the landfill and railroad ponds contained similarly low concentrations of 2-butanone and carbon disulfide.

Leachate

A sample of the landfill leachate was collected from one of the two holding tanks on site. It contained a number of the same VOCs that have historically been identified in site groundwater samples. These included: 1,2 DCE (160 ppb), TCE (18 ppb), vinyl chloride (17 ppb), and 1,1 DCA (28 ppb). The total VOC concentration in the leachate sample was 390 ppb. Typical of many municipal solid waste leachates, the sample also contained significant levels of iron (10,500 ppb), magnesium (88,600 ppb), potassium (251,000 ppb) and sodium (233,000 ppb). It was also noted that the concentration of dissolved carbon dioxide was generally high (192 ppm) while the concentration of oxygen was low (1 ppm), suggesting the biological decay of organic material in the landfill waste.

Summary of Human Exposure Pathways

The types of human exposure pathways identified during the RI that may present added health risks to persons at or around the Site is summarized in the following paragraphs. An exposure pathway is the manner by which an individual may come in contact with a contaminant. The five elements of an exposure pathway are 1) the source of contamination; 2) the environmental media and transport mechanisms; 3) the point of exposure; 4) the route of exposure; and 5) the receptor population. These elements of an exposure pathway may be based on past, present, or future events. Pathways which are known to or may exist at the site include:

- Ingestion of contaminated groundwater should it be used for potable purposes (drinking or cooking);
- Dermal contact with contaminated groundwater should it be used for bathing or showering;
- Dermal contact with contaminants if the landfill cover is allowed to erode exposing wastes and contaminants: and
- Inhalation of VOCs in the form of vapors from contaminated water should it be used for bathing or showering.

At the present time, the only well located in the area of impacted groundwater is the landfill water supply well. The water supply well is not used for drinking water and a sign is currently posted which prohibits such use. In the future, development of the area south of the landfill is possible. Development could be accompanied by the installation of other water supply wells. Exposure to contaminants in groundwater could then occur through ingestion, inhalation and dermal contact. However, this future scenario is considered unlikely given the rural, isolated nature of the area and the fact that the County owns much of the land south of the landfill and west of the creek.

Summary of Environmental Exposure Pathways

This section summarizes the types of environmental exposures and ecological risks which may be presented by the site. As noted earlier in this document, there were no landfill-related contaminants of concern identified in any of the sediment or surface water samples from Ischua Creek. Remediation of the creek was deemed unnecessary. The RI found no evidence of adverse impacts to plants or wildlife. However, the RI noted that portions of the landfill cover have settled. If not properly maintained, the landfill cover might fail in the future to adequately contain the hazardous waste. Exposed hazardous waste and/or contaminated surface water runoff would create a complete environmental exposure pathway.

2.3.3 Summary of Remedial Actions

The site was remediated in accordance with the NYSDEC-approved *Remedial Design Report Farwell Road Landfill Remediation*, (January 2002) and the *Technical Specifications for Farwell Road Landfill Remediation*, (January 2002).

The following is a summary of the Remedial Actions performed at the Site:

1. Damaged or settled portions of the existing landfill cover were repaired. In areas of the landfill where settlement of the cap occurred, the existing topsoil layer was scraped away and the depressed area was filled with compacted soils matching the low permeability characteristics of the original barrier layer. The topsoil was then replaced and reseeded. The cap repairs were designed to

prevent water from ponding on the landfill surface and reduce the potential for infiltration and production of leachate.

2. The existing perimeter fence was supplemented with vegetation barriers to restrict public access to the landfill. A hedge of thorny shrubs were planted along Farwell Road and the railroad to limit trespassers from eroding the existing low permeability soil cap.

3. The ongoing collection and off-site disposal of leachate from the landfill established during the 1989 closure activities has continued as required by the ROD.

4. Implementation of a long-term groundwater sampling program to monitor the natural attenuation of contaminants in areas of groundwater impact. This included the installation of three new groundwater monitoring wells downgradient of the landfill site.

5. Property use restrictions were implemented to prevent future exposure to residual contamination. Cattaraugus County placed Deed Restrictions on the Site to limit the land use to only solid waste management facility usage; prohibit the use of Site groundwater and require compliance with a long-term monitoring and maintenance plan.

Remedial activities were completed at the Site in mid to late 2002.

2.3.4 Removal of Contaminated Materials from the Site

With the exception of the on-going collection and off-site disposal of leachate generated at the Site, no other contaminated media was removed from the Site. As summarized above leachate from the landfill is currently collected and combined in two 10,000-gallon underground storage tanks located south of the landfill, near the storage garage. The stored leachate is pumped from the USTs as needed and transported off-site to a permitted wastewater treatment plant.

2.3.5 Site-Related Treatment Systems

No long-term treatment systems were installed as part of the site remedy.

2.4 Remedial Action Objectives

The Remedial Goals for the Site as listed in the Record of Decision dated March 2000 and included:

- Eliminate, to the extent practicable, ingestion of groundwater affected by the site which does not attain NYSDEC Class GA Ambient Water Quality Criteria;
- Eliminate, to the extent practicable, exposures to groundwater contaminants through inhalation or dermal contact;
- Eliminate, to the extent practicable, off-site migration of groundwater that does not attain NYSDEC Class GA Ambient Water Quality Criteria.

2.5 Remaining Contamination

Remaining contamination at the Site includes the materials disposed of in the three phases of the landfill, groundwater underlying and immediately downgradient of the landfill and leachate generated from the landfill. Summaries of these contaminated media encountered during the RI are included in Section 2.3.2 above. As stated above contaminated groundwater is being addressed via natural attenuation; therefore, contaminant concentrations, while noted to be declining, are constantly in flux. Summaries of the current contaminant concentrations for groundwater and leachate can be found in the most recent water quality monitoring report, which prior to 2021 were prepared on a quarterly basis but transitioned to annual reporting in 2021 as part of the long-term monitoring program required by the remedy.

3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

3.1 General

Since remaining contamination exists at the site, Institutional Controls (ICs) and Engineering Controls (ECs) are required to protect human health and the environment. This IC/EC Plan describes the procedures for the implementation and management of all IC/ECs at the site. The IC/EC Plan is one component of the SMP and is subject to revision by the NYSDEC.

This plan provides:

- A description of all IC/ECs on the site;
- The basic implementation and intended role of each IC/EC;
- A description of the key components of the ICs set forth in the Deed Restriction;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of IC/ECs, such as the implementation of the Excavation Work Plan (EWP) (as provided in Appendix B) for the proper handling of remaining contamination that may be disturbed during maintenance or redevelopment work on the site; and
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the site remedy, as determined by the NYSDEC.

3.2 Institutional Controls

A series of ICs is required by the ROD to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination prohibiting the use of Site groundwater without treatment rendering it safe for drinking water or industrial purposes; and, (3) limit the use and development of the site to solid waste management facilities uses only. Adherence to these ICs on the site is required by the Deed Restriction and will be implemented under this SMP. ICs identified in the Deed Restriction may not be discontinued without an amendment to or extinguishment of the Deed Restriction. The IC boundaries are shown on Figures 1A- 1C. These ICs are:

- Compliance with the Deed Restriction filed with the Cattaraugus County Clerk's Office (February 2023) under Instrument No. 202302210 by Cattaraugus County and the County's successors and assigns;
- Operation and maintenance of all IC's and ECs in accordance with the SMP (previously the FLCD);
- Inspection of all ECs at the Site in accordance with the SMP;
- No person shall engage in any activity that will, or that reasonably is anticipated to prevent or interfere significantly with any proposed, ongoing or completed program at the Site or that will or is reasonably foreseeable to expose the public health or the environment to a significantly increased threat of harm or damage;
- Reporting of all required monitoring data in accordance with the SMP;
- The Site may only be used for solid waste management facilities and may not ever be used for other purposes without the express written waiver of such prohibition by the NYSDEC;
- The use of the groundwater underlying the Site is prohibited without: treatment rendering it safe for intended use; and permission from the NYSDEC;
- The Deed Restrictions shall run with the land and shall be binding upon all future owners of the Site; and
- The NYSDEC shall retain the right to access the Site at any time in order to evaluate any and all controls.

3.3 Engineering Controls

3.3.1 Soil Cover

Exposure to remaining contamination within the 16-acre landfill at the Site is prevented by a soil cover system placed over the Site. Following closure in 1989, the entire landfill was capped with a minimum 18 inches of compacted soil followed by a 6-inch topsoil layer in accordance with NYSDEC regulations at the time. The cap has an established vegetative cover consisting of mixed grasses and herbaceous plants. Figure 2 presents the approximate boundaries of the cover system.

The Excavation Work Plan (EWP) provided in Appendix B outlines the procedures required to be implemented in the event the cover system is breached, penetrated or temporarily removed, and any underlying remaining contamination is disturbed. Procedures for the inspection of this cover are provided in the Monitoring and Sampling Plan included in Section 4.0 of this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and associated Community Air Monitoring Plan (CAMP) prepared for the site. A sample HASP and CAMP are attached as Appendices F and G, respectively to this SMP. Based on future changes to State and Federal health and safety requirements, and specific methods employed by future contractors, a site and or project specific HASP and CAMP may be required, if required these plans will be submitted along with the notification provided in Section B-1 of the EWP. Any intrusive construction work will be performed in compliance with the EWP, HASP and CAMP, and will be included in the periodic inspection and certification reports submitted under the Site Management Reporting Plan (See Section 7).

3.3.2 Leachate Collection System

In 1986, the County installed a leachate collection system around the Phase I and II portions of the landfill. The system consists of gravel filled trenches with plastic pipe. Lateral trenches extend into the landfill and lead to a six-inch plastic header pipe along the southern side of the landfill. Leachate is collected in two 10,000-gallon storage tanks located on the eastern portion of the site. Each tank is equipped with secondary containment and a leak detection system. In addition, a four-inch plastic leachate collection pipe was installed in 1986 along the eastern edge of the landfill, extending to the northwest beyond the north face of the landfill. This lateral provides additional leachate collection capacity for eastern portion of the Site and connects to the main leading to the storage tanks. The system for the Phase I/II portion of the landfill includes a gravel trench along the west side between Phase I/II and Phase III.

The leachate collection system for Phase III, installed as part of that phase's original construction includes four gravel beds that contain Schedule 80 PVC pipe, located on top of the liner. The system extends into the waste disposal area and connects to a six-inch main. The leachate collection systems for Phase I/II and Phase III operate as separate systems, although all leachate collected from them is mixed and conveyed to the two storage tanks. Leachate is pumped from the tanks as needed and transported off site to a permitted wastewater treatment facility. The Record Drawings for the leachate collection system are included in Appendix I.

Procedures for monitoring the system are included in the Site Monitoring Plan (Section 3 of this SMP).

3.3.3 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.4 of NYSDEC DER-10.

3.3.3.1 Soil Cover

The composite cover system is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in accordance with this SMP in perpetuity.

3.3.3.2 Monitored Natural Attenuation

Groundwater monitoring activities to assess natural attenuation will continue, as determined by the NYSDEC with consultation with NYSDOH, until residual groundwater concentrations are found to be consistently below ambient water quality standards, the site SCGs, or have become asymptotic at an acceptable level over an extended period. In the event that monitoring data indicates that monitoring for natural attenuation may no longer be required, a proposal to discontinue the system will be submitted by the remedial party. Monitoring will continue until permission to discontinue is granted in writing by the NYSDEC. If groundwater contaminant levels become asymptotic at a level that is not acceptable to the NYSDEC, additional source removal, treatment and/or control measures will be evaluated.

4.0 MONITORING AND SAMPLING PLAN

4.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of site management for the site are summarized below.

This Monitoring and Sampling Plan describes the methods to be used for:

- Sampling and analysis of all appropriate media (e.g., groundwater and leachate);
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs), particularly groundwater standards; and
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment;
- Sampling locations, protocol, and frequency;
- Quality Assurance/Quality Control (QA/QC) requirements;

To adequately address these issues, this Monitoring and Sampling Plan provides information on:

- Sampling locations, protocol and frequency;
- Information on all designed monitoring systems;
- Analytical sampling program requirements;
- Inspection and maintenance requirements for monitoring wells;

- Monitoring well decommissioning procedures; and
- Annual inspection and periodic certification.

Reporting requirements are provided in Sections 4.5 and 7.0 of this SMP.

4.2 Site wide Inspection

Site-wide inspections are performed on a monthly basis April through November. Modification to the frequency or duration of the inspections will require approval from the NYSDEC. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. During these inspections, an inspection form will be completed as provided in Appendix J – Site Management Forms. The form will compile sufficient information to assess the following:

- Compliance with all ICs, including site usage;
- An evaluation of the condition and continued effectiveness of ECs;
- General site conditions at the time of the inspection;
- The site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection; and
- Confirm that site records are up to date.

As part of the selected site remedy, the County implemented a formal landfill inspection and maintenance program. This program will occur for the 30-year post-closure monitoring period, or as subsequently amended by the NYSDEC as appropriate. Inspection checks are to be conducted monthly from April through November when the surface is free of snow cover, and site-wide inspection forms (Appendix J) are to be completed for each inspection. Copies of the monthly inspection reports will be maintained at the Cattaraugus County's Department of Public Works office. Annual summary reports of the inspection program in the form of a Periodic Review Report (further described in Section 5 of this

SMP) will be submitted to NYSDEC. A summary of Site components requiring inspection is included in the following paragraphs.

Drainage Ditches and Retention Basins - Existing drainage features will be checked for failure or obstructions once in the spring and once in the fall, as well as after the occurrence of severe storms (greater than 1 inch of rain per hour). Drainage conveyances will be maintained free of obstructions, damaged or failed sections will be repaired, and sediment build-up removed. Areas on site which are frequently eroded by drainage will be repaired, and riprap or erosion blankets will be placed on them.

Cover and Vegetation - Post-closure cover maintenance will include:

- Mowing the vegetation as required maintaining a healthy cover. In general, it is anticipated that mowing will be performed once during the late summer or early fall to discourage the growth of woody plants.

- Revegetating areas as needed; clearing trees and brush.

- Repairing eroded or settled areas by adding compacted soil and/or topsoil and then reseeding. Heavy equipment and vehicular traffic should be limited to the access road to prevent damage to the cap. In areas with more than 6 inches of settlement, compacted clay fill would be used to fill the depression to within 6 inches below grade, then 6 inches of topsoil would be added and reseeded.

Additional inspection requirements for the soil cover system are included in Section 4.3 below.

Access Control - Access control is to be maintained such that unauthorized entrance to the facility is prevented. There is presently no need for public access to the Site, and the County owns the majority of lands immediately surrounding the landfill. These facts by themselves will naturally limit public access to the site. However, access control was expanded to include the planting and maintenance of multi-floral rose shrubbery around the landfill perimeter. This plant is shallow rooted, hardy and spiny, requires little maintenance, and forms a dense hedge wall to restrict unauthorized access. This vegetation will be inspected, repaired, and replaced as needed as part of the on-going monitoring and maintenance activities. Further, the landfill's existing water supply well has been posted with a warning sign as being unsuitable for drinking. This warning sign will be maintained. Additionally, access to water is limited to a faucet (which is not used) and a toilet within the on-site storage building. This building is kept locked and only County employees have access.

<u>Gas Venting System</u> - The gas venting system will be inspected during the annual or biennial water quality sampling events at the landfill for plugging and damage of the vent risers and return bends. If damage has occurred, the vent risers will be replaced from the connecting union.

<u>Groundwater Monitoring Wells</u> - During the annual or biennial events at the landfill, the groundwater monitoring wells will be checked to assure that the locks, risers, and caps are in good condition. Any evidence of damage or tampering will be noted on the inspection form and repaired.

Inspections of all remedial components installed at the site will be conducted. A comprehensive site-wide inspection will be conducted and documented according to the SMP schedule, regardless of the frequency of the Periodic Review Report. The inspections will determine and document the following:

- Whether ECs continue to perform as designed;
- If these controls continue to be protective of human health and the environment;
- Compliance with requirements of this SMP and the Deed Restriction;
- Achievement of remedial performance criteria; and
- If site records are complete and up to date; and

Reporting requirements are outlined in Section 7.0 of this plan.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the site, verbal notice to the NYSDEC must be given by noon of the following day. In addition, an inspection of the site will be conducted within 5 days of the event to verify the effectiveness of the IC/ECs implemented at the site by a qualified environmental professional, as determined by the NYSDEC. Written confirmation must be provided to the NYSDEC within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

4.3 Cover System Monitoring

The soil cover system is described in Section 3.3.1 and a description of the cover system inspection requirements is presented in the following paragraphs.

The soil cover shall be observed by traversing the cover on foot and making appropriate observations, notes and photographic records as necessary, for inclusion with the report. The inspection should at minimum make note of areas with settled or uneven surfaces, seepage or flooding. The following characteristics shall be looked for during the observation of the cover system:

- Sloughing
- Cracks
- Settlement
- Distressed vegetation/turf

Sloughing, cracks and settlement features such as depressions or areas of ponding on the soil cover may occur over time, most likely resulting for weather related impacts. The locations of these features on the soil cover should be noted on the inspection log and site map, including width, length and depth of the feature. In addition, post-closure maintenance will include regular inspection of the landfill final cover for cracks or stressed vegetation that might signal the release of landfill gas. Areas where there are cracks or where vegetation appears to be stressed will be tested with a portable explosive gas detector. Areas of the final cover which may have been damaged will be repaired and steps taken to prevent future damage, such as the installation of additional vents. Also, eroded or settled areas shall be repaired by adding compacted soil and/or topsoil and then reseeding. Heavy equipment and vehicular traffic should be limited to the access road to prevent damage to the cap. In areas with more than six inches of settlement, compacted clay fill will be used to fill the depression to within six inches below grade, then six inches of topsoil would be added and re-seeded. Areas of distressed turf shall be re-seeded and a starter fertilizer applied. A complete list of components to be checked is provided in the monthly inspections, including the soil cover is included in Appendix J.

4.4 Post-Remediation Media Monitoring and Sampling

Samples shall be collected from the groundwater monitoring wells and the leachate storage tank on a routine basis.

The permanent monitoring program for the landfill includes an Operation, Maintenance & Monitoring (OM&M) annual monitoring program and Part 360 biennial monitoring program. The permanent monitoring network currently consists of 23 groundwater monitoring wells (11 groundwater monitoring wells sampled annually as part of OM&M program, seven groundwater monitoring wells sampled biennially as part of the Part 360 program, and five groundwater monitoring recently removed (to remain in place and not be decommissioned) from the monitoring program following the July 2020 reduction request, one on-site (SW-4) and three off-site (SW-1, SW-2 & SW-3) surface water monitoring locations (removed from the Part 360 program), three piezometer/off-site water level monitoring locations (measured annually) and one leachate collection system point (sampled annually as part of the Part 360 program). Figure 2 depicts the on-site monitoring network as well as the locations of the five off-site compliance monitoring wells.

The upgradient monitoring wells include the OM&M program wells MW-17I and MW-17S and the Part 360 program wells MW-6 and MW-13D. The downgradient wells include the OM&M program wells MW-14S, MW-14I, MW-15S, MW-15I, MW-16S, MW-16I, MW-21, MW-22, and MW-23; the Part 360 program wells MW-9D, MW-10S, MW-10D, MW-11S and MW-11D. Downgradient groundwater monitoring wells MW-19, MW-20, MW-24, and MW-25 have been removed from the monitoring program and will remain on site rather than be decommissioned. Downgradient wells MW-9S (a Part 360 program well) historically has not been able to be sampled due to either being consistently dry or having insufficient water and as a result is no longer included in the monitoring program. Additionally, PZ-15, MW-18S, MW-18D and Ischua Creek serve as annual water level monitoring locations. The 'S' in the well nomenclature indicates a shallow well the 'D' indicates a deep well, while an 'I' indicates an interface well.

Table 3 below denotes sample identification numbers, location relative to the landfill, depth and estimated screen length of the monitoring points included in the Part 360 and OM&M monitoring programs.

Table 3: Summary of Monitoring Points

Sampling Location	Position	Aquifer Screened	Approximate Depth (ft)	Estimated Screen Length (ft)
Part 360 Program				
Groundwater				
MW-6	Up gradient	Bedrock	160	10
MW-9S*	Down gradient	Overburden	42	10
MW-9D	Down gradient	Overburden	76	10
MW-10S	Down gradient	Overburden	33	10
MW-10D	Down gradient	Overburden	87	10
MW-11S	Down gradient	Overburden	45	10
MW-11D	Down gradient	Overburden	92	5
MW-13D	Cross gradient	Overburden/bedrock	99	10
Surface Water (Water Levels Only)				
SW-1*	Upstream	-	-	-
SW-2*	Adjacent	-	-	-
SW-2A	Downstream	-	-	-
SW-3*	Downstream	-	-	-
SW-4*	Landfill Pond	-	-	-
Leachate				
L-1	Leachate Storage Tank			
OM&M Program				
MW-14S	Down gradient	Overburden	56	5
MW-14I	Down gradient	Overburden/bedrock	84	10
MW-15S	Down gradient	Overburden	47	5
MW-15I	Down gradient	Overburden/bedrock	81	10
MW-16S	Down gradient	Overburden	42	5
MW-16I	Down gradient	Overburden/bedrock	87	10
MW-17S	Up gradient	Overburden	40	5
MW-17I	Up gradient	Overburden/bedrock	97	10
MW-19*	Down gradient	Overburden	45	10
MW-20*	Down gradient	Bedrock	135	10
MW-21	Down gradient compliance well	Overburden	123.4	10
MW-22	Down gradient compliance well	Overburden	57.5	10
MW-23	Down gradient compliance well	Overburden	54.2	10
MW-24*	Down gradient compliance well	Overburden	53.6	10
MW-25*	Down gradient compliance well	Overburden	54.5	10
Water Levels Only				
PZ-15	Down gradient	Overburden	25.3	10
MW-18S	Down gradient	Overburden	30	10
MW-18D	Down gradient	Bedrock	114	10

1. - The 'S' in the well nomenclature indicates a shallow well the 'D' indicates a deep well, while an 'I' indicates an interface well.

* - Denotes a monitoring location removed from the current Part 360 and OM&M monitoring programs.

The network of monitoring wells has been installed to monitor both up-gradient and down-gradient groundwater conditions at the site.

The sampling and analysis schedule for the OM&M and Part 360 Monitoring programs are provided in Tables 4 and 5 below.

Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Table 4: OM&M Program Sampling and Analysis Schedule

OM&M PROGRAM					
MATRIX	**NO. OF SAMPLING POINTS**	**NO. OF FIELD QC SAMPLES**	**NO. OF SAMPLES BY MATRIX**	**FREQUENCY**	**REQUIRED ANALYSIS**
Groundwater	11	1 Field Dup; 1 Trip Blank for VOCs	12 + Trip Blank	Annual (May)	TCL VOCs and Field Parameters

Table 5: Part 360 Program Sampling and Analysis Schedule

Part 360 Program					
MATRIX	**NO. OF SAMPLING POINTS**	**NO. OF FIELD QA/QC SAMPLES**	**NO. OF SAMPLES BY MATRIX**	**FREQUENCY**	**REQUIRED ANALYSIS**
Groundwater	7	1 Field Dup; 1 Trip Blank for VOCs	8 + Trip Blank	Biennially (May)	See Table 5-1 below
Leachate	1	Included in Ground Water QC	1	Annual (May)	Part 360 Expanded Parameters and Field Parameters

- Modified Baseline Analytical List: Leachate indicators (alkalinity, ammonia, biological oxygen demand, boron, bromide, chloride, chemical oxygen demand, color, hardness, nitrate, phenols, sulfate, total dissolved solids, total Kjeldahl nitrogen, and total organic carbon) and VOCs
- Field Parameters: Depth to water, depth of well, temperature, conductivity, salinity, dissolved oxygen, oxidation reduction potential, and turbidity.

Table 5-1: Part 360 Monitoring Program Analytical Parameter List and Analytical Methods

Analytical Parameter	Analytical Method
MODIFIED BASELINE SAMPLING EVENTS	
LEACHATE INDICATORS	
Alkalinity	310.2
Ammonia	350.1
Biological oxygen demand	SM5210B
Boron	6010C
Bromide	300.0
Chloride	300.0
Chemical oxygen demand	410.4
Color	SM2120B
Hardness	SM2340B
Nitrate	353.2
Phenols	420.1
Sulphate	300.0
Total dissolved solids	SM2540C
Total kjeldahl nitrogen	351.2
Total organic carbon	9060A
VOLATILE ORGANIC COMPOUNDS	
1,1,1,2-tetrachloroethane	8260C
1,1,1-trichloroethane	8260C
1,1,2,2-tetrachloroethane	8260C
1,1,2-trichloroethane	8260C
1,1-dichloroethane	8260C
1,1-dichloroethene	8260C
1,2,3-trichloropropane	8260C
1,2-dibromo-3-chloropropane	8260C
1,2-dibromoethane	8260C
1,2-dichlorobenzene	8260C
1,2-dichloroethane	8260C
1,2-dichloropropane	8260C
1,4-dichlorobenzene	8260C

Analytical Parameter	Analytical Method
2-butanone (MEK)	8260C
2-hexanone (MBK)	8260C
4-methyl-2-pentanone (MIBK)	8260C
Acetone	8260C
Acrylonitrile	8260C
Benzene	8260C
Bromochloromethane	8260C
Bromodichloromethane	8260C
Bromoform	8260C
Bromomethane	8260C
Carbon disulfide	8260C
Carbon tetrachloride	8260C
Chlorobenzene	8260C
Chlorodibromomethane	8260C
Chloroethane	8260C
Chloroform	8260C
Chloromethane	8260C
cis-1,2-dichloroethene	8260C
cis-1,3-dichloropropene	8260C
Dibromomethane	8260C
Dichloromethane	8260C
Ethylbenzene	8260C
Iodomethane	8260C
Styrene	8260C
Trichloroethene	8260C
Tetrachloroethene	8260C
Toluene	8260C
trans-1,2-dichloroethene	8260C
trans-1,3-dichloropropene	8260C
trans-1,4-Dichloro-2-butene	8260C
Trichlorofluoromethane	8260C
Vinyl acetate	8260C
Vinyl chloride	8260C

Analytical Parameter	Analytical Method
Xylene (m & p)	8260C
Xylene (o)	8260C
FIELD PARAMETERS	
pH, Field	Calibrated Field Meter
Field Conductivity	Calibrated Field Meter
Temperature, Field	Calibrated Field Meter
Field Turbidity	Calibrated Field Meter
Field EH/ORP	Calibrated Field Meter
MODIFIED EXPANDED PARAMETERS LEACHATE SAMPLING EVENTS	
METALS	
Aluminum	6010C
Barium	6010C
Beryllium	6010C
Cadmium	6010C
Calcium	6010C
Chromium	6010C
Cobalt	6010C
Copper	6010C
Iron	6010C
Magnesium	6010C
Manganese	6010C
Nickel	6010C
Potassium	6010C
Silver	6010C
Sodium	6010C
Vandium	6010C
Zinc	6010C
Antimony	6020A
Arsenic	6020A
Lead	6020A
Selenium	6020A
Thallium	6020A

Analytical Parameter	Analytical Method
Mercury	7470A
LEACHATE INDICATORS	
Calcium and Magnesium Hardness	SM2340B
Bromide	300.0
Chloride	300.0
Sulfate	300.0
Alkalinity, Total	310.2
Ammonia as N	350.1
Total Kjeldahl Nitrogen	351.2
Nitrate	353.2
Chemical Oxygen Demand	410.4
Total Recoverable Phenolics	420.1
Boron	6010C
Hexavalent chromium	7196A
Cyanide, Total	9012B
Total Organic Carbon	9060A
Total Dissolved Solids	SM2540C
Biological Oxygen Demand	SM5210B
Specific Conductance	120.1
Color	SM2120B
VOLATILE ORGANIC COMPOUNDS	
1,1-Dichloroethane	8260C
2-Butanone	8260C
Acetone	8260C
Benzene	8260C
Chlorobenzene	8260C
Chloroethane	8260C
Chloromethane	8260C
cis-1,2-Dichloroethene	8260C
Ethylbenzene	8260C
m,p-Xylene	8260C
Methylene Chloride	8260C
o-Xylene	8260C

Analytical Parameter	Analytical Method
Toluene	8260C
Trichloroethene	8260C
Vinyl chloride	8260C
FIELD PARAMETERS	
pH, Field	Calibrated Field Meter
Field Conductivity	Calibrated Field Meter
Temperature, Field	Calibrated Field Meter
Field Turbidity	Calibrated Field Meter
Field EH/ORP	Calibrated Field Meter

Deliverables for the groundwater monitoring program are specified below.

Detailed sample collection and QA/QC procedures and protocols are provided in Appendix D Field Sampling Plan and Appendix E Quality Assurance Project Plan.

4.4.1 Groundwater Sampling

Groundwater monitoring will be performed annually (for OM&M program locations) and biennially (Part 360 program monitoring locations) to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

As per NYSDEC's September 14, 2020 acceptance of the July 2020 reduction request it is required that groundwater elevations will be measured in all monitoring wells annually.

Monitoring well construction logs are included in Appendix H of this document.

Monitoring Well Repairs, Replacement and Decommissioning

If biofouling or silt accumulation occurs in the on-site and/or off-site monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced, if an event renders the wells unusable.

Repairs and/or replacement of wells in the monitoring well network will be performed based on assessments of structural integrity and overall performance.

The NYSDEC will be notified prior to any repair or decommissioning of any monitoring well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Well decommissioning without replacement will be done only with the prior approval of the NYSDEC. Well abandonment will be performed in accordance with NYSDEC's guidance entitled "CP-43: Groundwater Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be replaced in kind in the nearest available location, unless otherwise approved by the NYSDEC.

The sampling frequency may only be modified with the approval of the NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by the NYSDEC.

Deliverables for the groundwater monitoring program are specified in 4.5 – Monitoring Reporting Requirements.

4.4.2 Leachate Sampling

A leachate sample is collected annually from the on-site leachate storage tank (L-1). The sampling and analysis schedule for the leachate sample is provided in Table 5 above.

The sampling frequency may only be modified with the approval of the NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by the NYSDEC.

Deliverables for the leachate sampling program are specified in Section 4.5 – Monitoring Reporting Requirements.

4.4.3 Monitoring and Sampling Protocol

All monitoring well sampling activities will be recorded in a field book and a groundwater-sampling log presented in Appendix K. Other observations (e.g., well integrity, etc.) will be noted on the well sampling log. The well sampling log will serve as the inspection form for the groundwater monitoring well network. Additional detail regarding monitoring and sampling protocols are provided in the site-specific Field Sampling Plan and Quality Assurance Quality Control procedures provided as Appendices D and E, respectively of this document.

4.5 MONITORING REPORTING REQUIREMENTS

Forms and any other information generated during regular monitoring events and inspections will be kept on file at the Cattaraugus County's Department of Public Works office. All forms, used during the monitoring/inspection events, will be (1) subject to approval by NYSDEC and (2) submitted at the time of the Periodic Review Report, as specified in the Reporting Plan of this SMP.

The results of the soil cover monitoring (Section 4.3) and the site-wide inspections (Section 3.4) will be documented on the appropriate form (Appendix J) and copies of these forms along with a summary of the results from these inspections will be documented in the Periodic Review Report as outlined in Section 7.0 below. Additionally, the results of the water quality monitoring programs (Section 4.4) will also be documented annually within the Periodic Review Report. As stated above the permanent water quality monitoring program for the landfill includes an annual Operation, Maintenance & Monitoring program and biennial Part 360 monitoring program. Summary tables documenting the results of the water quality monitoring programs shall be submitted within 90 days of the sampling event. The annual reporting a summary of the water quality monitoring results for the given year will be presented within the Periodic Review Report.

The annual water quality monitoring reports will be prepared in accordance with 6 NYCRR Part 363 regulations and NYCRR Part 375 (as applicable) and will include, at a minimum:

- Date of the sampling event;
- Personnel conducting sampling;
- Description of the activities performed;
- Type of samples collected (e.g., groundwater and leachate);
- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation, etc.);
- A table showing sample collection date, analytical results, designation of up-gradient wells, location of each monitoring point, water quality standards, NYS Department of Health guidance values, statistical standard deviation and mean, QA/QC notations, method detection limits and Chemical Abstract Services numbers on all compounds;
- Tables or graphical representations comparing current, existing and up-gradient water qualities;
- A summary of results including parameters with concentrations above background levels, trigger values or State water quality standards;
- A figure illustrating sample type and sampling locations;
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and
- A determination as to whether groundwater conditions have changed since the last reporting event.
- Proposed modifications or actions required to follow the site monitoring plan or NYSDEC regulations;
- For baseline sampling events, or any monitoring points sampled for baseline analytes, a data validator shall review analytical results in accordance with 6 NYCRR Part 363-4.6(h). The County will include a copy of the data validator's report in its submittal to the NYSDEC;

- At the end of every other year Cattaraugus County shall submit the required Part 363 biennial summary to the NYSDEC which will include summaries of test results and comparisons with historical data;

- Upon request, the County must provide the NYSDEC with all QA/QC documentation.

Data will be reported in hard copy or digital format as determined by NYSDEC.

4.5.1 Contingency Monitoring

The following contingency plans have been developed to address the possibility that contaminants may be detected within the established compliance boundary wells at some time in the future.

4.5.1.1 Downgradient Groundwater Monitoring Wells

If VOCs are detected in the downgradient monitoring well MW-23 the County will notify NYSDEC within 24 hours of receiving the analytical results. A confirmatory sampling round of the affected compliance wells would occur within 30 days of the initial finding. A written report will be prepared and submitted to NYSDEC within 14 days of receiving the analytical results of the confirmatory round. If the confirmatory sampling refutes the initial finding, then the annual monitoring program would resume for all wells involved in the supplemental monitoring program. If confirmatory sampling verifies the initial finding that a particular well is affected, the following steps would be taken:

- The County will notify NYSDEC within 24 hours of confirmation of results. If the data indicate a specific residential well is affected, the County will also notify that resident within 24 hours and immediately provide the resident with an alternate water supply, including bottled water and/or the installation of a new well.

- The County would prepare a field investigation program (FIP) plan and submit it to NYSDEC within 30 days. The FIP will describe the County's plan for investigating and mitigating the groundwater impacts.

Following the execution of the FIP, if it is determined that corrective action is needed, the County will prepare a Corrective Measures Work Plan, which will include the following steps:

- Prepare a report which describes the activities of the FIP, including conclusions and recommendations, within 60 days of completing the field investigation.
- Complete a corrective measures assessment, as needed based on the findings of the FIP, which proposes a preferred remedial alternative (within 60 days of NYSDEC acceptance of FIP report).
- Begin remediation as outlined in the corrective measures assessment within 30 days of NYSDEC approval of plans and specifications relating to the preferred alternative.

The selected corrective measure must satisfy the following criteria:

- Protect public health, safety, and the environment.
- Attain an established groundwater protection standard.
- Control the source of release to the maximum extent practical so as to reduce or eliminate future releases.
- Comply with applicable state and federal regulations.

In addition, the County will consider the following six additional criteria when selecting the corrective measure:

- The long-term and short-term effectiveness and protectiveness of the measure.
- The probability of success of the corrective measure.
- The corrective action's effectiveness in preventing the release of additional contaminants.
- The ease or difficulty of implementation.
- The technical and economic resources available for implementation.
- The degree to which community concerns are addressed by the measure.

Remedial actions may include:

- Additional drainage controls to divert flows away from the landfill to further reduce leachate production.
- Providing a permanent potable water source to residents with affected water supplies.
- Renovation of existing leachate collection system to further control/minimize leachate release to groundwater.
- Implementation of groundwater control and/or recovery by extraction or cut-off wall.
- Point of use treatment of any impacted water supply wells.

5.0 OPERATION AND MAINTENANCE PLAN

5.1 General

The site remedy does not rely on any mechanical systems, such as groundwater treatment systems, sub-slab depressurization systems or air sparge/soil vapor extraction systems to protect public health and the environment. Therefore, the operation and maintenance of such components is not included in this SMP.

However as stated in Section 2.0 above leachate is still generated at the Site. Leachate from the landfill is currently collected and combined in two 10,000-gallon underground storage tanks located south of the landfill, near the storage garage. The stored leachate is pumped from the USTs as needed and transported off-site to a permitted wastewater treatment plant. The leachate volume in the storage tanks is monitored remotely using a system provided by RAFA Systems, Inc. The system utilizes a pressure sensing transducer in each tank, which sends data to a controller on site. The County will receive twice daily emails with the current tank level. The system will also send out alarms, via text, to notify the County of high-water levels within the tanks or if there is a potential power outage.

In order to ensure that leachate generated on-site is being properly managed the County developed the following procedures:

- Farwell Leachate Pumps – Tank Trailer Loading Procedures,
- Farwell Leachate Regular Hauling Requirements,
- Farwell Leachate Power Failure Procedures ; and
- Farwell Leachate Remote Monitoring System

These procedures will be reviewed and discussed on an annual basis by the Waste Management Coordinator with the each of the County's Truck Drivers that will be responsible for hauling leachate; the Maintenance Mechanic and the Hauling Supervisor.

Additionally, any other County personnel involved in the management of leachate at this landfill will be trained utilizing these procedures. Copies of these procedures, as well as the Remote Monitoring System Manual, are included in Appendix L of this SMP and will be posted at the Site office building as well as in the pump control structure (i.e. doghouse). Also, included in Appendix I are the record plans for the landfill which depict the layout of the leachate collection system and associated details.

6.0 PERIODIC ASSESSMENTS/EVALUATIONS

6.1 Climate Change Vulnerability Assessment

Increases in both the severity and frequency of storms/weather events, an increase in sea level elevations along with accompanying flooding impacts, shifting precipitation patterns and wide temperature fluctuation, resulting from global climactic change and instability, have the potential to significantly impact the performance, effectiveness and protectiveness of a given site and associated remedial systems. Vulnerability assessments provide information so that the site and associated remedial systems are prepared for the impacts of the increasing frequency and intensity of severe storms/weather events and associated flooding.

This section provides a summary of vulnerability assessments that will be conducted for the site during periodic assessments, and briefly summarizes the vulnerability of the site and/or engineering controls to severe storms/weather events and associated flooding.

An assessment of potential vulnerabilities of this site included reviewing the location of flood plains, site drainage and storm water management, erosion, high wind, electricity, and spill/containment released and are described in depth below:

- Flood Plain: The site is not located within the 100-year flood plain or is low-lying in nature; therefor it is unlikely to be impacted by flooding events.

- Site Drainage and Storm Water Management: Due to the installation of swales and the sloped nature of the site it is unlikely that flooding will occur on site due to inadequate site drainage and storm water management.

- Erosion: Areas susceptible to erosion during periods of severe rain events include the swales designed to carry stormwater as well as the cap of the landfill. These areas will be inspected on a monthly basis and after 1-inch rain events. If erosion is observed at any location the area will be regraded and stabilized as soon as practicable.

- High Wind: During high winds there is potential for trees to fall and block access to the landfill.

- Electricity: Though the site is susceptible to power loss and or dips/surges in voltage during severe weather events, including lightning strikes, the leachate system is equipped with a monitor that will notify county personnel if power is lost.

- Spill/Contaminant Release: Areas which may be susceptible to a spill or other contaminant release due to storm-related damage caused by flooding, erosion, high winds, loss of power etc. include the parking lot and the on-site pond. These areas are adjacent and lower in elevation than the leachate collection system.

6.2 Green Remediation Evaluation

N/A

6.3 Remedial System Optimization

A Remedial Site Optimization (RSO) study will be conducted any time that the NYSDEC or the remedial party requests in writing that an in-depth evaluation of the remedy is needed. An RSO may be appropriate if any of the following occur:

- The remedial actions have not met or are not expected to meet RAOs in the time frame estimated in the Decision Document;
- The management and operation of the remedial system is exceeding the estimated costs;
- The remedial system is not performing as expected or as designed;
- Previously unidentified source material may be suspected;
- Plume shift has potentially occurred;
- Site conditions change due to development, change of use, change in groundwater use, etc.;
- There is an anticipated transfer of the site management to another remedial party or agency; and
- A new and applicable remedial technology becomes available.

An RSO will provide a critique of a site's conceptual model, give a summary of past performance, document current cleanup practices, summarize progress made toward the site's cleanup goals, gather additional performance or media specific data and information and provide recommendations for improvements to enhance the ability of the present system to reach RAOs or to provide a basis for changing the remedial strategy.

The RSO study will focuses on overall site cleanup strategy, process optimization and management with the intent of identifying impediments to cleanup and improvements to site operations to increase efficiency, cost effectiveness and remedial time frames. Green remediation technology and principals are to be considered when performing the RSO.

7.0. REPORTING REQUIREMENTS

7.1 Site Management Reports

All site management inspection, maintenance and monitoring events will be recorded on the appropriate site management forms provided in Appendix J. These forms are subject to NYSDEC revision.

All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the site during the reporting period will be provided in electronic format to the NYSDEC and summarized in the Periodic Review Report.

Table 6: Monitoring / Inspection Schedule

Monitoring Program	Frequency*	Matrix	Analysis
Landfill Inspection and Maintenance Program (Sections 4.2 and 4.3)	Monthly (April through November)	N/A	Visual
Water Quality Monitoring Program	OM&M Component of Program – Annually Part 360 of Program - Biennial	Groundwater and Leachate	Chemical Analysis (see Tables 4 & 5)
Leachate Level Monitoring	Continuous	Leachate	N/A

* The frequency of events will be conducted as specified until otherwise approved by the NYSDEC.

The reporting for the Water Quality Monitoring Program will be prepared in accordance with the requirements summarized in Section 4.5. Additionally, Landfill Inspection and Maintenance Program and the associated reporting requirements are summarized in Sections 4.2 and 4.3. The results of the Water Quality Monitoring Program and the Landfill Inspection and Maintenance Program will be summarized in the Periodic Review Report as detailed in Section 7.2 below.

7.2 Periodic Review Report

A Periodic Review Report will be submitted to the Department at the end of every year following the fourth quarter. The reporting procedures and schedules shall not be modified without NYSDEC approval. The report will be prepared in accordance with NYSDEC DER-10 and submitted within 30 days of the end of each certification period. A summary of the media sampling results will also be incorporated into the Periodic Review Report. In the event that the site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the site described in Appendix C - Deed Restriction. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the site.

- Results of the required annual site inspections and severe condition inspections, if applicable.

- All applicable site management forms and other records generated for the site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.

- A summary of any discharge monitoring data and/or information generated during the reporting period, with comments and conclusions.

- Data summary tables and graphical representations of contaminants of concern by media (groundwater and leachate), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends.

- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link: http://www.dec.ny.gov/chemical/62440.html.

- A site evaluation, which includes the following:
  - The compliance of the remedy with the requirements of the site-specific ROD;
  - The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications;
  - Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring and Sampling Plan for the media being monitored;
  - Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan; and
  - Trends in contaminant levels in the affected media will be evaluated to determine if the remedy continues to be effective in achieving remedial goals as specified by the Decision Document.
  - The overall performance and effectiveness of the remedy.

7.2.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a qualified environmental professional will prepare, and include in the Periodic Review Report, the following certification as per the requirements of NYSDEC DER-10:

"*For each institutional or engineering control identified for the site, I certify that all of the following statements are true:*

- *The inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*
- *The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;*

- *Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control; Use of the site is compliant with the Deed Restriction;*

- *The engineering control systems are performing as designed and are effective;*

- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program and generally accepted engineering practice; and*

- *The information presented in this report is accurate and complete.*

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Owner Designated Site Representative] for the site."

The signed certification will be included in the Periodic Review Report.

The Periodic Review Report will be submitted, in hard-copy and electronic format, to the NYSDEC Region 9 Office.

7.3 Corrective Measures Work Plan

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control, a Corrective Measures Work Plan will be submitted to the NYSDEC for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the Corrective Measures Work Plan until it has been approved by the NYSDEC.

7.4 Remedial Site Optimization Report

In the event that an RSO is to be performed (see Section 6.3), upon completion of an RSO, an RSO report must be submitted to the Department for approval. A general outline for the RSO report is provided in Appendix O. The RSO report will document the research/ investigation and data gathering that was conducted, evaluate the results and facts obtained, present a revised conceptual site model and present recommendations. RSO recommendations are to be implemented upon approval from the NYSDEC. Additional work plans, design documents, HASPs etc., may still be required to implement the recommendations, based upon the actions that need to be taken. A final engineering report and update to the SMP may also be required.

The RSO report will be submitted, in electronic format, to the NYSDEC project manager identified in Table 1 and Appendix A, or their designee.

8.0 REFERENCES

6NYCRR Part 375, Environmental Remediation Programs. December 14, 2006.

NYSDEC DER-10 – “Technical Guidance for Site Investigation and Remediation”.

NYSDEC, 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1. June 1998 (April 2000 addendum).

Farwell Landfill Comprehensive Document (Work Plan, OM&M Manual and EMP), Cattaraugus County, NY August 2001, prepared by Stearns & Wheler, LLC Environmental Engineers & Scientists.

Post-Closure Landfill Monitoring Reduction Request, Farwell Landfill, Cattaraugus County, New York, July 2020, prepared by GHD on behalf of Cattaraugus County Department of Public Works.

TABLE 2 – GROUNDWATER ELEVATION DATA

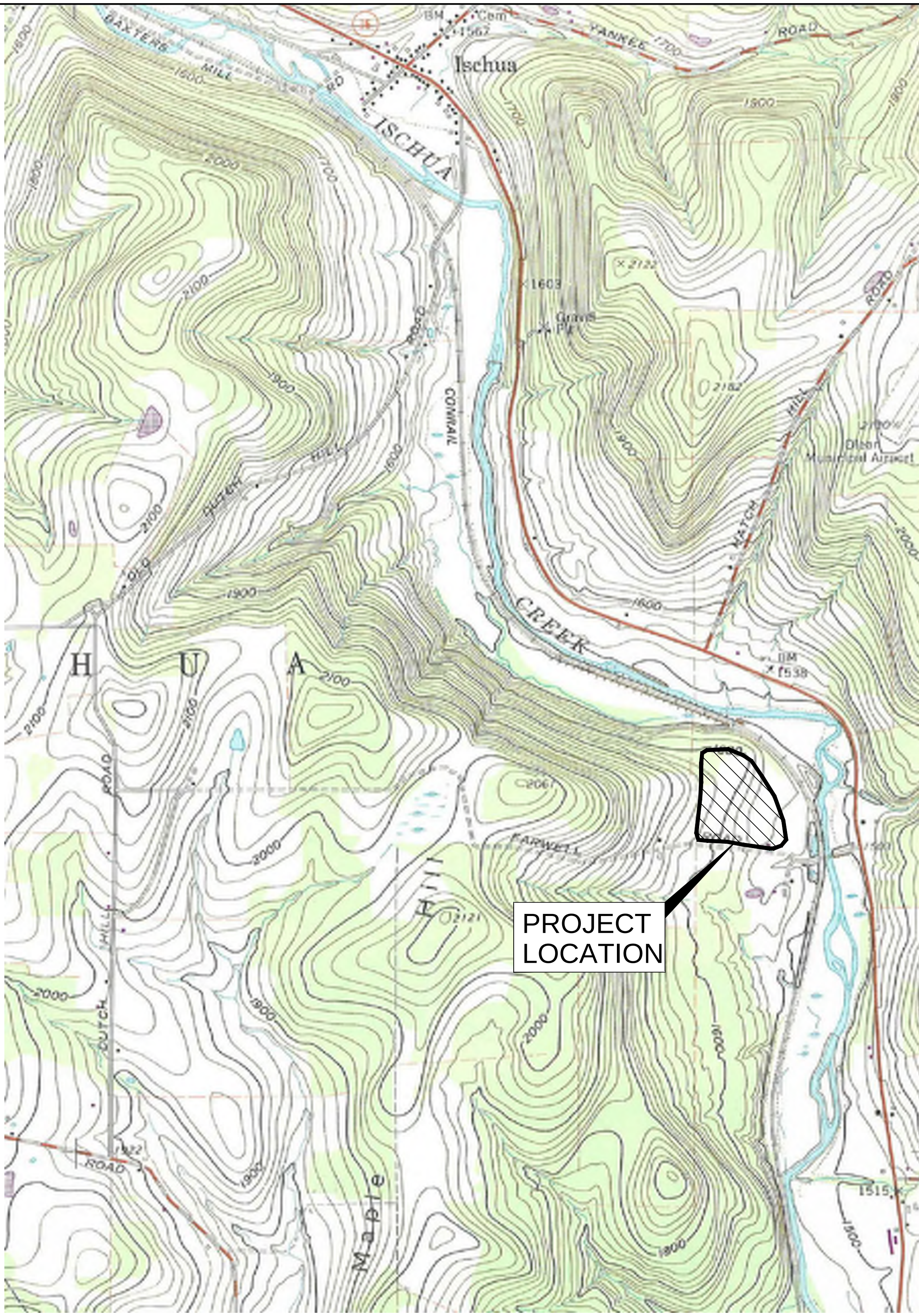
Farwell Landfill

Groundwater Elevation Data

GPI Greenman-Pedersen, Inc.	TOP OF CASING ELEVATION	Feb-20	Apr-20	Jul-20	Dec-20	May-21	DEPTH TO WATER May-22	ELEVATION OF WATER May-22	COMPARED TO LAST YEAR
Down-Gradient (annual)									
MW-14S	1539.42	1481.12	1492.62	1484.52	1488.92	1489.22	49.70	1489.72	0.50
MW-14I	1539.79	1474.99	1490.89	1484.69	1488.79	1490.19	50.50	1489.29	-0.90
MW-15S	1508.83	1489.23	1494.23	1489.83	1489.03	1489.03	19.20	1489.63	0.60
MW-15I	1509.5	1489.55	1489.90	1487.50	1488.80	1489.10	19.80	1489.70	0.60
MW-16S	1506.55	1488.84	1490.65	1489.45	1490.15	1489.45	15.90	1490.65	1.20
MW-16I	1507.61	1490.21	1490.31	1488.21	1489.91	1489.51	16.80	1490.81	1.30
MW-19	1543.31	1489.01	1488.21	1486.81	1483.91	1483.91	54.60	1488.71	4.80
MW-20	1534.12	1489.22	1489.22	1487.62	1486.12	1486.12	45.80	1488.32	2.20
MW-21	1535.5	1486.40	1489.10	1486.00	1496.40	1487.90	47.60	1487.90	0.00
MW-22	1498.28	1486.18	1487.28	1484.58	1486.38	1485.58	11.80	1486.48	0.90
MW-23	1495	1485.00	1486.50	1484.60	1486.80	1483.30	9.80	1485.20	1.90
MW-24	1486.54	1482.14	1482.64	1481.14	1482.74	1480.84	4.20	1482.34	1.50
MW-25	1496.91	1480.21	1480.81	1478.91	1480.11	1479.81	16.50	1480.41	0.60
Cross-Gradient (annual)									
MW-17I	1510.45	1491.67	1492.45	1491.45	1492.55	1500.35	18.10	1492.35	-8.00
MW-17S	1509.24	1492.04	1492.44	1491.74	1492.44	1491.84	16.80	1492.44	0.60
Down-Gradient Piezometer / Off-Site Locations (quarterly)									
PZ-15	1508.16	NA	NA	NA	NA	1488.26	18.70	1489.46	1.20
MW-18S	1502.53	NA	NA	NA	NA	1488.03	11.50	1491.03	NA
MW-18D	1502.51	NA	NA	NA	NA	1488.61	11.40	1491.11	NA
Ischua Creek ** (SW-2) at Farwell Rd Bridge	1504.75	NA	NA	NA	NA	1487.25	15.40	1489.35	NA
Ischua Creek ** (SW-2A) downstream of Bridge	???	NA	NA	NA	NA	NA	NA	NA	NA
Down-Gradient (biennially)									
MW-9S *	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-9D	1545.11	NA	1492.41	NA	NA	1490.11	53.50	1491.61	1.50
MW-10S	1530.49	NA	1499.99	NA	NA	1498.49	32.20	1498.29	-0.20
MW-10D	1528.42	NA	1490.42	NA	NA	1489.42	38.30	1490.12	0.70
MW-11S	1535.19	NA	1496.19	NA	NA	1495.39	39.20	1495.99	0.60
MW-11D	1535.57	NA	1490.57	NA	NA	1489.07	46.30	1489.27	0.20
Up/Cross-Gradient (biennially)									
MW-6 (up)	1623.68	NA	1494.88	NA	NA	1493.68	129.00	1494.68	1.00
MW-13D (cross)	1586.65	NA	1491.45	NA	NA	1487.65	96.40	1490.25	2.60

Notes: NA - Not available.
Elevations in feet above mean sea level (AMSL).
* - MW-9S was dry - no sample collected
** - Elevation of bolt on northwest side of the bridge, water elevation is determined by measuring down to the top of water from this bolt

FIGURES



USGS QUADRANGLE – HINSDALE, NY

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ENGINEERING • SURVEYING • PLANNING
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GPI

GRAPHIC SCALE

2000 0 1000 2000

(IN FEET)
1 inch = 2000 ft.

FARWELL LANDFILL
CATTARAUGUS COUNTY, NY

SITE LOCATION MAP

FIGURE NO.

1

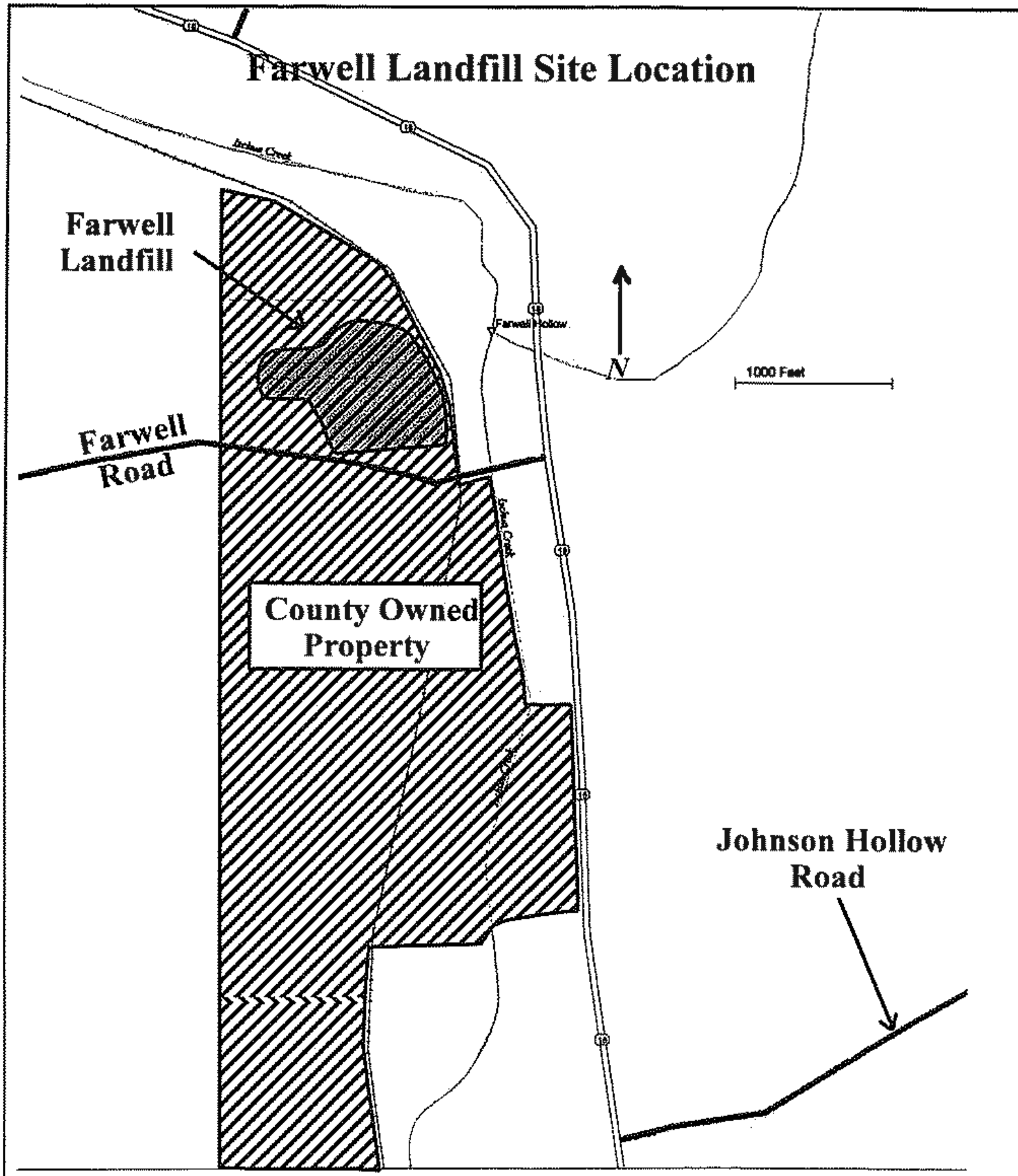
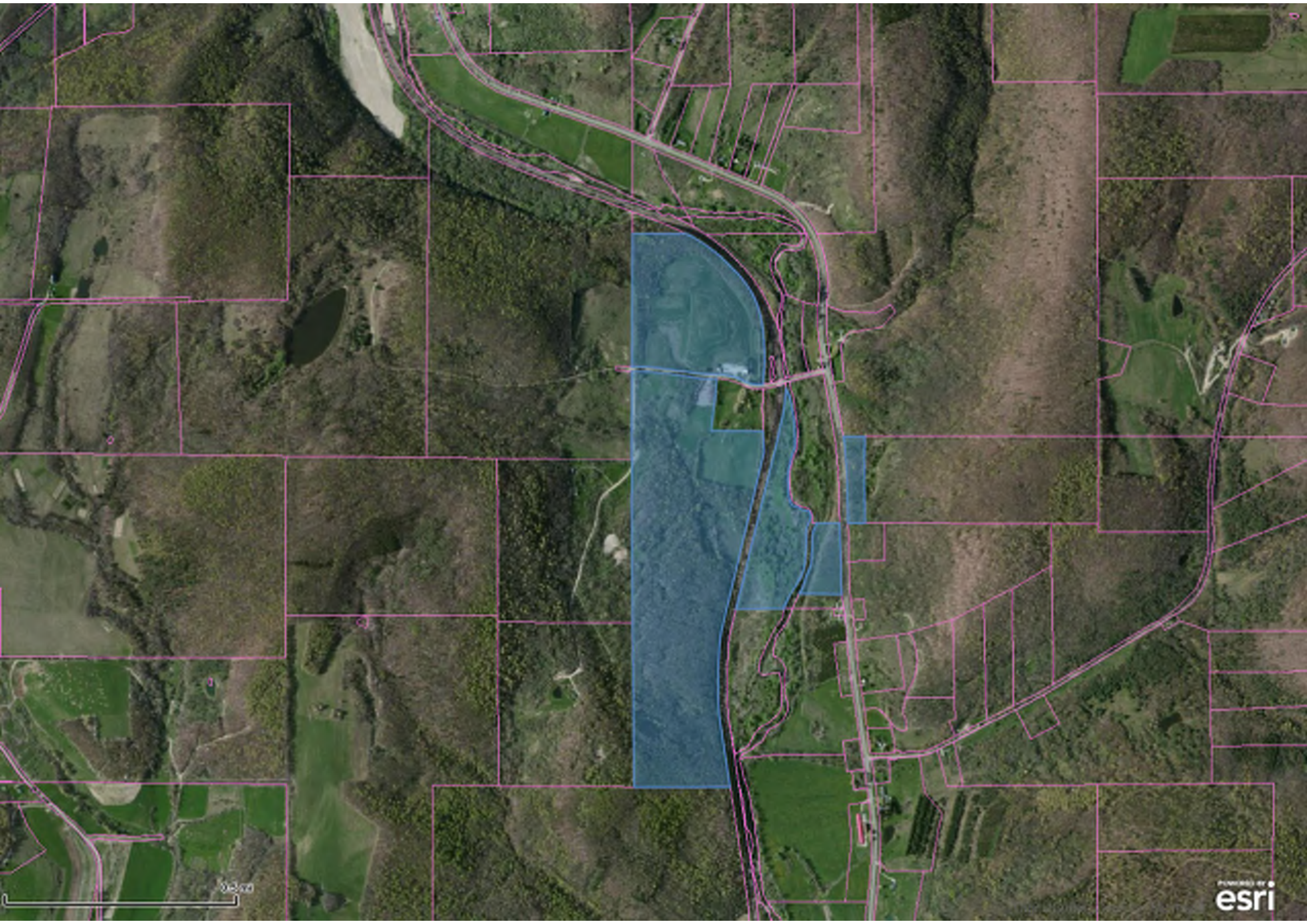


Figure 1A - Site Overview Plan

Figure 1B - Tax Map

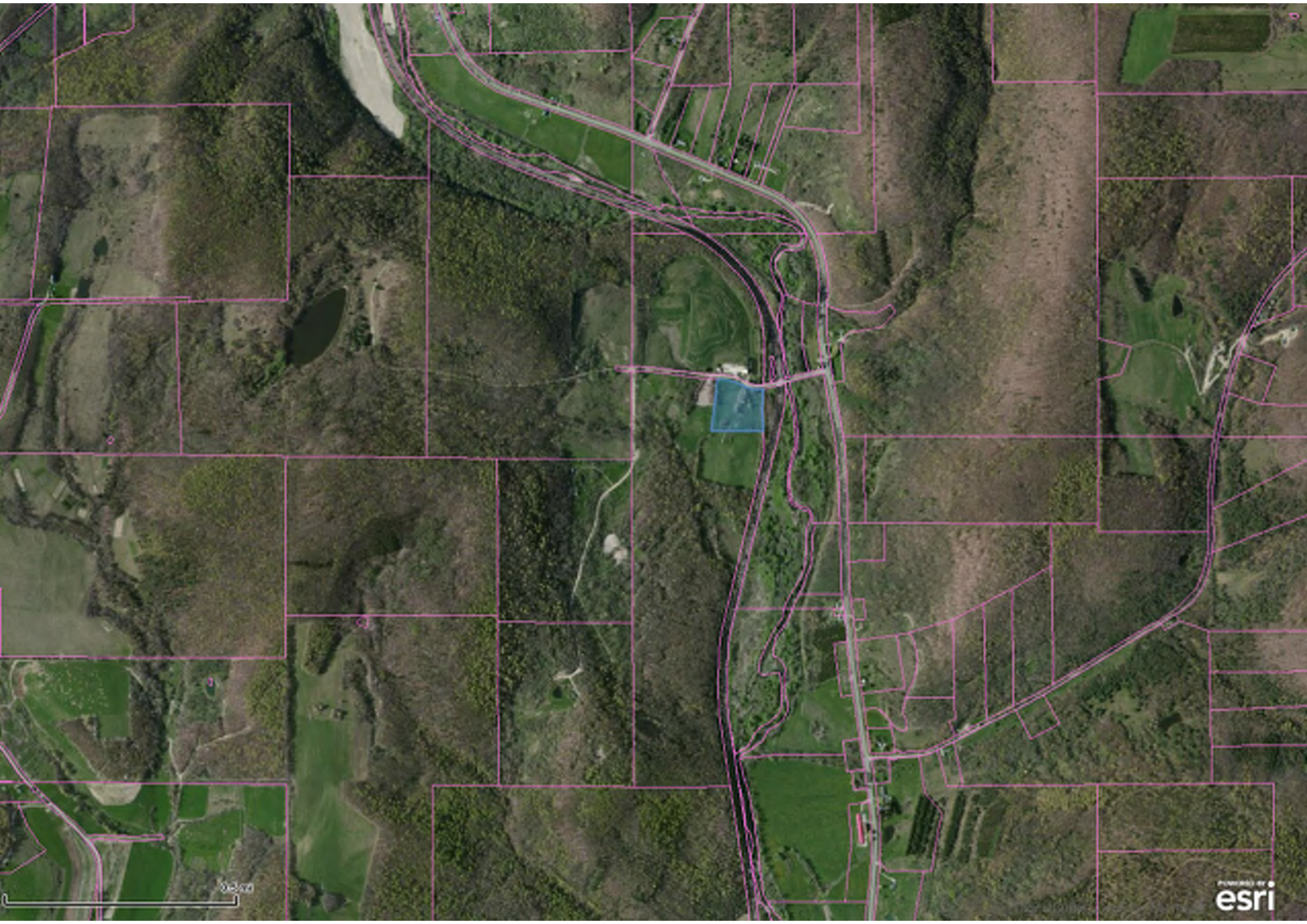
Parcel 68.003-1-1



Mon Jun 2 2014 11:11:42 AM.

Figure 1C - Tax Map

Parcel 68.001-1-18



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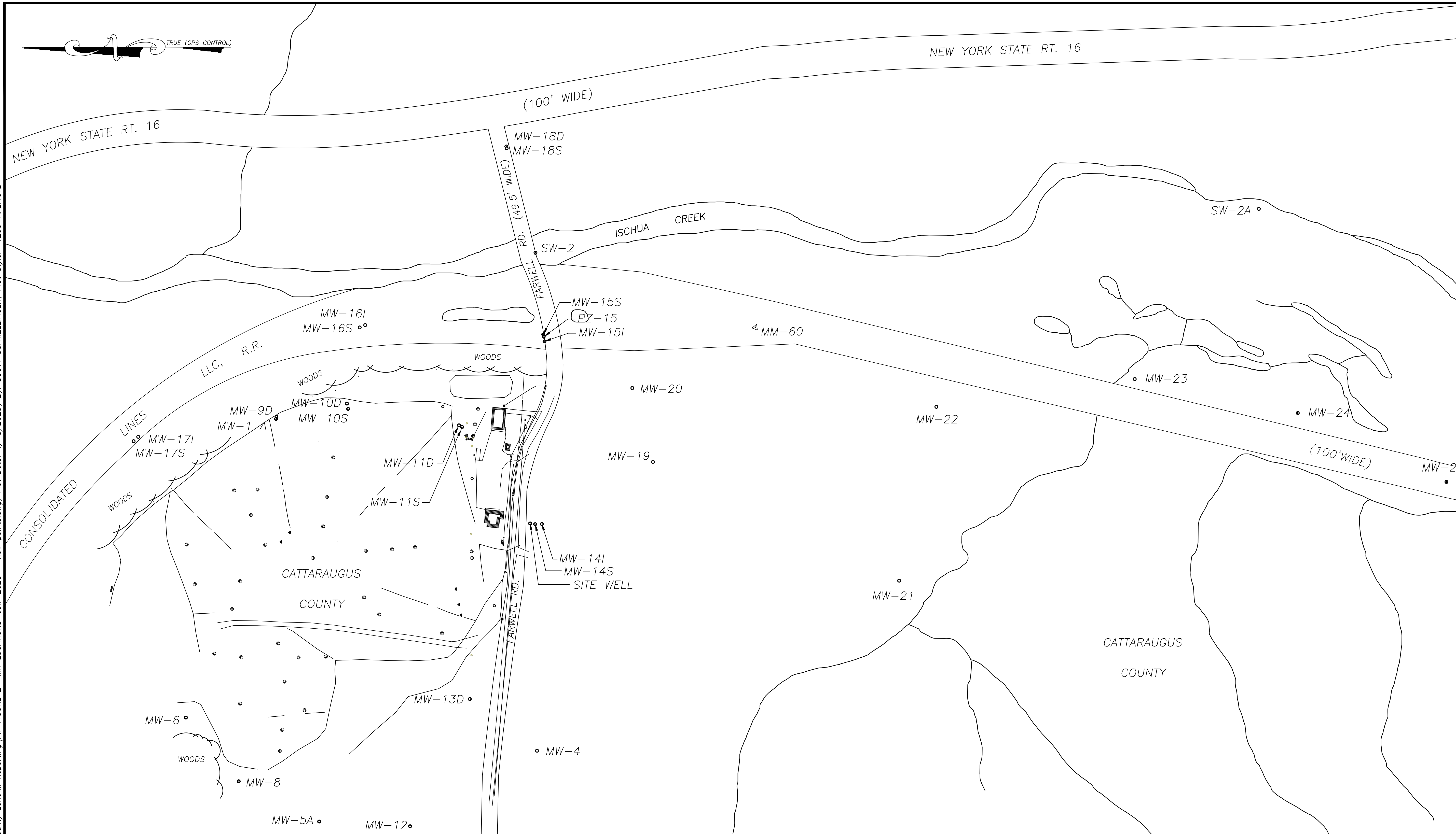


NOTE:
THIS MAP IS A COMPILATION OF MAPPING FROM THREE SOURCES. MONITORING WELL LOCATIONS AND ELEVATIONS ARE TAKEN FROM TWO INDIVIDUAL SURVEYS CONDUCTED BY THE CATTARAUGUS COUNTY DEPARTMENT OF PUBLIC WORKS USING ONSITE GPS MONUMENTATION AS CONTROL POINTS FOR THE SURVEYS. THE SECOND SOURCE IS TOPOGRAPHIC MAPPING DONE BY CORNERSTONE LAND SURVEYING, HINSDALE NEW YORK (USING THE SAME GPS MONUMENTATION FOR CONTROL AS THAT USED BY COUNTY FORCES FOR THEIR WORK) FOR STEARNS & WHEELER AND SUPPLIED TO CATTARAUGUS COUNTY BY STEARNS & WHEELER. THE FINAL MAPPING SOURCE UTILIZED IN CREATING THIS MAP IS THE TAX MAPPING FOR THE AREA, WHICH CONTAINS ROAD RIGHT OF WAYS, STREAMS, AND ASSOCIATED LABELING.

300 0 150 300
1 inch = 300 ft.

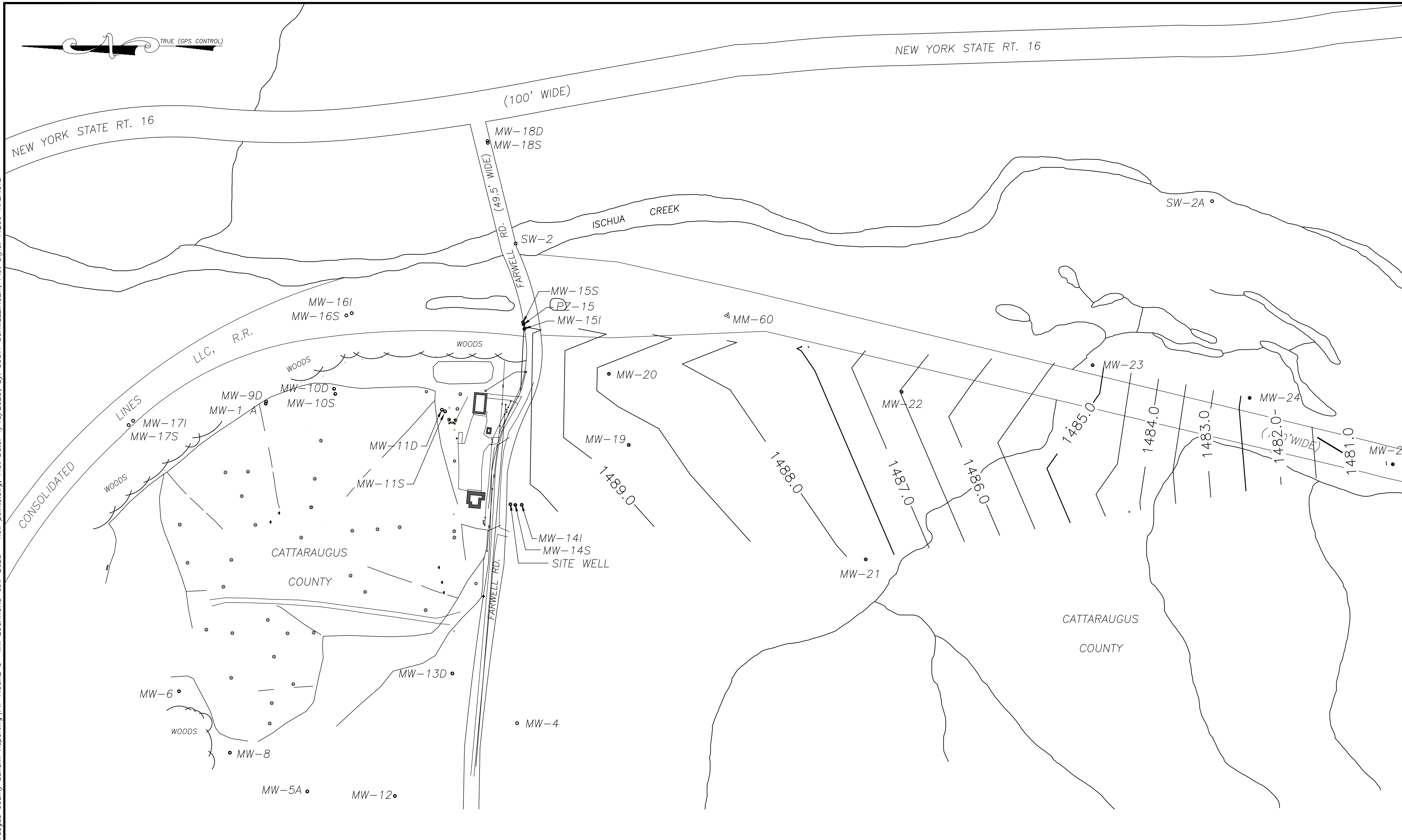
GREENMAN-PEDERSEN, INC.
CONSULTING ENGINEERS
ENGINEERING • SURVEYING • PLANNING
403 MAIN STREET SUITE 330 BUFFALO, NY 14203
(716) 633-4844 FAX (716) 633-4940
GPI

FARWELL LANDFILL
CATTARAUGUS COUNTY, NY

MONITORING POINT LOCATIONS

FIGURE NO.
2

File: N:\2018\BUF-2018023.00 Cattaraugus County Landfill Reporting\FW-FIGURE 2- MW LOCATIONS-eow-2023 - new points.dwg, Plot Date: 4/18/2023, By: SCOTT SCHMELZINGER, Plot Style: T1200-HALF.CTB



NOTE:
THIS MAP IS A COMPILATION OF MAPPING FROM THREE SOURCES. MONITORING WELL LOCATIONS AND ELEVATIONS ARE TAKEN FROM TWO INDIVIDUAL SURVEYS CONDUCTED BY THE CATTARAUGUS COUNTY DEPARTMENT OF PUBLIC WORKS USING ONSITE GPS MONUMENTATION AS CONTROL POINTS FOR THE SURVEYS. THE SECOND SOURCE IS TOPOGRAPHIC MAPPING DONE BY CORNERSTONE LAND SURVEYING, HINSDALE NEW YORK (USING THE SAME GPS MONUMENTATION FOR CONTROL AS THAT USED BY COUNTY FORCES FOR THEIR WORK) FOR STEARNS & WHEELER AND SUPPLIED TO CATTARAUGUS COUNTY BY STEARNS & WHEELER. THE FINAL MAPPING SOURCE UTILIZED IN CREATING THIS MAP IS THE TAX MAPPING FOR THE AREA, WHICH CONTAINS ROAD RIGHT OF WAYS, STREAMS, AND ASSOCIATED LABELING.

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FARWELL LANDFILL
CATTARAUGUS COUNTY, NY

GROUNDWATER CONTOURS
2022 SAMPLING EVENT

FIGURE NO.
3

File: N:\2018\BUF-2018023.00 Cattaraugus County Landfill Reporting\FW-FIGURE 3- MW LOCATIONS-eow-2023 - new points.dwg, Plot Date: 4/18/2023, By: SCOTT SCHMELZINGER, Plot Style: T1200-HALF.CTB

APPENDIX A – LIST OF SITE CONTACTS

APPENDIX A – LIST OF SITE CONTACTS

Name	Phone/Email Address
Cattaraugus County DPW Waste Management Coordinator (Owner)	(716) 378-5676; amkimes@cattco.org
James C. Manzella, Greenman-Pedersen Inc. (QEP)	716-989-3325; jmanzella@gpinet.com
Benjamin McPherson (NYSDEC Project Manager)	716-851-7220; benjamin.mcpherson@dec.ny.us

APPENDIX B - EXCAVATION WORK PLAN

APPENDIX B – EXCAVATION WORK PLAN (EWP)

B-1 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination, the site owner or their representative will notify the NYSDEC. Table 1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix A.

Table 1: Notifications*

Benjamin McPherson (NYSDEC PM)	716-851-7220; benjamin.mcpherson@dec.ny.us
Kelly Lewandowski	518-402-9553; kelly.lewandowski@dec.ny.us

* Note: Notifications are subject to change and will be updated as necessary.

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent of excavation, plans/drawings for site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated and any work that may impact an engineering control;
- A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work;
- A summary of the applicable components of this EWP;
- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120;

- A copy of the contractor's health and safety plan (HASP), in electronic format;
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

B-2 SOIL SCREENING METHODS

Visual, olfactory and instrument-based (e.g. photoionization detector) soil screening will be performed by a qualified environmental professional during all excavations into known or potentially contaminated material (remaining contamination). Soil screening will be performed when invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the COC.

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal and material that requires testing to determine if the material can be reused on-site as soil beneath a cover or if the material can be used as cover soil. Further discussion of off-site disposal of materials and on-site reuse is provided in Section B-7 of this Appendix.

B-3 SOIL STAGING METHODS

Soil stockpiles will be continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters and other discharge points.

Stockpiles will be stored on plastic and kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced.

Stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC.

B-4 MATERIALS EXCAVATION AND LOAD-OUT

A qualified environmental professional or person under their supervision will oversee all invasive work and the excavation and load-out of all excavated material.

The owner of the property and remedial party (if applicable) and its contractors are responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under this SMP is posed by utilities or easements on the site.

Loaded vehicles leaving the site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements).

A truck wash will be operated on-site, as appropriate. The qualified environmental professional will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the site until the activities performed under this section are complete Truck wash waters will be collected and disposed of off-site in an appropriate manner.

Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site soil tracking.

The qualified environmental professional will be responsible for ensuring that all egress points for truck and equipment transport from the site are clean of dirt and other materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

B-5 MATERIALS TRANSPORT OFF-SITE

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Material transported by trucks exiting the site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

Truck transport routes will be dependent upon the destination of material to be transported off-site. All trucks loaded with site materials will exit the vicinity of the site using only these approved truck routes. In general truck transport routes will be identified that will take into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project site.

Egress points for truck and equipment transport from the site will be kept clean of dirt and other materials during site remediation and development.

Queuing of trucks will be performed on-site in order to minimize off-site disturbance. Off-site queuing will be prohibited.

B-6 MATERIALS DISPOSAL OFF-SITE

All material excavated and removed from the site will be treated as contaminated and regulated material and will be transported and disposed in accordance with all local, State (including 6NYCRR Part 363) and Federal regulations. If disposal of material from this site is proposed for unregulated off-site disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated off-site management of materials from this site will not occur without formal NYSDEC approval.

Off-site disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility if appropriate, i.e. hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, C/D recycling facility, etc. Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Periodic Review Report. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and contaminated soils taken off-site will be handled consistent with 6 NYCRR Parts 360, 361, 362, 363, 364 and 365. Material that does not meet Unrestricted SCOs is prohibited from being taken to a New York State C&D debris recovery facility (6 NYCRR Subpart 360-15 registered or permitted facility).

B-7 MATERIALS REUSE ON-SITE

The qualified environmental professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on-site. Contaminated on-site material, including historic fill and contaminated soil, that is acceptable for reuse on-site will be placed below the demarcation layer (i.e. existing soil cover) or impervious surface, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

Excavated soil/fill that is visibly stained, discolored, or produces elevated PID readings will be sampled and classified for reuse, treatment, or off-site disposal. A tiered approach based upon the volume of soil/fill being excavated will be used to determine the frequency of sampling. See Table 5.4(e)10 (DER-10, May 2010) below for the frequency of sampling. A copy of the Allowable Constituent Levels (ACLs) from DER-10 is included in Appendix M of the SMP.

Table 5.4(e)10 Recommended Number of Soil Samples for Soil Imported To or Exported From a Site			
Contaminant	**VOCs**	**SVOCs, Inorganics & PCBs/Pesticides**	
Soil Quantity (cubic yards)	**Discrete Samples**	**Composite**	**Discrete Samples/Composite**
0-50	1	1	3-5 discrete samples from different locations in the fill being provided will comprise a composite sample for analysis
50-100	2	1	
100-200	3	1	
200-300	4	1	
300-400	4	2	
400-500	5	2	
500-800	6	2	
800-1000	7	2	
➢ 1000	Add an additional 2 VOC and 1 composite for each additional 1000 Cubic yards or consult with DER		

While VOC samples will consist of a discrete grab sample, a minimum of five grab samples will be collected for each composite sample collected for SVOCs, PCBs/pesticides and metals. Approximately equal fractions of the grab samples will be composited in the field using a stainless-steel trowel and bowl. The trowel and bowl shall be decontaminated with alconox or liquinox and potable water mixture, then triple-rinsed with deionized water between sampling locations. The discrete grab samples will be analyzed by a NYSDOH ELAP certified laboratory for Target Compound List (TCL) VOCs. The composite sample will be analyzed by a NYSDOH ELAP certified laboratory for TCL SVOCs, PCB/pesticides, and the metals listed on the table in Appendix M of the SMP. In addition, one sample jar will be filled and sent to the laboratory for possible characterization analysis, as described below. All analyses shall be performed using methods acceptable to NYSDEC at the time of analysis.

Any demolition material proposed for reuse on-site will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing on-site will not be performed without prior NYSDEC approval. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the site will not be reused on-site.

B-8 FLUIDS MANAGEMENT

Liquids to be removed from the site, including excavation dewatering will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Dewatering fluids, will not be recharged back to the land surface or subsurface of the site, but will be managed off-site, unless prior approval is obtained from NYSDEC. Groundwater monitoring well purge and development waters will may be discharged to the ground surface of the Site in the vicinity of each monitoring location in a manner that does not result in overland flow or erosion.

While not anticipated, the discharge of water generated during large-scale construction activities to surface waters (i.e. a local pond, stream or river) will be performed under a SPDES permit.

B-9 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities the cover system will be restored in a manner that complies with the Record of Decision. The existing cover system is comprised of a minimum of 18 inches of compacted soil followed by a 6-inch topsoil layer. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy and the upper surface of the remaining contamination. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in an updated SMP.

B -10 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the site will be approved by the qualified environmental professional and will be in compliance with provisions in this SMP prior to receipt at the site. A Request to Import/Reuse Fill or Soil form, which can be found at http://www.dec.ny.gov/regulations/67386.html, will be prepared and submitted to the NYSDEC project manager allowing a minimum of 5 business days for review.

Material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated sites will not be imported to the site.

All imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d) and the requirements for backfill used at the site will be consistent with the backfill requirements provided in DER-10 (e.g., Appendix 5). Based on an evaluation of the land use, protection of groundwater and protection of ecological resources criteria, the resulting soil quality standards will use the Soil Cleanup Objective (SCO) for commercial criteria, which is included in Appendix M. Soils that meet 'exempt' fill requirements under 6 NYCRR Part 363, but do not meet backfill or cover soil objectives for this site, will not be imported onto the site without prior approval by NYSDEC. Solid waste will not be imported onto the site.

Off-site borrow soils will be documented as having originated from locations having no evidence of disposal or release of hazardous, toxic or radioactive substances, wastes or petroleum products.

If the contractor designates a source as "virgin" soil, it shall be further documented in writing to be native soil material from areas not having supported any known prior industrial or commercial development or agricultural use.

Virgin soils will be subject to collection of one representative composite sample per source. The sample will be analyzed for TCL VOCs, SVOCs, pesticides, and PCBs, plus the metals listed in Appendix M of the SMP. The samples will also be analyzed for PFAS and 1,4 dioxane consistent with the DEC's guidance document included in Appendix N. The soil will be acceptable for use as backfill provided that all parameters meet the maximum concentration limits listed in this table.

Testing of imported soil will be at the frequency of DEC-10 Table 5.4(e)10, unless otherwise approved in a specific EWP notification.

Trucks entering the site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

B -11 STORMWATER POLLUTION PREVENTION

Based on the deed restrictions in place which limit the Site's use to that of a solid waste management facility it is not anticipated that excavations over 1 acre will occur on the Site. The following paragraphs summarize the general erosion and sediment control measures will be implemented for any land disturbance activities that take place on the Site.

Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC. All necessary repairs shall be made immediately.

Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.

All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.

Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

Erosion and sediment control measures identified in the SMP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

Silt fencing or hay bales will be installed around the entire perimeter of the construction area.

For construction projects exceeding 1 acre a Stormwater Pollution Prevention Plan that conforms to the requirements of NYSDEC Division of Water guidelines and NYS regulations will be prepared.

B -12 EXCAVATION CONTINGENCY PLAN

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and PCBs), unless the site history and previous sampling results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC’s Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the Periodic Review Report.

B -13 COMMUNITY AIR MONITORING PLAN

Real time air monitoring will be performed at downwind locations during site excavation activities that is anticipated to encounter remaining contamination. A Community Air Monitoring Plan (CAMP) is included as Appendix G of the SMP. This plan was prepared in general accordance with the requirements contained within the Generic Community Air Monitoring Plan included in Appendix 1A of DER-10 (May 2010).

If any excavation activities are required at the Site a figure showing the location of air sampling stations will be included with the notification documents listed under Section B-1 of this EWP. These locations will be adjusted on a daily or more frequent basis based on actual wind directions to provide an upwind and at least two downwind monitoring stations.

Exceedances of action levels listed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers.

B-14 ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors off-site. While there will be no specific odor control methods used on a routine basis, monitoring for VOCs and particulates will be performed during all intrusive activities that is anticipated to encounter remaining contamination. If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the remedial party’s Remediation Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, these measures will include: (a) limiting the area of open excavations and size of soil stockpiles; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils;. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-site disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

B-15 DUST CONTROL PLAN

Particulate monitoring will be performed along the downwind perimeter of the site during subgrade excavation, grading, and handling activities that is anticipated to encounter remaining contamination in accordance with the Community Air Monitoring Plan (Appendix G of the SMP).

Dust suppression techniques will be employed as necessary to mitigate fugitive dust from unvegetated or disturbed soil/fill to the extent practicable during excavation activities. Such techniques shall be employed even if the community air monitoring results indicate particulate levels are below action levels.

A dust suppression plan that addresses dust management during invasive on-site work will include, at a minimum, the items listed below:

- Dust suppression will be achieved though the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.

- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.

- Gravel will be used on roadways to provide a clean and dust-free road surface.

- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

APPENDIX C - DEED RESTRICTIONS & METES AND BOUNDS DESCRIPTION

GPI

Darrell Klute, County Clerk
303 Court St
Little Valley, NY 14755
(716) 938-2293

Cattaraugus County Clerk Recording Cover Sheet

Received From :
CATTARAUGUS COUNTY ATTORNEY

Return To :
CATTARAUGUS COUNTY ATTORNEY

Method Returned : NO MAIL BACK

First PARTY 1

CATTARAUGUS COUNTY

First PARTY 2

Index Type : Deeds

Inst Number : 202302210

Book : **Page :**

Type of Instrument : Restrictive Covenants

Recording Fee: $0.00

Recording Pages : 11

Recorded Information

State of New York

County of Cattaraugus

I hereby certify that the within and foregoing was recorded in the Clerk's office for Cattaraugus County, New York

On (Recorded Date) : 02/03/2023

At (Recorded Time) : 2:11:15 PM

Doc ID - 014444780011

Darrell Klute, County Clerk

This sheet constitutes the Clerks endorsement required by Section 319 of Real Property Law of the State of New York

DECLARATION of COVENANTS and RESTRICTIONS

THIS COVENANT, made the 3rd day of February, 2023, by the COUNTY OF CATTARAUGUS, a corporation organized and existing under the laws of the State of New York and having an office for the transaction of business at 303 Court Street, Little Valley, New York 14755.

WHEREAS, the COUNTY OF CATTARAUGUS is the owner of an inactive hazardous waste disposal site which is listed in the Registry of Inactive Hazardous Waste Disposal Sites in New York State as Site Number 905024, located in the Town of Ischua, County of Cattaraugus, State of New York, which is part of lands conveyed by Donald R. Farwell and Arlene J. Farwell to the County of Cattaraugus by deed dated September 24, 1973 and recorded in the Cattaraugus County Clerk's Office on October 4, 1973 in Book 742 of Deeds at Page 937 and by deed dated May 19, 1990 and recorded in the Cattaraugus County Clerk's Office on June 24, 1990 in Book 901 of Deeds at Page 804, and being more particularly described in Appendix "A", attached to this declaration and made a part hereof, and hereinafter referred to as "the Property"; and

WHEREAS, the Property is the subject of a consent order issued by the New York State Department of Environmental Conservation to the COUNTY OF CATTARAUGUS; and

WHEREAS, the New York State Department of Environmental Conservation set forth a remedy to eliminate or mitigate all significant threats to the environment presented by hazardous waste disposal at the Site in a Record of Decision ("ROD") dated March 30, 2001, and such ROD or the Work Plan for the implementation of the ROD required that the Property be subject to restrictive covenants.

NOW, THEREFORE, the COUNTY OF CATTARAUGUS, for itself and its successors and/or assigns, covenants

First, the Property subject to this Declaration of Covenants and Restrictions is as shown on a map attached to this declaration as Appendix "B" and made a part hereof, and consists of that property owned by the County of Cattaraugus described in the first Whereas, supra.

Second, unless prior written approval by the New York State Department of Environmental Conservation or, if the Department shall no longer exist, any New York State agency or agencies subsequently created to protect the environment of the State and the health of the State's citizens, hereinafter referred to as "the Relevant Agency", is first obtained, no person shall engage in any activity that will, or that reasonably is anticipated to, prevent or interfere significantly with any proposed, ongoing or completed program at the Property or that will, or is reasonably foreseeable to, expose the public health or the environment to a significantly increased threat of harm or damage.

Third, the owner of the Property shall maintain the cap covering the Property by maintaining its grass cover or, after obtaining the written approval of the Relevant Agency, by capping the Property with another material.

Fourth, the owner of the Property shall prohibit the Property from ever being used for purposes other than for solid waste management facilities as defined in New York State County Law Section 226-b, without the express written waiver of such prohibition by the Relevant Agency.

Fifth, the owner of the Property shall prohibit the use of the groundwater underlying the Property without treatment rending it safe for drinking water or industrial purposes, as appropriate, unless the user first obtains permission to do so from the Relevant Agency.

Sixth, the owner of the Property shall continue in full force and effect any institutional and engineering controls the required County of Cattaraugus to put into place and maintain unless the owner first obtains permission to discontinue such controls from the Relevant Agency and shall operate, maintain and monitor the property in accordance with the Department-approved Site Management Plan for the Property, as may be amended in the future with Department approval. The controls and requirements listed in the Department-approved Site Management Plan are incorporated into and made part of this Declaration.

Seventh, this Declaration is, and shall be deemed a covenant that shall run with the land and shall be binding upon all future owners of the Property and shall provide that the owner, and it successors and assigns, consents to the enforcement by the Relevant Agency of the prohibitions and restrictions required to be recorded and hereby covenants not to contest the authority of the Department to seek enforcement.

Eighth, any deed of conveyance of the Property, or any portion thereof, shall recite, unless the Relevant Agency has consented to the termination of such covenants and restrictions, that said conveyance is subject to this Declaration of Covenants and Restrictions.

This document does hereby supersede and replace entirely the Declaration of Covenants and Restrictions dated May 14, 2003 and recorded in Liber 1024 of Deeds at Page 1043 in the Cattaraugus County Clerk's Office.

IN WITNESS WHEREOF, the undersigned has executed this instrument the day written below.

IN PRESENCE OF

(Corporate Seal)

COUNTY OF CATTARAUGUS

HOWARD V. VANRENSSELAER, Chairman
Cattaraugus County Legislature

STATE OF NEW YORK :
: ss.
COUNTY OF CATTARAUGUS:

On the 3rd day of February, in the year 2023, before me, the undersigned, a Notary Public in and for said State, personally appeared Howard V. VanRensselaer, personally known to me or proved to me on the basis of satisfactory evidence to be the individual whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his capacity, and that by his signature on the instrument, the individual, or the person upon behalf of ~~which~~ the individual acted, executed the instrument.

Diane K Graham
Notary Public

DIANE K. GRAHAM
Notary Public, State of New York
Reg. No. 01GR6018552
Qualified in Cattaraugus County
Commission Expires 1/11/2027

APPENDIX A

04700 FORM 58XX N. Y. DEED—WARRANTY with Lien Covenant

This Indenture

Made the 25th day of September

Nineteen Hundred and Seventy-three,

Between DONALD R. FARWELL and ARLENE J. FARWELL, his wife, R. D. # 1, Hinsdale, New York 14743 (no street address),

parties of the first part, and

THE COUNTY OF CATTARAUGUS, State of New York,

party of the second part,

Witnesseth that the parties of the first part, in consideration of

ONE HUNDRED FIFTEEN THOUSAND-------------------------Dollars ($115,000.00) lawful money of the United States, paid by the party of the second part, do hereby grant and release unto the party of the second part, its successors and assigns forever, all THAT TRACT OR PARCEL OF LAND, situate in the Town of Ischua, County of Cattaraugus and State of New York, known and distinguished as a part of Lot number forty-four, Township Three, Range Three of the Holland Land Company's Survey and bounded and described as follows: Beginning at the northeast corner of said lot; thence south on the lot line to the southeast corner of lands deeded by John H. Farwell to Jonathan Davis and Abram Farwell for mill purposes; thence westerly along the south bounds of said lot to the center of the highway; thence northerly along the center of the highway to the north bounds of lot forty-four; and from thence east on lot line to the place of beginning, be the same more or less, excepting and reserving however, the part thereof owned by the heirs at law or grantees of said Jonathan Davis in said mill property.

ALSO, CONVEYING ALL THAT TRACT OR PARCEL OF LAND situate in the Town, County and State aforesaid, known and distinguished as the north part of lot forty-four, township, range and survey as aforesaid and bounded; north by lot forty-five, thirty-eight chains, forty-one links; east by lot number nine, fourteen chains, seventy-five links; west by lot line, fourteen chains, seventy-five links; and south by a line parallel to the north bounds of said lot, thirty-eight chains, thirty-five links, to the place of beginning, containing fifty-six and three-fourths acres of land more or less. Excepting, however, therefrom all that part thereof which was deeded by John H. Farwell to Jonathan Davis and Abram M. Farwell for mill purposes.

ALSO CONVEYING ALL THAT TRACT OR PARCEL OF LAND situate in the Town, County and State aforesaid, known and distinguished as the north part of lot number thirty-six, Town Three, Range Three of said survey, bounded; north by lot thirty-seven, forty chains, sixty links; east by lot number twenty-eight, fourteen chains, seventy-five links; south by land deeded by the Holland Land Company to Jonathan Davis, forty chains, seventy-eight links; and west by lot number forty-four, fourteen chains, seventy-five links, containing sixty acres more or less.

ALSO CONVEYING ALL THAT TRACT OR PARCEL OF LAND, situate in the Town, County and State aforesaid and township and range aforesaid, bounded and described as follows: Beginning at the southwest corner of said lot, and thence north on lot line, thirty-four chains, sixty-three links to the southwest corner of lands formerly owned by Thaddeus Farwell; thence east on the south line of said Farwell's land to the center of the Ischua Creek; thence southerly along the center of said Ischua Creek to the south line of said lot; thence west on the lot line to the place of beginning, containing eighty-nine acres more or less.

LIBER 742 PAGE 937

ALSO CONVEYING ALL THAT TRACT OR PARCEL OF LAND, situate in the Town, County and State aforesaid, known and distinguished as part of Lot number forty-four, bounded and described as follows: Beginning at the southwest corner of the farm purchased by G. W. Bullard of Johnathan Davis, January 5th, 1865; running thence northerly on the West line of said Bullard's farm, thirty chains to land sold to John H. and A. N. Farwell thence easterly on the south line of land sold to said Farwells to the railroad lands; thence southerly on the west line of the railroad lands to the south bounds of said Bullard Farm; thence westerly on the south line of said Bullard Farm to the place of beginning, containing forty-six and forty-five one hundredths acres of land more or less, together with the privilege of the cattle pass described in the deed from said Bullard to John H. Farwell and others dated November 10th, 1884.

ALSO CONVEYING ALL THAT TRACT OR PARCEL OF LAND, situate in the Town, County and State aforesaid, bounded and described as follows: Beginning at the northwest corner of the farm purchased by one G. W. Bullard of Jonathan Davis by deed bearing date January 5th, 1865, and recorded in Liber 62 of deeds at page 74; running thence south on the west line of said farm, fourteen chains, ninety-six links to a stake; thence east on a line parallel to the north bounds of said farm, twenty-seven chains, seventy-six links to the west bank of the feeder, so-called; thence on a northerly direction on the west bank of said feeder and to a point in the creek, two chains and forty-six links; thence east on a line parallel to the north bounds of said farm, eight chains, fifty links to the center of the highway running from Hinsdale to Franklinville; thence northerly in the center of said highway to the north bounds of said farm, twelve chains, fifty links to Bullard's north line; thence westerly on the north line of said farm to the place of beginning, thirty-six chains, containing fifty-one and one-half acres more or less.

ALSO CONVEYING ALL THAT TRACT OR PARCEL OF LAND, situate in the Town, County and State aforesaid, distinguished as part of Lot number forty-five, township three, range three as aforesaid, bounded and described as follows: Commencing in the center of the Ischua Creek on the Section Line; thence up said Creek, north, five degrees west, eight chains, fifty links; thence north, eighty-five degrees west, five chains, thirty-three links up a ravine and a road to a stake; thence south, thirteen degrees west, eight chains eighty-seven links to the south line of lot number forty-five; thence east on said lot line eight chains, fifty links to the place of beginning, containing five and ninety-six one hundredths acres of land more or less.

ALSO CONVEYING ALL THOSE TWO CERTAIN TRACTS OR PIECES OF LAND, situate in the Town of Ischua, in the County of Cattaraugus and State of New York, bounded and described as follows, viz:

Number One: Beginning at a point in the middle of a former location of Ischua Creek at the distance of one hundred and twenty-five feet measured southwestwardly from a point in and radially to the line established as the center line of the railroad of the Western New York and Pennsylvania Railway Company; extending thence in a general southeasterly direction by other land of the said Railway Company on a line parallel with the aforesaid center line and one hundred and twenty-five feet distant southwestwardly therefrom, as follows, viz: First, on a line curving toward the left with a radius of two thousand four hundred and seventeen feet and one one-hundredth of a foot, a distance of one thousand two hundred and eighty-seven feet and two-tenths of a foot to a point; and Second, south sixty-five degrees, thirty-eight minutes east one thousand five hundred and ninety feet and ninety-two one-hundredths of a foot to a point in the former location of Ischua Creek aforesaid; thence along the middle of said Creek, by land now or formerly of Oakley W. Chamberlain and land of the said Eugene B. Farwell, as follows, viz: First, south eighty-five degrees, thirteen minutes west two hundred and ninety-three feet and thirteen one-hundredths of a foot to a point; second, north eighty-five degrees, seven minutes west five hundred and thirty feet and five-tenths of a foot to a point; Third, north sixty-five degrees, thirty-seven minutes west one thousand two hundred and eighty-six feet to a point; Fourth, north forty-five degrees west five hundred and eighty-eight feet and seven-tenths of a foot to a point;

and Fifth, north one degree, four minutes west five hundred and six feet and five one-hundredths of a foot to the place of beginning, containing seventeen acres and nine hundred and seventy-two one-thousandths of an acre, more or less.

NUMBER TWO: Beginning at a point in the dividing line between the original tracts of Fred J. Schrader and Eugene B. Farwell, etal., at the distance of one hundred and twenty-five feet measured southwestwardly from a point in and radially to said center line; extending thence along said original dividing line by land of the said Eugene B. Farwell, south eighty-eight degrees, seven minutes west six hundred and seventy-six feet and thirty-seven one-hundredths of a foot to a point; thence still by land of the said Eugene B. Farwell, north five degrees, thirty-two minutes east three hundred and sixty-six feet and thirteen one hundredths of a foot to a point; thence in a general southeasterly direction by other land of the said Railway Company on a line parallel with the aforesaid center line and one hundred and twenty-five feet distant southwestwardly therefrom, as follows, viz: First, south sixty-five degrees, thirty-eight minutes east two hundred and eighty-three feet and eighty-seven one-hundredth of a foot to a point; and Second, on a line curving toward the right with a radius of one thousand nine hundred and fifty-eight feet and sixty-eight one hundredths of a foot, a distance of four hundred and forty-six feet and eighty-eight one-hundredths of a foot to the place of beginning, containing three acres and seventy-three one-thousandths of an acre, more or less. EXCEPTING AND RESERVING from the above described premises those certain premises conveyed to the Western New York and Pennsylvania Railway Company.

Being the same premises conveyed by deed dated March 19, 1934, Eugene B. Farwell and Catherine W. Farwell to Clement H. Farwell and Olive B. Farwell recorded March 20, 1934 Liber 343 of Deeds at Page 541.

EXCEPTING AND RESERVING FROM ALL OF THE ABOVE DESCRIBED PREMISES, ALL THAT TRACT OR PARCEL OF LAND, SITUATE IN THE Town of Ischua, County of Cattaraugus and State of New York, known and distinguished as the north part of lot number thirty-six, town three, range three of said survey, bounded: North by lot thirty-seven, forty chains, sixty links; east by lot number twenty-eight, fourteen chains, seventy-five links; south by land deeded by the Holland Land Company to Jonathan Davis, forty chains, seventy-eight links; and west by lot number forty-four, fourteen chains, seventy-five links, containing sixty acres more or less.

All of the foregoing premises being the same premises described in deed dated May 4, 1973 Clement H. Farwell to Donald R. Farwell and Arlene J. Farwell recorded May 7, 1973 in Liber 738 of Deeds at Page 355.

EXCEPTING AND RESERVING FROM ALL OF THE FOREGOING PREMISES: ALL THAT TRACT OR PARCEL OF LAND, situate in the Town of Ischua, County of Cattaraugus and State of New York, known and distinguished as being part of Lot No. 45, township 3, range 3 of the Holland Land Company Survey bounded and described as follows: Beginning at a point in the centerline of Farwell Road on Lot No. 45 which said point is south 84° 18' 30" east, measured along the centerline of Farwell Road a distance of 1024.25 feet from the intersection of the centerline of Farwell Road and the west boundary line of Lot No. 45; thence south 4° 47' 30" west from the point of beginning 612.14 feet to a point; thence south 85° 51' 30" east a distance of 637.84 feet to a point in the centerline of the Pennsylvania Railroad right of way and which said point is 91.5 feet northerly, measured along the centerline of said Railroad from the intersection of said Railroad and the south boundary of Lot No. 45; thence northeasterly along the centerline of the right of way of the Pennsylvania Railroad to the intersection of the centerline of said Railroad and the centerline of said Farwell Road; thence south 82° 19' 30" west along the centerline of Farwell Road a distance of 313.94 feet to an angle point therein; thence north 64° 51' 30" west along the centerline of said Farwell Road a distance of 253.62 feet to an angle point in said Farwell Road; thence north 84° 18' 30" west along the centerline of Farwell Road a distance of 128.56 feet to the place and point of beginning containing 9.34 acres be the same more or less; all of the foregoing 9.34 acres more or less being a portion of the premises once described in a Deed dated May 4, 1973 Clement H. Farwell to Donald R. Farwell and Arlene J. Farwell recorded May 7, 1973 in Liber 738 of Deeds at Page 355.

FOREGOING PREMISES ARE ALSO BOUNDED AND DESCRIBED AS FOLLOWS:
ALL THAT TRACT OF PARCEL OF LAND, situate in the Town of Ischua, County
of Cattaraugus and State of New York, being part of Lot 44 and 45,
Township 3, Range 3 of the Holland Land Company's survey and bounded
and described as follows:

Beginning at the southwest corner of Lot 45; thence North 0° 54'
30" east along the west bounds of Lot 45 a distance of 2285.58 feet to
a point; thence south 89° 51' 30" east a distance of 835.42 feet to
a point in the center of the Pennsylvania Railroad; thence southerly
along the centerline of said Railroad to the centerline of Farwell
Road; thence North 75° 13' 30" east along said centerline a distance
of 79.6 feet to the center of Ischua Creek; thence southerly along
center of said creek a distance of 660± to the south bounds of
Lot 45 and north bounds of Lot 44; thence south 89°49' east along said
Lot line a distance of 170 feet to a point; thence south 21° 29' east
a distance 378.84 feet to a point; thence south 89° 49' east a distance
of 419.1 feet to a point in the east bounds of Lot 44; thence south
0° 11' west along the east bounds of Lot 44 a distance of 676.5 feet to
a point; thence north 89° 49' west a distance of 115.5 feet to the
centerline of Route 16; thence South 0° 38' 30" east along the center-
line of Route 16 a distance of 818.81 feet to a point; thence north
89° 28' west a distance of 561.0 feet to a point; thence south 0° 32'
west a distance of 162.0 feet to a point; thence north 89° 54' west a
distance of 710.26 feet to a point in the centerline of the Pennsylvania
Railroad thence southerly along the centerline of said railroad to the
south bounds of Lot 44; thence south 89° 34' west along the south bounds
of Lot 44 a distance of 1212.88 feet to the west bounds of Lot 44;
thence north 0° 54' 30" east a distance of 3940.86 feet to the north
bounds of Lot 44 and the point of beginning containing 230.70 acres of
land more or less.

EXCEPTING AND RESERVING ALL THAT TRACT OR PARCEL OF LAND, situate
in the Town of Ischua, County of Cattaraugus and State of New York,
known and distinguished as being part of Lot No. 45, township 3, range
3 of the Holland Land Company Survey bounded and described as follows:
Beginning at a point in the centerline of Farwell Road on Lot No. 45
which said point is south 84° 18' 30" east, measured along the centerline
of Farwell Road a distance of 1024.25 feet from the intersection of
the centerline of Farwell Road and the west boundary line of Lot No.
45; thence south 4° 47' 30" west from the point of beginning 612.14
feet to a point; thence south 85° 51' 30" east a distance of 637.84
feet to a point in the centerline of the Pennsylvania Railroad right
of way and which said point is 91.5 feet northerly, measured along
the centerline of said Railroad from the intersection of said Railroad
and the south boundary of Lot No. 45; thence northeasterly along the
centerline of the right of way of the Pennsylvania Railroad to the
intersection of the centerline of said Railroad and the centerline
of said Farwell Road; thence south 82° 19' 30" west along the centerline
of Farwell Road a distance of 313.94 feet to an angle point therein;
thence north 64° 51' 30" west along the centerline of said Farwell
Road a distance of 253.62 feet to an angle point in said Farwell Road;
thence north 84° 18' 30" west along the centerline of Farwell Road
a distance of 128.56 feet to the place and point of beginning containing
9.34 acres be the same more or less; all of the foregoing 9.34 acres
more or less being a portion of the premises once described in a Deed
dated May 4, 1973 Clement H. Farwell to Donald R. Farwell and Arlene
J. Farwell recorded May 7, 1973 in Liber 738 of Deeds at Page 355.

The net acreage hereby described is calculated as follows:

Total	230.70
Less EXCEPTION	-9.34
Net acres described	221.36 acres.

REAL ESTATE TRANSFER TAX
STATE OF NEW YORK
00.00
CATTARAUGUS COUNTY
018182
Dept. of Taxation & Finance

Together with the appurtenances and all the estate and rights of the parties of the first part in and to said premises,

To have and to hold the premises herein granted unto the party of the second part, its successors and assigns forever.

And said parties of the first part

covenants as follows:

First. That the party of the second part shall quietly enjoy the said premises;

Second. That said parties of the first part

will forever Warrant the title to said premises.

Third. That, in Compliance with Sec. 13 of the Lien Law, the grantors will receive the consideration for this conveyance and will hold the right to receive such consideration as a trust fund to be applied first for the purpose of paying the cost of the improvement and will apply the same first to the payment of the cost of the improvement before using any part of the total of the same for any other purpose.

In Witness Whereof, the parties of the first part have hereunto set their hands and seals the day and year first above written.

In Presence of

Donald R. Farwell
DONALD R. FARWELL

Arlene J. Farwell
ARLENE J. FARWELL

State of New York } ss. On this 25th day of September
County of Allegany } Nineteen Hundred and Seventy-three,
before me, the subscriber, personally appeared

Donald R. Farwell and Arlene J. Farwell

to me personally known and known to me to be the same persons described in and who executed the within Instrument, and they acknowledged to me that they executed the same.

Peter R. Sprague
Notary Public

PETER R. SPRAGUE
Notary Public, State of New York
Residing in Allegany Co. Clerk's No. 725
Commission Expires March 30, 1975

STATE OF NEW YORK SS.
COUNTY OF CATTARAUGUS
RECORDED Oct. 4, 1973
AT 11:36 AM IN LIBER 742
PAGE 937 OF Deeds
AND EXAMINED
Mynetta Fleckner CLERK

Form N.Y. DEED – WARRANTY with Lien Covenant

LIBER 901 PAGE 804

This Indenture, *Made the* 19th *day of* May *Nineteen Hundred and* Ninety

Between

DONALD R. FARWELL and ARLENE J. FARWELL, husband and wife, residing at R.D. 1, Hinsdale, New york 14743

04283

part ies *of the first part, and*

THE COUNTY OF CATTARAUGUS, a municipality with a place for the transaction of buisness at Court Street, Little Valley, New York 14755

part y *of the second part,*

Witnesseth *that the part* y *of the first part, in consideration of*

ONE --- *Dollar* ($ 1.00)

lawful money of the United States, *paid by the part* y *of the second part, do*es *hereby grant and release unto the part* y *of the second part,* its successors *and assigns forever, all*

ALL THAT TRACT OR PARCEL OF LAND, situate in the Town of Ischua, County of Cattaraugus and State of New York, known and distinguished as being part of Lot No. 45, Township 1, Range 3 of the Holland Land Company Survey bounded and described as follows:

BEGINNING at a point in the centerline of Farwell Road on Lot No. 45 which said point is south 84° 18' 30" east, measured along the centerline of Farwell Road a distance of 1024.25 feet from the intersection of the centerline of Farwell Road and the west boundary line of Lot No. 45; thence south 4° 47' 30" west from the point of beginning 612.14 feet to a point; thence south 85° 51' 30" east a distance of 637.84 feet to a point in the centerline of the Pennsylvania Railroad right of way and which said point is 91.5 feet northerly, measured along the centerline of said Railroad from the intersection of said Railroad and the south boundary of Lot No. 45; thence northeasterly along the centerline of the right of way of the Pennsylvania Railroad to the intersection of the centerline of said Railroad and the centerline of said Farwell Road; thence south 82° 19' 30" west along the centerline of Farwell Road a distance of 313.94 feet to an angle point therein; thence north 64° 51' 30" west along the centerline of said Farwell Road a distance of 253.62 feet to an angle point in said Farwell Road; thence north 84° 18' 30" west along the centerline of Farwell Road a distance of 128.56 feet to the place and point of beginning. Containing 9.34 acres be the same more or less; all of the foregoing 9.34 acres more or less being a portion of the premises once described in a deed dated May 4, 1973 Clement H. Farwell to Donald R. Farwell and Arlene J. Farwell recorded May 7, 1973 in Liber 738 of Deeds at Page 355.

RECEIVED
REAL ESTATE
JUN 25 1990
TRANSFER TAX
CATTARAUGUS
COUNTY

Together *with the appurtenances and all the estate and rights of the part* ies *of the first part in and to said premises.*

To have and to hold *the premises herein granted unto the part* y *of the second part,* *and assigns forever.*

And *said part* ies *of the first part* *covenant* *as follows:*

First. *That the part* y *of the second part shall quietly enjoy the said premises;*

Second. *That said part* ies *of the first part* *will forever* **Warrant** *the title to said premises.*

Third. *That, in Compliance with Sec. 13 of the Lien Law, the grantor* *will receive the consideration for this conveyance and will hold the right to receive such consideration as a trust fund to be applied first for the purpose of paying the cost of the improvement and will apply the same first to the payment of the cost of the improvement before using any part of the total of the same for any other purpose.*

In Witness Whereof, *the part* ies *of the first part have* *hereunto set* their *hand* *and seal* *the day and year first above written.*

In Presence of

Donald R. Farwell
DONALD R. FARWELL

Arlene J. Farwell
ARLENE J. FARWELL

State of New York } ss. *On this* 19th *day of* May
County of Cattaraugus *Nineteen Hundred and* Ninety

before me, the subscriber, personally appeared

DONALD R. FARWELL and ARLENE J. FARWELL

to me personally known and known to me to be the same person *described in and who executed the within Instrument, and* they *acknowledged to me that* they *executed the same.*

Notary Public 11/30/90

State of New York } ss. *On this* *day of*
County of *Nineteen Hundred and*

before me, the subscriber, personally appeared

to me personally known and known to me to be the same person *described in and who executed the within Instrument, and* *he* *acknowledged to me that* *he* *executed the same.*

Notary Public

Deed

Warranty With Lien Covenant

DONALD R. FARWELL and
ARLENE J. FARWELL

45-3/3

TO

COUNTY OF CATTARAUGUS
Att: Bill Newman

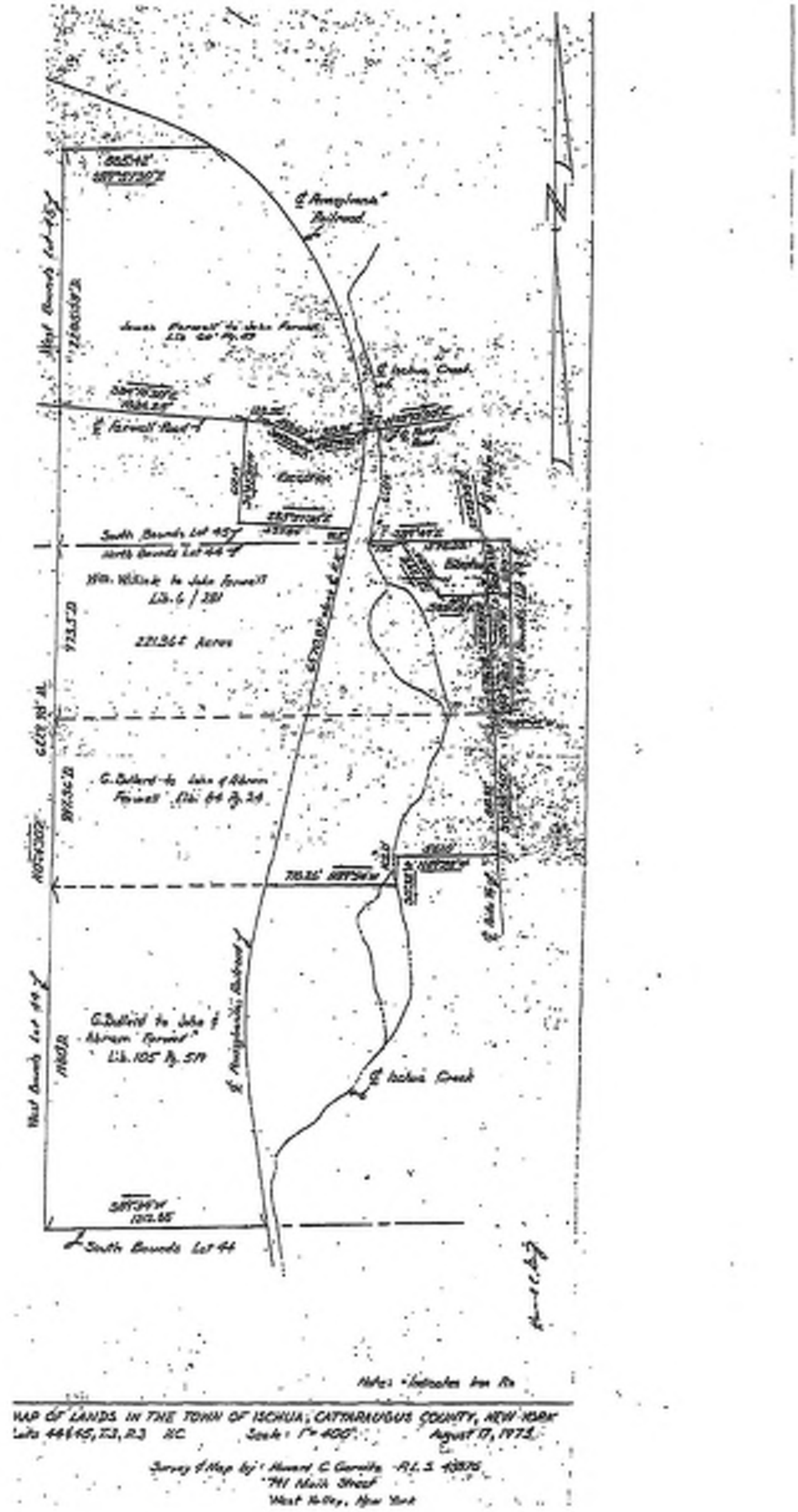
Dated, 19

STATE OF NEW YORK SS.
COUNTY OF CATTARAUGUS
RECORDED Jun 25, 1990
AT 2:03PM IN LIBER 901
PAGE 804 OF Deeds
AND EXAMINED
Gloria Bilotta CLERK

Raymond W. Bulson
Attorney at Law
6 South Main Street
Portville, New York 14770

LIBER 901 PAGE 805

APPENDIX B



West Bounds Lot 45
℄ Pennsylvania Railroad
℄ Ischua Creek
℄ Farwell Road
South Bounds Lot 45
North Bounds Lot 44
221.36± Acres
G. Bullard to John & Abram Farwell Lib. 64 Pg. 34
West Bounds Lot 44
G. Bullard to John & Abram Farwell Lib. 105 Pg. 519
South Bounds Lot 44
Notes: • Indicates Iron Pin
MAP OF LANDS IN THE TOWN OF ISCHUA, CATTARAUGUS COUNTY, NEW YORK
Lots 44 & 45, T.3, R.3 H.C.
Scale: 1" = 400'
August 17, 1973
Survey & Map by: Howard C. Gorsiche - R.L.S. 43875
741 Main Street
West Valley, New York

TMP 68.003-1-1

04700

FORM 583X N. Y. DEED—WARRANTY with Lien Covenant

TUTTLELAW

This Indenture

Made the 25th *day of* September

Nineteen Hundred and Seventy-three,

Between DONALD R. FARWELL and ARLENE J. FARWELL, his wife,
R. D. # 1, Hinsdale, New York 14743 (no street address),

part ies *of the first part, and*

THE COUNTY OF CATTARAUGUS,
State of New York,

part y *of the second part,*

Witnesseth *that the part* ies *of the first part, in consideration of*

ONE HUNDRED FIFTEEN THOUSAND---------------------- *Dollar* s ($115,000.00) *lawful money of the United States, paid by the part* y *of the second part, do hereby grant and release unto the party of the second part,* its successors *and assigns forever, all* THAT TRACT OR PARCEL OF LAND, situate in the Town of Ischua, County of Cattaraugus and State of New York, known and distinguished as a part of Lot number forty-four, Township Three, Range Three of the Holland Land Company's Survey and bounded and described as follows: Beginning at the northeast corner of said lot; thence south on the lot line to the southeast corner of lands deeded by John H. Farwell to Jonathan Davis and Abram Farwell for mill purposes; thence westerly along the south bounds of said lot to the center of the highway; thence northerly along the center of the highway to the north bounds of lot forty-four; and from thence east on lot line to the place of beginning, be the same more or less, excepting and reserving however, the part thereof owned by the heirs at law or grantees of said Jonathan Davis in said mill property.

ALSO, CONVEYING ALL THAT TRACT OR PARCEL OF LAND situate in the Town, County and State aforesaid, known and distinguished as the north part of lot forty-four, township, range and survey as aforesaid and bounded; north by lot forty-five, thirty-eight chains, forty-one links; east by lot number nine, fourteen chains, seventy-five links; west by lot line, fourteen chains, seventy-five links; and south by a line parallel to the north bounds of said lot, thirty-eight chains, thirty-five links, to the place of beginning, containing fifty-six and three-fourths acres of land more or less. Excepting, however, therefrom all that part thereof which was deeded by John H. Farwell to Jonathan Davis and Abram M. Farwell for mill purposes.

ALSO CONVEYING ALL THAT TRACT OR PARCEL OF LAND situate in the Town, County and State aforesaid, known and distinguished as the north part of lot number thirty-six, Town Three, Range Three of said survey, bounded; north by lot thirty-seven, forty chains, sixty links; east by lot number twenty-eight, fourteen chains, seventy-five links; south by land deeded by the Holland Land Company to Jonathan Davis, forty chains, seventy-eight links; and west by lot number forty-four, fourteen chains, seventy-five links, containing sixty acres more or less.

ALSO CONVEYING ALL THAT TRACT OR PARCEL OF LAND, situate in the Town, County and State aforesaid and township and range aforesaid, bounded and described as follows: Beginning at the southwest corner of said lot, and thence north on lot line, thirty-four chains, sixty-three links to the southwest corner of lands formerly owned by Thaddeus Farwell; thence east on the south line of said Farwell's land to the center of the Ischua Creek; thence southerly along the center of said Ischua Creek to the south line of said lot; thence west on the lot line to the place of beginning, containing eighty-nine acres more or less.

See L. 976 Deeds P. 1134 for Deed Restrict + covenants 8/28/98
See L. 1034 Deeds P. 1042 for Deed Restrict & (Dev.) 6/5/03

LIBER 742 PAGE 937

ALSO CONVEYING ALL THAT TRACT OR PARCEL OF LAND, situate in the Town, County and State aforesaid, known and distinguished as part of Lot number forty-four, bounded and described as follows: Beginning at the southwest corner of the farm purchased by G. W. Bullard of Johnathan Davis, January 5th, 1865; running thence northerly on the West line of said Bullard's farm, thirty chains to land sold to John H. and A. M. Farwell; thence easterly on the south line of land sold to said Farwells to the railroad lands; thence southerly on the west line of the railroad lands to the south bounds of said Bullard Farm; thence westerly on the south line of said Bullard Farm to the place of beginning, containing forty-six and forty-five one hundredths acres of land more or less, together with the privilege of the cattle pass described in the deed from said Bullard to John H. Farwell and others dated November 10th, 1884.

ALSO CONVEYING ALL THAT TRACT OR PARCEL OF LAND, situate in the Town, County and State aforesaid, bounded and described as follows: Beginning at the northwest corner of the farm purchased by one G. W. Bullard of Jonathan Davis by deed bearing date January 5th, 1865, and recorded in Liber 62 of deeds at page 74; running thence south on the west line of said farm, fourteen chains, ninety-six links to a stake; thence east on a line parallel to the north bounds of said farm, twenty-seven chains, seventy-six links to the west bank of the feeder, so-called; thence on a northerly direction on the west bank of said feeder and to a point in the creek, two chains and forty-six links; thence east on a line parallel to the north bounds of said farm, eight chains, fifty links to the center of the highway running from Hinsdale to Franklinville; thence northerly in the center of said highway to the north bounds of said farm, twelve chains, fifty links to Bullard's north line; thence westerly on the north line of said farm to the place of beginning, thirty-six chains, containing fifty-one and one-half acres more or less.

ALSO CONVEYING ALL THAT TRACT OR PARCEL OF LAND, situate in the Town, County and State aforesaid, distinguished as part of Lot number forty-five, township three, range three as aforesaid, bounded and described as follows: Commencing in the center of the Ischua Creek on the Section Line; thence up said Creek, north, five degrees west, eight chains, fifty links; thence north, eighty-five degrees west, five chains, thirty-three links up a ravine and a road to a stake; thence south, thirteen degrees west, eight chains eighty-seven links to the south line of lot number forty-five; thence east on said lot line eight chains, fifty links to the place of beginning, containing five and ninety-six one hundredths acres of land more or less.

ALSO CONVEYING ALL THOSE TWO CERTAIN TRACTS OR PIECES OF LAND, situate in the Town of Ischua, in the County of Cattaraugus and State of New York, bounded and described as follows, viz:

Number One: Beginning at a point in the middle of a former location of Ischua Creek at the distance of one hundred and twenty-five feet measured southwestwardly from a point in and radially to the line established as the center line of the railroad of the Western New York and Pennsylvania Railway Company; extending thence in a general southeasterly direction by other land of the said Railway Company on a line parallel with the aforesaid center line and one hundred and twenty-five feet distant southwestwardly therefrom, as follows, viz: First, on a line curving toward the left with a radius of two thousand four hundred and seventeen feet and one one-hundredth of a foot, a distance of one thousand two hundred and eighty-seven feet and two-tenths of a foot to a point; and Second, south sixty-five degrees, thirty-eight minutes east one thousand five hundred and ninety feet and ninety-two one-hundredths of a foot to a point in the former location of Ischua Creek aforesaid; thence along the middle of said Creek, by land now or formerly of Oakley W. Chamberlain and land of the said Eugene B. Farwell, as follows, viz: First, south eighty-five degrees, thirteen minutes west two hundred and ninety-three feet and thirteen one-hundredths of a foot to a point; second, north eighty-five degrees, seven minutes west five hundred and thirty feet and five-tenths of a foot to a point; Third, north sixty-five degrees, thirty-seven minutes west one thousand two hundred and eighty-six feet to a point; Fourth, north forty-five degrees west five hundred and eighty-eight feet and seven-tenths of a foot to a point;

and Fifth, north one degree, four minutes west five hundred and six feet and five one-hundredths of a foot to the place of beginning, containing seventeen acres and nine hundred and seventy-two one-thousandths of an acre, more or less.

NUMBER TWO: Beginning at a point in the dividing line between the original tracts of Fred J. Schrader and Eugene B. Farwell, etal., at the distance of one hundred and twenty-five feet measured southwestwardly from a point in and radially to said center line; extending thence along said original dividing line by land of the said Eugene B. Farwell, south eighty-eight degrees, seven minutes west six hundred and seventy-six feet and thirty-seven one-hundredths of a foot to a point; thence still by land of the said Eugene B. Farwell, north five degrees, thirty-two minutes east three hundred and sixty-six feet and thirteen one hundredths of a foot to a point; thence in a general southeasterly direction by other land of the said Railway Company on a line parallel with the aforesaid center line and one hundred and twenty-five feet distant southwestwardly therefrom, as follows, viz: First, south sixty-five degrees, thirty-eight minutes east two hundred and eighty-three feet and eighty-seven one-hundredth of a foot to a point; and Second, on a line curving toward the right with a radius of one thousand nine hundred and fifty-eight feet and sixty-eight one hundredths of a foot, a distance of four hundred and forty-six feet and eighty-eight one-hundredths of a foot to the place of beginning, containing three acres and seventy-three one-thousandths of an acre, more or less. EXCEPTING AND RESERVING from the above described premises those certain premises conveyed to the Western New York and Pennsylvania Railway Company.

Being the same premises conveyed by deed dated March 19, 1934, Eugene B. Farwell and Catherine W. Farwell to Clement H. Farwell and Olive B. Farwell recorded March 20, 1934 Liber 343 of Deeds at Page 541.

EXCEPTING AND RESERVING FROM ALL OF THE ABOVE DESCRIBED PREMISES, ALL THAT TRACT OR PARCEL OF LAND, SITUATE IN THE Town of Ischua, County of Cattaraugus and State of New York, known and distinguished as the north part of lot number thirty-six, town three, range three of said survey, bounded: North by lot thirty-seven, forty chains, sixty links; east by lot number twenty-eight, fourteen chains, seventy-five links; south by land deeded by the Holland Land Company to Jonathan Davis, forty chains, seventy-eight links; and west by lot number forty-four, fourteen chains, seventy-five links, containing sixty acres more or less.

All of the foregoing premises being the same premises described in deed dated May 4, 1973 Clement H. Farwell to Donald R. Farwell and Arlene J. Farwell recorded May 7, 1973 in Liber 738 of Deeds at Page 355.

EXCEPTING AND RESERVING FROM ALL OF THE FOREGOING PREMISES: ALL THAT TRACT OR PARCEL OF LAND, situate in the Town of Ischua, County of Cattaraugus and State of New York, known and distinguished as being part of Lot No. 45, township 3, range 3 of the Holland Land Company Survey bounded and described as follows: Beginning at a point in the centerline of Farwell Road on Lot No. 45 which said point is south 84° 18' 30" east, measured along the centerline of Farwell Road a distance of 1024.25 feet from the intersection of the centerline of Farwell Road and the west boundary line of Lot No. 45; thence south 4° 47' 30" west from the point of beginning 612.14 feet to a point; thence south 85° 51' 30" east a distance of 637.84 feet to a point in the centerline of the Pennsylvania Railroad right of way and which said point is 91.5 feet northerly, measured along the centerline of said Railroad from the intersection of said Railroad and the south boundary of Lot No. 45; thence northeasterly along the centerline of the right of way of the Pennsylvania Railroad to the intersection of the centerline of said Railroad and the centerline of said Farwell Road; thence south 82° 19' 30" west along the centerline of Farwell Road a distance of 313.94 feet to an angle point therein; thence north 64° 51' 30" west along the centerline of said Farwell Road a distance of 253.62 feet to an angle point in said Farwell Road; thence north 84° 18' 30" west along the centerline of Farwell Road a distance of 128.56 feet to the place and point of beginning containing 9.34 acres be the same more or less; all of the foregoing 9.34 acres more or less being a portion of the premises once described in a Deed dated May 4, 1973 Clement H. Farwell to Donald R. Farwell and Arlene J. Farwell recorded May 7, 1973 in Liber 738 of Deeds at Page 355.

FOREGOING PREMISES ARE ALSO BOUNDED AND DESCRIBED AS FOLLOWS: ALL THAT TRACT OF PARCEL OF LAND, situate in the Town of Ischua, County of Cattaraugus and State of New York, being part of Lot 44 and 45, Township 3, Range 3 of the Holland Land Company's survey and bounded and described as follows:

Beginning at the southwest corner of Lot 45; thence North 0° 54' 30" east along the west bounds of Lot 45 a distance of 2285.58 feet to a point; thence south 89° 51' 30" east a distance of 835.42 feet to a point in the center of the Pennsylvania Railroad; thence southerly along the centerline of said Railroad to the centerline of Farwell Road; thence North 75° 13' 30" east along said centerline a distance of 79.6 feet to the center of Ischua Creek; thence southerly along center of said creek a distance of 660± to the south bounds of Lot 45 and north bounds of Lot 44; thence south 89°49' east along said Lot line a distance of 170 feet to a point; thence south 21° 29' east a distance 378.84 feet to a point; thence south 89° 49' east a distance of 419.1 feet to a point in the east bounds of Lot 44; thence south 0° 11' west along the east bounds of Lot 44 a distance of 676.5 feet to a point; thence north 89° 49' west a distance of 115.5 feet to the centerline of Route 16; thence South 0° 38' 30" east along the centerline of Route 16 a distance of 818.81 feet to a point; thence north 89° 28' west a distance of 561.0 feet to a point; thence south 0° 32' west a distance of 162.0 feet to a point; thence north 89° 54' west a distance of 710.26 feet to a point in the centerline of the Pennsylvania Railroad thence southerly along the centerline of said railroad to the south bounds of Lot 44; thence south 89° 34' west along the south bounds of Lot 44 a distance of 1212.88 feet to the west bounds of Lot 44; thence north 0° 54' 30" east a distance of 3940.86 feet to the north bounds of Lot 44 and the point of beginning containing 230.70 acres of land more or less.

EXCEPTING AND RESERVING ALL THAT TRACT OR PARCEL OF LAND, situate in the Town of Ischua, County of Cattaraugus and State of New York, known and distinguished as being part of Lot No. 45, township 3, range 3 of the Holland Land Company Survey bounded and described as follows: Beginning at a point in the centerline of Farwell Road on Lot No. 45 which said point is south 84° 18' 30" east, measured along the centerline of Farwell Road a distance of 1024.25 feet from the intersection of the centerline of Farwell Road and the west boundary line of Lot No. 45; thence south 4° 47' 30" west from the point of beginning 612.14 feet to a point; thence south 85° 51' 30" east a distance of 637.84 feet to a point in the centerline of the Pennsylvania Railroad right of way and which said point is 91.5 feet northerly, measured along the centerline of said Railroad from the intersection of said Railroad and the south boundary of Lot No. 45; thence northeasterly along the centerline of the right of way of the Pennsylvania Railroad to the intersection of the centerline of said Railroad and the centerline of said Farwell Road; thence south 82° 19' 30" west along the centerline of Farwell Road a distance of 313.94 feet to an angle point therein; thence north 64° 51' 30" west along the centerline of said Farwell Road a distance of 253.62 feet to an angle point in said Farwell Road; thence north 84° 18' 30" west along the centerline of Farwell Road a distance of 128.56 feet to the place and point of beginning containing 9.34 acres be the same more or less; all of the foregoing 9.34 acres more or less being a portion of the premises once described in a Deed dated May 4, 1973 Clement H. Farwell to Donald R. Farwell and Arlene J. Farwell recorded May 7, 1973 in Liber 738 of Deeds at Page 355.

The net acreage hereby described is calculated as follows:

Total------------------------------------230.70
Less EXCEPTION-------------------------- -9.34
Net acres described--------------221.36 acres.

CATTARAUGUS COUNTY
0181182
REAL ESTATE TRANSFER TAX
STATE OF NEW YORK
Dept. of Taxation & Finance
00.00

Together *with the appurtenances and all the estate and rights of the part* ies *of the first part in and to said premises,*

To have and to hold *the premises herein granted unto the part* y *of the second part,* its successors *and assigns forever.*

And *said* parties of the first part

covenant s *as follows:*

First, *That the party of the second part shall quietly enjoy the said premises;*

Second, *That said* parties of the first part

will forever **Warrant** *the title to said premises.*

Third, *That, in Compliance with Sec. 13 of the Lien Law, the grantor* s *will receive the consideration for this conveyance and will hold the right to receive such consideration as a trust fund to be applied first for the purpose of paying the cost of the improvement and will apply the same first to the payment of the cost of the improvement before using any part of the total of the same for any other purpose.*

In Witness Whereof, *the part* ies *of the first part have hereunto set* their *hand* s *and seal* s *the day and year first above written.*

In Presence of

Donald R Farwell
DONALD R. FARWELL
Arlene J. Farwell
ARLENE J. FARWELL

State of New York
County of Allegany } ss. *On this* 25th *day of* September *Nineteen Hundred and* Seventy-three, *before me, the subscriber, personally appeared*

Donald R. Farwell and Arlene J. Farwell

to me personally known and known to me to be the same person s *described in and who executed the within Instrument, and* they *acknowledged to me that* they *executed the same.*

Peter R. Sprague
Notary Public

PETER R. SPRAGUE
Notary Public, State of New York
Residing in Allegany Co. Clerk's No. 725
Commission Expires March 30, 1975

STATE OF NEW YORK SS.
COUNTY OF CATTARAUGUS
RECORDED Oct. 4, 1973
AT 11:36 AM IN LIBER 742
PAGE 937 OF Deeds
AND EXAMINED
Mynetta Fluker CLERK

TMP 68.001-1-18

See L. 976 Deeds P. 1134 for Decl. Restrictive Covenants 8/28/95
See L. 1024 Deeds P. 1043 for Decl. Restrictive Cov. 6/5/03

Form 15835 N.Y. DEED—WARRANTY with Lien Covenant

LIBER 901 PAGE 804

This Indenture, Made the 19th day of May Nineteen Hundred and Ninety

Between

DONALD R. FARWELL and ARLENE J. FARWELL, husband and wife, residing at R.D. 1, Hinsdale, New york 14743

04283

parties of the first part, and

THE COUNTY OF CATTARAUGUS, a municipality with a place for the transaction of buisness at Court Street, Little Valley, New York 14755

party of the second part,

Witnesseth that the party of the first part, in consideration of

ONE -- Dollar ($ 1.00)

lawful money of the United States,
paid by the party of the second part, does hereby grant and release unto the party of the second part, its successors and assigns forever, all

ALL THAT TRACT OR PARCEL OF LAND, situate in the Town of Ischua, County of Cattaraugus and State of New York, known and distinguished as being part of Lot No. 45, Township 3, Range 3 of the Holland Land Company Survey bounded and described as follows:

BEGINNING at a point in the centerline of Farwell Road on Lot No. 45 which said point is south 84° 18' 30" east, measured along the centerline of Farwell Road a distance of 1024.25 feeet from the intersection of the centerline of Farwell Road and the west boundary line of Lot No. 45; thence south 4° 47' 30" west from the point of beginning 612.14 feet to a point; thence south 85° 51' 30" east a distance of 637.84 feet to a point in the centerline of the Pennsylvania Railroad right of way and which said point is 91.5 feet northerly, measured along the centerline of said Railroad from the intersection of said Railroad and the south boundary of Lot No. 45; thence northeasterly along the centerline of the right of way of the Pennsylvania Railroad to the intersection of the centerline of said Railroad and the centerline of said Farwell Road; thence south 82° 19' 30" west along the centerline of Farwell Road a distance of 313.94 feet to an angle point therein; thence north 64° 51' 30" west along the centerline of said Farwell Road a distance of 253.62 feet to an angle point in said Farwell Road; thence north 84° 18' 30" west along the centerline of Farwell Road a distance of 128.56 feet to the place and point of beginning. Containing 9.34 acres be the same more or less; all of the foregoing 9.34 acres more or less being a portion of the premises once described in a deed dated May 4, 1973 Clement H. Farwell to Donald R. Farwell and Arlene J. Farwell recorded May 7, 1973 in Liber 738 of Deeds at Page 355.

RECEIVED
$ EXEMPT
REAL ESTATE
JUN 25 1990
TRANSFER TAX
CATTARAUGUS
COUNTY

Together *with the appurtenances and all the estate and rights of the part* ies *of the first part in and to said premises,*

To have and to hold *the premises herein granted unto the part* y *of the second part,* *and assigns forever.*

And *said part* ies *of the first part* *covenant as follows:*

First. *That the part*y *of the second part shall quietly enjoy the said premises;*

Second. *That said part* ies *of the first part* *will forever* **Warrant** *the title to said premises.*

Third. *That, in Compliance with Sec. 13 of the Lien Law, the grantor will receive the consideration for this conveyance and will hold the right to receive such consideration as a trust fund to be applied first for the purpose of paying the cost of the improvement and will apply the same first to the payment of the cost of the improvement before using any part of the total of the same for any other purpose.*

In Witness Whereof, *the part* ies *of the first part have hereunto set* their *hand and seal the day and year first above written.*

In Presence of

Donald R. Farwell
DONALD R. FARWELL (L.S.)

Arlene J. Farwell
ARLENE J. FARWELL (L.S.)

State of New York } ss. *On this* 19th *day of* May
County of Cattaraugus *Nineteen Hundred and* Ninety

before me, the subscriber, personally appeared

DONALD R. FARWELL and ARLENE J. FARWELL

to me personally known and known to me to be the same person described in and who executed the within Instrument, and they *acknowledged to me that* they *executed the same.*

Ronald W. Bul
Notary Public 11/30/90

State of New York } ss. *On this* *day of*
County of *Nineteen Hundred and*

before me, the subscriber, personally appeared

to me personally known and known to me to be the same person described in and who executed the within Instrument, and he *acknowledged to me that* he *executed the same.*

Notary Public

Deed
Warranty With Lien Covenant

DONALD R. FARWELL and
ARLENE J. FARWELL

45-3/3

TO

COUNTY OF CATTARAUGUS
Att: Bill Newman

Dated, 19

STATE OF NEW YORK SS.
COUNTY OF CATTARAUGUS
RECORDED June 25, 1990
AT 2:03 PM IN LIBER 901
PAGE 804 OF Deeds
AND EXAMINED
Gloria Bilotta
CLERK

LIBER 901 PAGE 805

Raymond W. Bulson
Attorney at Law
6 South Main Street
Portville, New York 14770

ATTACHED NOTATIONS:

See Also Deed - RESTRICTIVE COVENANTS Recorded 06/05/2003 as Instrument Number A000101-675
See Notice in Deed Liber 1008 Page 23 recorded 11/20/2001

APPENDIX D - FIELD SAMPLING PLAN

APPENDIX D – FIELD SAMPLING PLAN

GROUNDWATER SAMPLING

Groundwater monitoring will be performed on an annual basis to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

The permanent monitoring program for the landfill includes an Operation, Maintenance & Monitoring (OM&M) annual monitoring program and Part 360 biennial monitoring program. The monitoring locations include 11 groundwater monitoring wells sampled annually as part of OM&M program, seven groundwater monitoring wells sampled biennially as part of the Part 360 program, three piezometer/off-site water level monitoring locations (measured annually) and one leachate collection system point (sampled annually as part of the Part 360 program). Groundwater elevations in the Part 360 monitoring wells are also required to be measured annually. Figure 2 depicts the on-site monitoring network as well as the locations of the five off-site compliance monitoring wells.

The upgradient monitoring wells include the OM&M program wells MW-17I and MW-17S and the Part 360 program wells MW-6 and MW-13D. The downgradient wells include the OM&M program wells MW-14S, MW-14I, MW-15S, MW-15I, MW-16S, MW-16I, MW-21, MW-22, and MW-23; the Part 360 program wells MW-9D, MW-10S, MW-10D, MW-11S and MW-11D. Additionally, P-15, MW-18S, MW-18D and Ischua Creek serve as annual water level monitoring locations. Ischua Creek will be measured at the northside of the bridge over the creek (SW-2) as well as at a location roughly parallel to MW-23, downstream of the bridge (SW-2A) as depicted on Figure 2. The 'S' in the well nomenclature indicates a shallow well the 'D' indicates a deep well, while an 'I' indicates an interface well.

Water Level Monitoring

The groundwater levels measured in the monitoring wells will be used to determine the volume of standing water in the wells and to characterize the groundwater flow direction. Water levels in all monitoring wells will be measured using an electronic water level indicator. The following procedures apply to each of the monitoring wells.

Procedure

- Pre-clean water level probe and lower portion of cable using deionized water and alconox or liquinox followed by a rinsing the cable and probe with deionized water.
- Test water level meter to check batteries and adjust sensitivity.
- Lower probe slowly into monitoring well until the audible alarm sounds, indicating that the probe is in contact with water.
- Read depth to the nearest 0.01 foot from the graduated cable using a surveyed mark on the monitoring well riser as a reference point.
- Repeat the measurement for confirmation and record the water level.
- The bottom of each monitoring well shall also be sounded to help assess if the well has silted in from reported installed depth.
- Remove the cable and probe from the monitoring well, drying the cable and probe with a clean paper towel or disposable wipe.
- Replace J-Plug, protective casing cap or casing lid and lock.

Monitoring Well Purging

To collect representative groundwater samples, groundwater wells must be adequately purged prior to sampling. Purging requires the removal of at least one well volume of water from wells with slow recharge rates or the removal of at least three volumes of standing water in rapidly recharging wells. Disposable or dedicated bailers should be used for the purging and sample collection from the groundwater monitoring wells; pumps are also acceptable for use, provided the pump and any non-dedicated tubing are cleaned between each groundwater monitoring well.

Procedure

- Remove and unlock the well cover and J-Plug carefully to avoid foreign material from entering the well.

- The interior of the riser pipe should be monitored for organic vapors with a PID. If a measurement greater than 5 ppm is recorded, allow the well to vent until levels drop below 5 ppm before proceeding with purging.

- Using an electronic water level indicator, determine the static water level below the top of the riser according to the procedure detailed above.

- Determine the depth of the monitoring well and subtract the depth to the water level to determine the length of the water column.

- Determine the volume of water in the monitoring well by multiplying the length of the water column by the appropriate conversions (i.e. 1-inch wells = 0.041 gal/ft; 2-inch wells = 0.163 gal/ft; 4-inch wells= 0.653 gal/ft).

- Calibrate the field water quality meter in accordance with the manufacturer's procedures.

- Pour the initial purge volume of water into a container and place the field water quality meter probe(s) in the container to measure the pH, Eh, temperature, conductivity and turbidity.

- Record the field parameter measurements on the Well Sampling Log (located in Appendix K).

- Continue purging and pour purge water into graduated five-gallon buckets to assist in measuring volumes removed.

- Measure pH, Eh, temperature, conductivity and turbidity following each well volume during purging using the field water quality meter.

- Record the volume removed and associated field parameter measurements on the Well Sampling Log form.

- Purging shall continue until at least three well volumes of water have been removed, or, in the case of wells with slow recharge rates, until the well is evacuated to dryness.

- In the event a monitoring well is purged to dryness, then purging should be stopped and the well allowed to recharge to static water levels to the extent practicable before sampling.

- All well purging data shall be recorded on a Well Sampling Log (located in Appendix K).

Groundwater Sample Collection

Groundwater sampling should be performed as soon as practicable after purging has been completed and the well has recovered sufficiently to sample, or within 24 hours after evacuation if the well recharges slowly. If a well does not contain or yield sufficient volume for all required laboratory analytical testing, a decision will be made to prioritize VOC analysis.

Procedure

- Using an electronic water level indicator, determine the static water level below the top of the riser according to the procedure detailed above.

- Slowly submerge a dedicated disposable bailer or pump/tubing into the water column.

- Allow sufficient time for the bailer/pump to sink and fill with water, and then retrieve it to the surface in a manner that minimizes sample agitation.

- Utilize the bailer to collect a groundwater sample and pour the first volume into a container or pump water directly into a container. Place the field water quality meter probe(s) in the container to measure the pH, Eh, temperature, conductivity and turbidity.

- Compare the resulting measurements with those taken at the conclusion of purging to ensure that representative groundwater samples are being collected.

- Continue the careful collection of groundwater and pour the sample from the bailer or pump directly into the appropriate sample containers in a manner that minimizes agitation and aeration of the sample to the greatest extent possible.

- Carefully pour the groundwater into verifiably clean sample bottles (containing preservatives when required) provided by the laboratory.

- The analytical laboratory contracted to perform the analysis of the samples should provide the required sample containers, as well as specify the appropriate sample volumes.

- All sample bottles will be labeled in the field using a waterproof permanent marker following the procedures outlined below.

- Sample handling, labeling, custody and shipping shall be in accordance with the procedures outlined below.

- After all sample containers have been filled at the well location, measure and record the field parameters within the well using the field water quality meter to ensure that representative groundwater samples have been collected.

- Record all sampling data on the Well Sampling Log.

Sampling Handling

Proper sample labeling, handling, packing and shipping will help ensure collected samples are accurate, secure and intact when they arrive at the laboratory for analysis. The following techniques should be implemented.

Sample Labeling

Proper labeling is required to prevent sample misidentification of samples collected in the field and will be performed using the procedures detailed below.

Procedure

- Affix a non-removable (when wet) label to each sample container.
- Cover the label with two-inch cellophane or mylar tape.
- Write the following information on the label with a permanent waterproof marker:
  - Project Site Name
  - Sample Identification Code
  - Project Number
  - Date/Time
  - Sampler's Initials
  - Sample Preservative
  - Analysis Required

Chain-of-Custody

The documentation of sample collection and the method used to standardize the action is referred to as a chain-of-custody (COC). The COC is a legally defensible document that may be utilized as evidence in litigation or administrative hearings by regulatory agencies.

Procedure

COC procedures are essential for the presentation of sample analytical chemistry in the form of an analytical report. Proper COC procedures will minimize the loss or misidentification of samples and may ensure unauthorized persons do not tamper with collected samples.

- The COC should be filled out with all relevant information in the appropriate space on the form.
- Information required at a minimum:
    1. Project site name;
    2. Sample identification;
    3. Project number;
    4. Date and time;
    5. Sampler's signature,
    6. Sample preservation; and,
    7. Required analysis.
- COCs should be completed in indelible ink.
- The COC is typically a carbon copy, which requires the preparer to apply sufficient pressure to mark all other pages.
- The top copy, usually a white original, should be sent to the laboratory with the samples.
- The preparer should retain the bottom copy, and any other carbon copies should be sent to the laboratory with the samples.

- The top copy of the COC should be placed in a zip-type plastic bag and placed in the cooler along with the samples and sealed according to the procedure outlined in next section.

- In cases the where carbon copy type COCs are not utilized a copy of the original COC should be produced and retained by the preparer in addition to the copy submitted to the laboratory with the samples.

Sample Shipping

The proper shipping of samples will help ensure sample security, by limiting access, integrity, by avoiding breakage, and validity, by maintaining temperature conditions.

Procedure

- Place approximately three inches of cushioning material in the bottom of the cooler.

- Separate bottles with cardboard or bubble-wrap plastic.

- Pack top of bottles with ice in plastic zip-type bags. Ice should originate from a potable water source.

- Place additional cushioning material in cooler as needed.

- Place COC in zip-type plastic bag inside cooler on to the top of packing material and sample bottles.

- Wrap cooler with strapping tape at two locations and secure lid, complete with two custody labels on the cooler.

- Be sure any drain plugs on cooler are closed and sealed with tape.

- Place “this side up” and “fragile” labels on cooler

  – Samples should be shipped on the same day as they are collected to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified laboratory for analysis.

LEACHATE SAMPLING

A leachate sample is collected annually from the on-site leachate storage tank (L-1). The sampling and analysis schedule for the leachate sample is provided in Section 4.0 of the SMP.

Procedure

- With proper protective equipment (e.g., latex gloves), collect the samples by slowly lowering a dedicated bailer into the leachate storage tanks.
- Transfer the sample from the bailer directly into the appropriate sample containers in a manner that minimizes agitation and aeration of the sample to the greatest extent possible.
- After all sample containers have been filled at the sampling location measure and record the field parameters of the water using a field water quality meter.
- Sample handling, labeling, custody and shipping shall be in accordance with the procedures outlined in the Groundwater Sampling procedures above.

APPENDIX E - QUALITY ASSURANCE PROJECT PLAN

GPI

APPENDIX E – QUALITY ASSURANCE PROJECT PLAN

The following Quality Control/Quality Assurance (QC/QA) procedures will be followed during the collection, sampling and analysis conducted as part of the monitoring program:

- Sampling Program
  - Sample containers will be properly washed, decontaminated, and appropriate preservative will be added (if applicable) prior to their use by the analytical laboratory. Containers with preservative will be tagged as such.
  - Sample holding times will be in accordance with the NYSDEC ASP requirements.
  - Field QC samples will be collected as detailed below.
- Calibration Procedures:
  - All field analytical equipment will be calibrated immediately prior to each day's use. Calibration procedures will conform to manufacturer's standard instructions.
  - The laboratory will follow all calibration procedures and schedules as specified in USEPA SW-846 and subsequent updates that apply to the instruments used for the analytical methods.
- Analytical Procedures;
  - For baseline sampling events, or any monitoring points sampled for baseline analytes a Data Usability Summary Report (DUSR) will be prepared. The DUSR will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain of custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method.

The following QA/QC samples will be collected and analyzed for by the field sampling/laboratory analysis contractor for each sampling event to ensure validity and acceptability of the data generated. These samples will be as follows:

- One (1) Blind Duplicate will be collected during each sampling event from the OM&M wells. Also, one (1) Blind Duplicate will be collected during biennial sampling event from the Part 360 wells.

- One (1) Trip Blank will be prepared and accompany samples each day aqueous volatile organic samples are taken.

- The Blind Duplicate samples will be analyzed for the same parameters as the well samples for the given sampling event.

- The Trip Blank(s) will be analyzed for the target compound list (TCL) volatile organic compounds identified in 6 NYCRR Part 363-4.6(h) only.

APPENDIX F - SAMPLE HEALTH & SAFETY PLAN

GPI

HEALTH AND SAFETY PLAN
FOR THE
FARWELL LANDFILL SITE

(NYSDEC SITE NO. 905024)

FARWELL ROAD
TOWN OF ISCHUA, NEW YORK

Prepared for:

Cattaraugus County Department of Public Works
Jack Ellis Drive
8810 Route 242
Little Valley, New York 14755

DISCLAIMER

This Health and Safety Plan has been written for use during routine sampling activities. Properly trained and experienced subcontractors may also use it as a guideline document. However, Cattaraugus County Department of Public Works does not guarantee the health and safety of any person entering the site.

Due to the potentially hazardous nature of the site and the activity occurring thereon, it is not possible to discover, evaluate, and provide protection for all possible hazards that may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but not eliminate, the potential for injury at the site. The health and safety guidelines in this plan were prepared specifically for this site and should not be used on any other site without prior research by trained health and safety specialists.

Cattaraugus County Department of Public Works claims no responsibility for the use of this Plan by others. The Plan is written for the specific project site conditions, purpose, dates, and personnel specified and must be amended if these conditions change.

HEALTH AND SAFETY PLAN
FOR THE
FARWELL LANDFILL SITE
(NYSDEC SITE NO. 905024)

FARWELL ROAD
TOWN OF ISCHUA, NEW YORK

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1.0 INTRODUCTION

The Farwell Landfill Site is located on Farwell Road west of NYS Route 16 in the Town of Ischua, Cattaraugus County, New York. The landfill occupies approximately 16 acres of the northern portion of a 205-acre property owned by the County. The sources of environmental concern at this site include the documented presence of groundwater contamination resulting from the historical use of the Site as a landfill.

This Health and Safety Plan (HASP) has been developed to govern all field work conducted during remedial activities at the former Farwell Landfill Site. This plan is intended to ensure that the procedures used during planned remedial activities meet reasonable professional standards to protect human health and safety of workers and the surrounding community. This Plan incorporates, by reference, the applicable requirements of the Occupational Safety and Health Administration in 29 CFR Parts 1910 and 1926.

The requirements and guidelines in the HASP are based on a review of available site specific information and an evaluation of potential hazards. These requirements can and will be modified if necessary.

All field personnel working on this project must familiarize themselves with this HASP and abide by its requirements. Since every potential health and safety hazard encountered at a site cannot be anticipated, it is imperative that personnel are equipped and trained to respond promptly to a variety of possible hazards. Adherence to this HASP will minimize the possibility that personnel at the project site as well as the public will be injured or exposed to significant health hazards. Information on potential health, safety and environmental hazards is discussed in conjunction with appropriate protective measures including assignment of responsibility, personal protective equipment (PPE) requirements, work practices, and emergency response procedures.

In general, contractors and subcontractors are responsible for complying with the HASP, as well as all Federal, State, and local regulations pertaining to their work. With the Cattaraugus County Department of Public Works' permission, a contractor may adopt this HASP for activities within the scope-of-work this Plan addresses. Any changes to the HASP by the contractor must be approved by the Cattaraugus County Department of Public Works. Personnel can and must stop work by an contractor who is not following the health and safety procedures required by this HASP. However, the contractor/subcontractor expressly retains all responsibility for the safety of their personnel while working on this site.

This HASP is specifically intended for those personnel who will be conducting activities within the defined scope of work in specified areas of the project site. Specific tasks covered by this HASP may include, but are not limited to:

- Observing the excavation of earthen materials;

- Collecting environmental soil/fill samples;
- Observing loading and backfilling operations;
- Performing site inspections;
- Sampling leachate;
- Sampling groundwater monitoring wells;
- Decontaminating personnel and equipment; and
- Performing air monitoring.

2.0 KEY PERSONNEL

2.1 Cattaraugus County Department of Public Works Personnel

Title: Director of Weights & Measures
Contact: Austin Kimes, (716) 378-5676

Title: Waste Management Coordinator
Contact: Mark Shaw, (716) 904-0419

Title: Hauling Supervisor
Contact: Jim Drain, (716) 801-2534

Title: Maintenance Mechanic
Contact: Joe Baker, (716) 378-1096

Title: Operations Manager
Contact: Scott Andrews, (716) 392-2453

2.2 NYSDEC Personnel

Title: NYSDEC PM
Contact: Benjamin McPherson, (716) 851-7220

Title: NYSDEC Remediation Engineer
Contact: Andrea Caprio, (716) 851-7220

Title: NYSDEC Site Control
Contact: Kelly Lewandowski, (518) 402-9553

3.0 SITE ENTRY

3.1 Objectives

This HASP has been developed for submittal to and review by the NYSDEC in order to ensure that the remedial program will satisfy applicable regulatory requirements.

3.2 Safety Meetings

To ensure that the HASP is being followed, the PTL shall conduct a safety meeting prior to initiating any site activities.

3.3 Safety Training

Every person assigned to a task must have adequate training for that task and the training is up-to-date. Contractor and subcontractor personnel working on the site shall have a minimum of at least 24 hours of classroom-style health and safety training and 3 days of on-site training, as required by OSHA 29 CFR 1910.120. All training will have been conducted and certified in accordance with OSHA regulations outlined in 29 CFR 1910.120.

3.4 Medical Surveillance

All contractors and subcontractor personnel working on this remedial program will have had a medical surveillance physical consistent with OSHA regulations in 29 CFR 1910.120, and performed by a qualified occupational health physician.

3.5 Site Mapping

Maps of the site and areas to subject to excavation are included in the notification submittal required in Section A-1 of the Excavation Work Plan (EWP). A map showing the route from the site to the nearest hospital has been included in the SMP.

4.0 SITE CHARACTERIZATION

4.1 Site Description

Disposal operations at the landfill began in 1975. The landfill was constructed in three phases to form a contiguous landfill. The Phase I and Phase II areas of the landfill are unlined. The disposal of municipal solid wastes, resource recovery (incinerator) ash, sewage treatment sludge and NYSDEC approved non-hazardous industrial wastes took place in these two areas until 1985, when they reached capacity. In 1984 the NYSDEC issued an Order on Consent (File #84-106) to the County to bring the landfill into compliance with New York State regulations (6NYCRR Part 360) for solid waste management facilities. The order required the County to begin hydrogeological studies, install a groundwater monitoring system and properly close the landfill. Also, in 1984 in response to a Community Right to Know Survey, the Alcas Cutlery Corporation stated that it disposed of approximately 8.5 tons of trichloroethene (TCE) sludge mixed with sawdust at the landfill between 1975 and 1980. The disposal time period indicates that the TCE wastes were disposed of in the unlined portions of the landfill (i.e. Phases I and II). In 1987 monitoring for USEPA priority pollutants was added to the groundwater monitoring program and results showed the presence of volatile organic compounds (VOCs), primarily chlorinated solvents, including TCE.

4.2 Neighboring Properties

The area surrounding the landfill is primarily rural and agricultural. The landfill is bounded to the south by Farwell Road, to the west by a narrow strip of trees and fields and to the north and east by an active Buffalo & Pittsburgh Railroad line and Ischua Creek. At its closest point, the creek is approximately 400 feet from the landfill.

4.3 Site Geology and Hydrology

The surficial geology of the site consists of a layered assortment of glacial deposits from the advance and retreat of glacial ice during the last ice age. The uppermost stratigraphic unit is a layer of glacial till containing silts, clays, sand and gravel, which is underlain by a coarser-grained deposit of silty sand and gravel (glaciofluvial layer). Below the silty sand and gravel is another layer of till.

The upper till layer is reported to be greater than 70 to 80 feet thick in the western portion of the site an thins to approximately 30 feet thick along the eastern portion of the site eventually being replaced by alluvial deposits of silt adjacent to Ischua Creek. The glaciofluvial layer is approximately 10 to 15 feet thick. The lower till layer is estimated to be 40 to 70 feet thick. These overburden layers rest on sedimentary bedrock consisting of highly fractured, fine-grained sandstone interbedded with thin layers of shale.

Groundwater generally flows from northwest to the southeast on the site where it converges into Ischua Creek. Historical data reports that there is vertical groundwater flow between the overburden layers. The average groundwater seepage velocity across the site was estimated to be 0.2 feet per day based on hydraulic conductivity tests in site wells.

4.4 Meteorological Data

This section shall be edited based on the time of year anticipated work is to occur on site. Prior to each day's activities, the daily forecast should be monitored for indications of adverse work conditions.

5.0 HAZARD EVALUATION

5.1 Physical Hazards

Physical hazards such as the following may be encountered on site:

- Slippery surfaces - trip/fall;
- Electrical - shock, fire;
- Mechanical/Large Equipment - cuts, amputation, trauma;
- Uneven Terrain/Excavations/Soil piles - trip/fall; and
- Unstable overhead structures - cuts, trauma.

Drilling (for new monitoring wells if required), excavation, loading, and backfilling activities also present hazards specific to working with heavy equipment. Personnel working on or around earthmoving equipment should be aware of the precautions listed below. The practices are meant to be guidelines and are not all-inclusive of the safety measures necessary while performing intrusive activities.

5.1.1 Utility Clearance

Personnel involved in intrusive work shall determine the minimum distance from marked utilities which work can be conducted with the assistance of the locator line service.

- Elevated superstructures (e.g., drill rig, backhoe, dump trucks, scaffolding, ladders, cranes) shall remain a distance of 10 feet away from utility lines and 20 feet away from power lines. The distance from utility lines may be adjusted depending on actual voltage of the lines.

- During all intrusive activities (e.g., direct push soil borings, excavating, backfilling, etc.), Dig Safely New York should be contacted (1-800-962-7962 or 811) to mark underground lines before any work is started.

5.1.2 Drilling Safety

Personnel working in the vicinity of drilling shall adhere to the following practices:

- Equipment should be inspected daily by the operator to ensure that there are no operational problems;
- Before leaving the controls, shift the transmission controlling the rotary drive into neutral and place the feed level in neutral. Before leaving the vicinity of the drill, shut down the drill engine;
- Do not drive the drill rig with the mast in the raised position;
- Before raising the mast, check for overhead obstructions;
- Before the mast of a drill rig is raised, the drill rig must first be leveled and stabilized with leveling jacks and/or cribbing. Re-level the drill rig if it settles after initial set up. Lower the mast only when the leveling jacks are down, and do not raise the leveling jack pads until the mast is lowered completely;
- Employees involved in the operation shall not wear any loose-fitting clothing that has the potential to be caught in moving machinery;
- During freezing weather, do not touch any metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously;
- Adequately cover or protect all unattended boreholes to prevent drill rig personnel or site visitors from stepping or falling into the borehole;
- Personnel shall wear steel-toed shoes, safety glasses, hearing protection and hard hats during drilling operations;
- The area shall be roped off, marked or posted, to keep the area clear of pedestrian traffic and/or spectators; and
- All personnel should be instructed in the use of the emergency kill switch on the drill rig.

5.2 Chemical Hazards

Known and suspected sources of contamination include:

- Contaminated groundwater;

- Disposed material within the landfill;

Potential chemical hazards, which could be encountered during future ground intrusive activities include chlorinated and aromatic hydrocarbons (i.e., trichloroethene (TCE), in site groundwater.

5.3 Exposure Limits

Recommended Exposure Limits (RELs), and OSHA Permissible Exposure Limits (PELs) for several of the above chemical hazards are listed below. The RELs and PELs for the compounds listed below can be found in the NIOSH Guide to Chemical Hazards. A complete list shall be developed for future activities where historical results indicate the potential presence of a given contaminant.

CHEMICAL	**REL** [1]	**PEL** [2]
Trichloroethlene	25 ppm	100 ppm
Tetrachloroethlene	CA	100 ppm
Vinyl Chloride	CA	1 ppm

1 REL = NIOSH recommended exposure limits, up to 10 hour work day exposure limit, 40 hours/week. REL in mg/m^3 = (REL in ppm x molecular weight) / 24.45.

2 PEL = OSHA permissible exposure limit, 8 hour exposure limit, 40 hours/week, OSHA 29 CFR 1910.1000. REL in mg/m^3 = (REL in ppm x molecular weight) / 24.45.

TWA = time weighted average

OSHA = Occupational Safety and Health Agency

ACGIH = American Conference of Governmental Industrial Hygienists

NIOSH = National Institute for Occupational Safety and Health

N.A. = no applicable value available

CA = NIOSH recommends the substance be treated as a potential human carcinogen

5.4 Dispersion Pathways

Potential exposure mechanisms that can transport particulate and organic compounds from the areas of investigation to other areas of the project site as well as beyond the boundaries of the project site are:

- Dust projected by wind;
- Contaminated dust blown by wind;
- Volatilization and wind transport of organic compounds;
- Groundwater flowing beneath the site;

5.5 Potential IDLH and Other Dangerous Conditions

The Immediately Dangerous to Life and Health (IDLH) levels for chemicals potentially on-site and their IDLH level are listed below.

CHEMICAL	IDLH Level
Vinyl Chloride	ND
Trichloroethlene	1000 ppm (CA)
Tetrachloroethlene	150 ppm

N.A. = No IDLH assigned
CA = NIOSH recommends the substance be treated as a potential human carcinogen
ND = indicated IDLH has not yet been determined

The IDLH level is defined only for the purpose of respirator selection. The IDLH level represents a maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without experiencing any escape-impairing or irreversible health effects.

Visible indicators of potential IDLH conditions as well as other dangerous conditions are listed below.

- Confined spaces;
- Unstable overhead structures;
- Unusually colored solid or liquid wastes;
- Containers or accumulation structures (e.g., drums, pits, sumps, etc.), the contents of which are unknown;
- Potentially explosive or flammable situations indicated by bulging drums, gas generation, effervescence, or instrument readings;
- Extremely hazardous materials such as cyanide, phosgene, radiation;
- Visible vapor clouds; and
- Biological indicators such as dead animals or stressed vegetation.

6.0 MONITORING AND ACTION LEVELS

6.1 Air Monitoring

The following environmental monitoring instruments and methods shall be used on site at the specified intervals.

6.1.1 Photoionization Detector (PID)

A PID shall be used continuously at the downwind perimeter of the work area during any remedial activity that involves the disturbance or handling of project site soil/fill to monitor for volatile organic compounds. The PID shall be calibrated daily following manufacturers' recommendations. Readings and calibration data shall be recorded in daily logs.

6.1.2 Temperature

Ambient temperature should be monitored throughout the workday for potential heat or cold stress conditions.

6.1.3 Dust

A real-time particulate monitor shall be used continuously in the vicinity of the work area, during the installation of the test borings, and during excavation, backfilling, loading and trucking operations to monitor for particulate matter less than ten microns (PM-10). The particulate monitor will be able to continuously monitor particulate concentrations. An audible alarm will be provided to indicate exceedances of the action levels. The particulate meter shall be calibrated daily following manufacturers' recommendations. Readings and calibration data shall be recorded in daily logs.

6.2 Action Levels

Should action levels be encountered, work operations shall cease until further evaluation is performed and safe levels are prevalent. If through engineering controls and monitoring, safe levels (below action levels) cannot be achieved, an upgrade in personal protection equipment shall be mandated, or operations shall cease in that portion of the project site. The action levels for this project are as follows:

- Volatile organic compounds (PID monitor) = consistent readings greater than 5 ppm above background levels in the breathing zone;
- Temperature = ambient air temperature of less than 36°F for cold stress, and greater than 90°F for heat stress;
- Dust = consistent downwind readings that are 150 ug/m^3 greater than background (i.e. upwind); and

Additional responses are described below. It should be noted that the following responses are in accordance with the Community Air Monitoring Plan.

6.2.1 Vapor Emission Response Plan

If the organic vapor level decreases below 5 ppm above background, after engineering controls are instituted, work activities can resume. If the organic vapor levels are greater than 5 ppm over background but less than 25 ppm over background at the perimeter of the work area, activities can resume (while using the appropriate PPE) provided the organic vapor level at the "downwind hot zone" is below 5 ppm over background. The "downwind hot zone" is defined as 200 feet downwind of the work area or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less, (but in no case less than 20 feet).

If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown. When a work shutdown occurs, downwind air monitoring will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.

6.2.2 Major Vapor Emission

If any organic levels greater than 5 ppm over background are identified within the "downwind hot zone", all work activities must be halted.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the work area, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20-Foot Zone).

If efforts to abate the emission source are unsuccessful and if levels greater than 5 ppm above background persist for more than 30 minutes in the 20-Foot Zone, then the Major Vapor Emission Response Plan shall automatically be placed into effect. The Major Vapor Emission Response Plan shall be immediately placed into effect if organic vapor levels are greater than 10 ppm above background.

6.2.3 Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

- All Emergency Response Contacts as listed in section 13.0 of the HASP will be contacted;

- The local police authorities will be immediately contacted and advised of the situation; and
- Frequent air monitoring will be conducted at 30 minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified.
- Abatement measures may include covering the source area with clean fill or plastic sheeting, or consolidating contaminated materials to minimize surface area. Worker personal protective equipment may be adjusted as necessary to protect workers from over-exposure to organic vapors.

6.2.4 Particulate Emission Response Plan

If the downwind PM-10 particulate level is 100 ug/m^3 greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 ug/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

If after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 ug/m^3 above the upwind level, work must be stopped, and a re-evaluation of activities should be examined. Work may continue with dust suppression techniques provided they are successful in reducing the downwind PM-10 particulate concentration to within 150 ug/m^3 of the upwind level and in preventing visible dust migration.

6.2.5 Dust Suppression Techniques

Dust suppression techniques may include but are not necessarily limited to the following measures:

- Reducing the number of areas subject to intrusive investigation, and limiting the number of exposed soil areas;
- Restricting vehicle speeds;
- Applying water on buckets during excavation and on exposed soil surfaces;
- Wetting equipment used in intrusive activities;
- Restricting work during extreme wind conditions; and
- Using a street sweeper on paved roads, where feasible.

7.0 SITE CONTROL MEASURES

Maintaining specific work zones both on-site and off-site, along with other precautionary measures outlined throughout this HASP, will help control site access. This section is primarily designed to address excavation or drilling activities; it is not expected these measures will be employed during site sampling,

7.1 On-Site Control Measures

Temporary fencing will be installed as appropriate around work areas to control access to the project site and to prevent unauthorized access to on-site work zones.

7.1.1 Exclusion Zone (EZ)

This will be the actual work area where remedial activities will take place. An outer boundary will be established and clearly marked. The area of the EZ will be established based on site work conditions, exposure monitoring, etc. In general, the EZ will incorporate the area being excavated or drilled and a 50-foot radius around the area.

- Access to the EZ will be limited to employees and visitors who have a minimum 24-Hour Hazardous Site Worker training, protective equipment and responsibilities for work in the EZ. The entry of unauthorized personnel into the EZ will be prohibited.
- The Exclusion Zone will be in areas of intrusive activities such as soil borings, excavating and sampling. Drilling or excavation activities inside the EZ will commence at Level D. Air monitoring will be performed while advancing soil borings or excavating using a photoionization detector (PID) and a particulate monitor.

7.1.2 Contamination Reduction Zone (CRZ)

An area between the EZ and Support Zone (SZ) will be established to facilitate employee and equipment decontamination, protective equipment storage and supply, and employee rest areas. The location of the CRZ will be established in an area offering minimal contamination and will be subject to change based on the work conditions, air monitoring, etc. The CRZ will contain a boot wash with brushes and soap, a source of wash water for washing equipment and hands, and plastic garbage bags to contain disposable protective equipment.

7.1.3 Support Zone (SZ)

An area free from contamination will be identified and clearly marked where administrative or other support functions (not requiring entrance to the EZ or CRZ) can be performed.

All personnel working in the project site will enter their names in a site log, which will be maintained in the SZ. Personnel will only enter an EZ after proceeding through a designated entry / checkpoint at the CRZ. Before engaging in any site work, all personnel involved in such work will be briefed on the following:

- Boundaries, exit and entry point locations of the Exclusion Zone;
- Decontamination procedures when required;
- Chemical, radiological and physical hazards suspected of being in the EZ and their signs and symptoms of exposure;
- Location of first aid equipment and qualified personnel;
- Procedures to be used in contacting emergency personnel, including potential site evacuation procedures in case of emergencies;
- Location of emergency equipment;
- Location of emergency meeting point;
- Contractor staff person in charge;
- Activities taking place that day;
- Location of emergency eyewash station;
- Heat or cold stress symptoms. All personnel will be advised to watch for signs of stress in staff working in the EZ; and
- Personnel protective equipment requirements and limitations.

7.2 Off-Site Control Measures

No off-site work is expected to occur; however, the following minimal control measures to protect the public from physical and chemical hazards associated with off-site activities may be necessary including the following:

- A localized contaminant reduction zone (CRZ) shall be established at the periphery of the EZ toward the site interior, if possible, to regulate flow of personnel and equipment into and out of the zone;
- Only properly trained and certified project personnel will be permitted to enter the CRZ and EZ; and
- Personnel will be present throughout the duration of remedial activities to monitor the work zone and prevent unauthorized parties from entry.

8.0 HAZARD COMMUNICATION

In compliance with 29 CFR 1910.1200, any hazardous materials brought on site by any personnel shall be accompanied with the material's Material Safety Data Sheet (MSDS). These personnel shall be responsible for maintaining the MSDSs on site, reviewing them for hazards that working personnel may be exposed to, and evaluating their use on site with respect to compatibility with other materials including personal protective equipment, and their hazards. Should the County deem the material too hazardous for use on site, the party responsible for bringing the material on site shall remove it from the site. Hazardous materials are not expected to be used during remedial activities at the project site.

9.0 CONFINED SPACE ENTRY

Confined space entry by personnel is not expected during the completion of remedial activities. Should a potential confined space hazard exist, all proper confined space entry procedures, techniques, and equipment shall be consistent with OSHA regulations in 29 CFR 1910.146.

10.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Based on evaluation of the potential hazards for the site, the initial levels of PPE have been designated as modified Level D for all site activities. No changes to the specified levels of PPE shall be made. If action levels are reached, work shall cease, and further evaluations shall be performed by the responsible party and advisors.

10.1 Modified Level D Protection

- Safety glasses with side shields;
- Chemical resistant gloves (during sampling activities);
- Steel-toe and shank boots; and
- Hard hat.

For the protection of site personnel, organic gas/vapor emissions, and particulate levels will be continuously monitored during drilling or excavation operations, and the required level of protection upgraded if action levels warrant. If an upgrade in PPE is warranted, Level C Protection including full face air-purifying respirators with appropriate cartridges will be implemented.

10.2 Level C Protection

Level C Protection, the maximum level likely to be needed at this site, includes the following;

- Full-face air purifying respirators with NIOSH/MSHA - approved high efficiency (HEPA) canisters for acid mists/organic vapors (half-face respirators may be substituted for certain tasks);
- Chemical-resistant (Poly-Tyvek) clothing, one piece, long sleeved;
- Outer and inner gloves. Inner gloves to be tight-fitting latex or vinyl. Outer gloves of neoprene or nitrile;
- Steel-toe and shank boots (chemical resistant);
- Disposable Tyvek “booties”;
- Neoprene or butyl rubber outer boots;
- Gloves and boots taped; and
- Hard hats.

For all personnel that may be required to wear full-face respirators (all persons working near an excavation, for example), only NIOSH/MSHA approved respirators will be used. These will contain cartridges approved for removal of organic vapors/acid mists and particulates. All team members will be fit-tested for respirators. Due to possible difficulties in achieving a proper seal between face and mask, persons with facial hair will not be fitted for respirators, nor will they be allowed to work in areas requiring respiratory protection. When respirators are used, the cartridges should be replaced when any indication of breakthrough or excess resistance to breathing is detected.

10.3 Donning PPE

The following procedures should be followed when donning protective equipment:

- Inspect all equipment to ensure it is in good condition;
- Don protective suit and gather suit around waist;
- Put on outer boots over feet of the suit and tape at boot/suit junction;
- Don inner gloves;
- Don top half of protective suit and seal (as necessary);
- Don respirator protection (if necessary);
- Don outer gloves and tape at glove/suit junction (as necessary); and
- Have assistant check all closures and observe wearer to ensure fit and durability of protective gear.

11.0 DECONTAMINATION

Level C or higher PPE utilized during site operations warrants the institution of decontamination procedures.

Contaminated material must be either decontaminated or isolated immediately. All materials brought into the Exclusion Zone are presumed contaminated. Alconox and water shall be used as the decontamination solution. Decontamination equipment consisting of large wash tubs, scrub brushes, plastic sheeting, distilled water, plastic garbage bags, trash barrel, and respirator wipes will be used.

Protective clothing, especially reusable boots and gloves, will be decontaminated before leaving the Exclusion Zone by a thorough soap-and-water wash on the decontamination pad. Washing and rinsing solutions will be disposed on site in areas where excavations occur unless elevated VOC levels are detected with a PID. If elevated levels are detected, it may be necessary to dispose of decon solutions in a drum or an approved containment tank. Solid waste materials (disposable gloves and garments, tape, plastic drop cloths, etc.) will be containerized for proper disposal. Personnel will be advised that all clothing worn under protective clothing (underwear, shirts, socks, trousers) on-site should be laundered separately from street clothing before redressing. If protective clothing is breached and personal clothing becomes contaminated, the personal clothing will be disposed.

Use of disposable sampling equipment will limit decontamination requirements. The need for widespread vehicle and heavy equipment decontamination will be limited by keeping to a minimum the number of vehicles entering the Exclusion Zone.

11.1 Personal Decontamination

The following steps must be taken to decontaminate personnel leaving a Level B or C work area:

- Place equipment and sample containers that must be decontaminated on a plastic drop cloth;
- Scrub non-disposable gloves and outer boots (if used) with a brush in a detergent water, then rinse in clean water;
- Remove outer gloves and boot covers;
- Remove protective garments, safety boots and hard hat;
- Wash inner gloves;
- Remove and wash respiratory protection (if worn);
- Remove inner clothing (as necessary for final decontamination at end of shift);

- Thoroughly wash face, hands and body; and
- Redress.

11.2 Equipment Decontamination

Personnel must take the following steps to decontaminate equipment and sample containers leaving Level A, B, or C work areas:

- Don protective equipment at Modified Level D;
- Wash reusable equipment in detergent solution and/or an appropriate solvent, or steam clean;
- Dry sample containers, etc., with paper towels (if necessary) and place on a clean drop cloth;
- Remove and discard used respirator cartridges. Wash respirators in fresh detergent water, rinse in clean water, and disinfectant. Store in a closed plastic bag, away from sources of contamination; and
- Launder clothing before reuse (or place in appropriate labeled impervious containers for transport to laundry).

Organic vapor/HEPA cartridges are the appropriate canisters for use with the contaminates of concern. All respirators used shall be NIOSH and/or MSHA approved and their use shall be consistent with OSHA regulations in 29 CFR 1910.134. All on-site personnel wearing a respirator shall have respirator clearance from a qualified occupational health physician. In addition, the respirator wearers on site shall perform qualitative fit tests to ensure proper fit of the face seal of the respirator. Filter cartridges used shall be of the same manufacturer as the respirator.

For projects involving ground intrusion activities equipment and vehicles leaving potentially contaminated areas will pass over one or more anti-tracking pads. These areas are comprised of NYSDOT #3 gravel to a depth of at least 4 inches, overlaying a filter fabric sheet to retain contaminated soil. The anti-tracking pads are at least 50 feet in length and 15 feet wide. These pads are intended to remove potentially contaminated soil from tires and wheels. Vehicles will not be permitted to enter or exit without traveling across one of the pads.

The locations of the anti-tracking pads will be determined prior to initiating, field activities. The locations will be adjusted as necessary to ensure that adjacent property and public roads are kept free from cross-contamination.

Construction equipment will be thoroughly decontaminated by the Contractor using a power washer prior to being removed from the project site. In addition, all construction equipment will undergo gross decontamination with a power washer as necessary to prevent dust generation.

12.0 EMERGENCY PROCEDURES

On-site personnel will abide by the following emergency procedures:

- The Waste Management Coordinator shall be notified of any on-site emergencies and be responsible for ensuring that the appropriate measures are followed;
- Non-emergencies will be treated on site, documented and the injured party will be directed to seek further medical attention; and
- All occupational injuries and illnesses will be reported, recorded, and investigated.

12.1 Communication

The on-site personnel will have a cellular-type telephone on-site at all times for direct outside communications with emergency response organizations.

12.2 Personnel Injury

The Waste Management Coordinator will be notified of any personal injury. The appropriate first aid shall be initiated and if necessary, contact shall be made for an ambulance and with the designated medical facility. If the injury increases the risk to others, activities on-site will stop until the added risk is removed or minimized.

12.3 Fire/Explosion

Upon notification of fire or explosion, the designated emergency signal shall be sounded, and all site personnel shall assemble at a safe distance upwind of the involved area. The site personnel shall alert the appropriate fire department through the 911 emergency reporting system.

12.4 PPE Failure

If any site worker experiences a failure or alteration of PPE that affects the protection factor, that person and his or her buddy shall immediately exit the work area. Reentry and resuming work activities shall not be permitted until the equipment has been repaired or replaced.

12.5 Other Equipment Failure

If any equipment on-site fails to operate properly, the field team leader shall be notified and will determine the effect of this failure on continuing operations on site. If the failure affects the safety of personnel or prevents completion of the remediation tasks, all personnel shall leave the work zone until the situation is evaluated and appropriate actions taken.

12.6 Spill Containment

Should a release of a chemical material occur on-site, the onsite personnel shall contain the spill to the extent immediately possible by the use of absorbent booms, pigs, pads, etc. The onsite personnel shall contact appropriate spill response public departments (local or state) and a hazardous materials response contractor for further containment (refer to Section 13.0).

13.0 EMERGENCY MEDICAL CARE

13.1 Hospitals

Site Location: Farwell Road Landfill, 1430 Farwell Road, Ischua NY 14743
Nearest Hospital Name: Olean General Hospital
Hospital Location: 515 Main Street, Olean, New York 14760
Hospital Telephone: 1-716-373-2600
Directions to the Hospital:

1. East on Farwell Road to NYS Route 16
2. Turn right (south) on NYS Route 16 for approximately 9 miles
3. Turn left on Delevan Avenue
4. Turn right on to Main Street
5. The hospital will be on the right approximately 0.7 miles after the turn on to Main.

Total Distance: Approximately 11 miles
Total Estimated Time: 15 minutes

13.2 Emergency Notification Numbers

Fire Department: 911
Police Department: 911
Department of Emergency Services: 911
NYSDEC Spill Response Unit: (716) 851-7220
NYSDEC Spill Hotline: 800-457-7362
NYSDOH Division of Environmental Health Assessment: (716) 847-4502

14.0 STANDARD OPERATING PROCEDURES

- Restricted areas are not to be accessed.
- Avoid unrestricted areas that seem questionable or unsafe.
- Minimize contact with hazardous substances.
- Use remote sampling, handling, and/or container-opening techniques whenever possible.
- Protect monitoring and sampling instruments by bagging, if necessary.
- Wear disposable outer garments and use disposable equipment where appropriate.
- All PPE and skin surfaces should be checked for cuts and/or punctures.
- Do not eat, smoke, or drink within the exclusion or contamination reduction zones.
- Prescription drugs should not be taken by personnel where potential for absorption, inhalation, or ingestion of toxic substance exists unless specifically approved by a qualified physician. Alcoholic beverage intake is prohibited.
- All personnel must be familiar with Client's operating safety procedures.
- The buddy system must always be used and enforced.
- No workers with beards or heavy sideburns are allowed to wear respirators.
- Use of contact lenses is prohibited on site.
- All heavy equipment involved should be equipped with available back-up signals.
- Eating, drinking, chewing gum or tobacco, smoking, or any similar practice is prohibited.
- Hands and face must be thoroughly washed upon leaving the Exclusion Zone.
- Whenever decontamination procedures for outer garments are in effect, it is recommended that the entire body should be thoroughly washed, as soon as possible, after the protective garment is removed.
- No excessive facial hair, which interferes with a satisfactory fit of the mask-to-face seal, is allowed for personnel required to wear respiratory protective equipment.
- Medicine and alcohol can exaggerate the effects from exposure to toxic chemicals.
- Fluids will be provided to staff to replace perspiration and will be sealed in containers. All fluids for ingestion will be kept in the Support Zone.
- Due to the effects of protective outer wear decreasing body ventilation, there exists an increase in the potential for heat casualties.
- All field personnel should check for any personal habit, which may allow contaminated soil or water onto or into the body. Jewelry, including watches, shall not be worn within the Exclusion Zone.
- All first aid treatments will be reported to the Waste Management Coordinator who will record each incident.

15.0 COMMUNITY HEALTH AND SAFETY PLAN

15.1 Potential Impacts

A Community Air Monitoring Plan that will require real-time monitoring for volatile organic compounds and particulates at the downwind perimeter of each designated work area will be implemented when remedial activities are in progress at the project site. Potential hazards to the general public and surrounding community are not expected now or in the future.

Limiting potential exposure mechanisms that can transport contaminants beyond the project site boundary will be completed by implementation of an air monitoring plan, maintaining site control, the use of engineering controls, and following emergency procedures.

15.2 Monitoring Plan

Excavation activities are not expected to produce measurable fugitive dust. The excavations will vary in size depending on the ground intrusive activities that may occur.

Should action levels be encountered, work operations shall cease until further evaluation is performed and safe levels are prevalent. If through engineering controls and monitoring, safe levels (below action levels) cannot be achieved, an upgrade in personal protection equipment shall be mandated, or operations shall cease in that portion of the project site. The action levels for this project and the response measures to be implemented to protect the community in the event that these action levels are exceeded are presented in Section 6.2.

15.3 Project Site Control

Access control is to be maintained such that unauthorized entrance to the facility is prevented. During the remedial actions conducted in the early 2000s a multi-floral rose shrubbery was planted around the landfill perimeter. This plant is shallow rooted, hardy and spiny and forms a dense hedge wall thereby restricting access.

15.4 Engineering Controls

In the event measurable dust levels are detected during the remedial activities, then standard dust suppression techniques may be utilized, including the following:

- Wetting excavation faces, boring spoils and equipment during excavation or soil borings;
- Restricting vehicle speeds to 10 mph;
- Postponing excavation activities during severe winds;

- Covering excavated areas and material after excavation activity ceases; and
- Decreasing the number and size of excavations.

If the dust suppression techniques being utilized do not reduce airborne particulates, then remedial activities will be suspended, until a review of the engineering controls can be completed.

15.5 Emergency Notification

This HASP has been developed to include details on emergency coordination and notification procedures to be implemented during an incident. The procedures for specific emergencies are outlined in Section 12.0 and the contact information for local emergency personnel is included in Section 13.0. In the event community health and safety is in question, dialing 911 will summon Fire and Police personnel that can take appropriate actions as necessary.

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APPENDIX G - COMMUNITY AIR MONITORING PLAN

COMMUNITY AIR MONITORING PLAN
FOR THE
FARWELL LANDFILL SITE

(NYSDEC SITE NO. 905024)

FARWELL ROAD
TOWN OF ISCHUA, NEW YORK

Prepared for:

Cattaraugus County Department of Public Works
Jack Ellis Drive
8810 Route 242
Little Valley, New York 14755

COMMUNITY AIR MONITORING PLAN

FARWELL LANDFILL SITE
(NYSDEC SITE NO. 905024)

FARWELL ROAD
TOWN OF ISCHUA, NEW YORK

TABLE OF CONTENTS

LIST OF ATTACHMENTS

1.0 INTRODUCTION

This Community Air Monitoring Plan (CAMP) presents requirements for real-time community air monitoring and responses during invasive activities at the Former Roblin Steel Site located in Dunkirk, New York. This plan is generally consistent with the requirements for community air monitoring at remediation sites as established by the New York State Department of Health (NYSDOH) and the New York State Department of Environmental Conservation (NYSDEC). It follows procedures and practices outlined under the NYSDOH's generic Community Air Monitoring Plan included in Appendix 1A of NYSDEC DER-10 (May 2010).

This CAMP requires real-time monitoring for particulates (i.e., dust) and volatile organic compounds (VOCs) at the downwind perimeter of each designated work area when certain activities are in progress at the project site. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community from potential airborne contaminant releases as a direct result of remedial, redevelopment or post-remediation monitoring and maintenance activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the implementation of this CAMP will help to document that on-site work activities have not introduced contamination into the surrounding community.

2.0 MONITORING AND MITIGATION REQUIREMENTS

Real-time air monitoring for particulate levels and organic vapors at the perimeter of the work area will be necessary. Periodic monitoring will be required for all ground intrusive activities. Ground intrusive activities include, but are not limited to, subgrade soil/fill excavation, grading and transporting soil/fill, and trench excavation and backfill.

"Periodic" monitoring will reasonably consist of taking at least one reading immediately following the initiation of the above-referenced activities and taking at least one reading during intrusive activities. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during invasive activities. Examples of such situations include any subgrade excavation and backfilling within 100 feet of occupied structures or publicly accessible locations.

2.1 Organic Vapors

Real-time air monitoring for VOCs at the perimeter of the work area will be performed for all ground intrusive activities with a hand-held photoionization detector (PID). If a sustained reading of 5 ppm above background or greater is registered by the PID at the perimeter of the work area or adjacent to a soil/fill stockpile area, the provisions in the following subsections will be implemented.

2.1.1 Vapor Emission Response Plan

If the ambient air concentration of total organic vapors at the downwind perimeter of the work area exceeds 5 parts per million (ppm), work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

If total organic vapor levels at the downwind perimeter of the work area persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the sources and vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level at the "downwind hot zone" below 5 ppm over background.

The "downwind hot zone" is defined as 200 feet downwind of the work area or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less, (but in no case less than 20 feet).

If the organic vapor level is above 25 ppm at the perimeter of the project site, the Site Safety and Health Officer will determine when re-entry of the work area is possible and will implement downwind air monitoring to ensure vapor emissions do not impact the nearest off-site residential or commercial structure at levels exceeding those specified under the Major Vapor Emission Monitoring program described below. All readings will be recorded over 15-minute time periods and be made available for State (NYSDEC and NYSDOH) personnel to review.

2.1.2 Major Vapor Emission Monitoring

If the organic vapor level is greater than 5 ppm over background at the "downwind hot zone," all work activities must be halted. If, following the cessation of the work activities or as the result of an emergency, organic levels persist above 5 ppm above background at the "downwind hot zone", then the air quality must be monitored within 20 feet of the perimeter of the nearest off-site receptor (20-foot zone).

If efforts to abate the emission source are unsuccessful and if organic vapor levels approach or exceed 5 ppm above background within the 20-foot zone for more than 30 minutes, or are sustained at levels greater than 10 ppm above background for longer than one minute, than the Major Vapor Emission Response Plan will automatically be placed into effect.

2.1.3 Major Vapor Emission Response Plan

Upon activation of Major Vapor Emission Response Plan, the following activities will be undertaken:

1. All Emergency Response Contacts as listed below and in the Site-Specific Health and Safety Plan will be contacted.
2. The local police authorities will be immediately contacted by the Site Safety and Health Officer and advised of the situation.
3. Frequent air monitoring will be conducted at 30-minute intervals within the 20-foot zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Site Safety and Health Officer.
4. The Site Safety and Health Officer will determine if project site workers can safely undertake source abatement measures. Abatement measures may include covering the source area with clean fill or plastic sheeting, or consolidating contaminated materials to minimize surface area. The Site Safety and Health Officer will adjust worker personal protective equipment as necessary to protect workers from over-exposure to organic vapors.

The following organizations are to be notified by the Site Safety and Health Officer in the listed sequence if the Major Vapor Emission Response Plan is activated:

Contact	**Phone**
Police/Fire Department	911
New York State Dept. of Health	(716) 847-4502
New York State Dept. of Environmental Conservation	(716) 851-7220
State Emergency Response Hotline	(800) 457-7362

In addition, the Site Safety and Health Officer will provide these authorities with a description of the apparent source of the contamination and abatement measures being taken by the contractor, if any.

2.2 Airborne Particulates

Fugitive dust suppression and airborne particulate monitoring shall be performed during any remedial, redevelopment or post-remediation activities involving the disturbance or handling of site soil/fill. Fugitive dust suppression techniques will include the following minimum measures:

- Dust suppression will be achieved though the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations, equipment and stockpiles.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.
- Excavated stockpiles from intrusive activities that generate unacceptable dust levels will be seeded, covered with synthetic materials (e.g., tarps, membranes, etc.), or watered to reduce dust generation to acceptable levels;

- Stockpiles of soil/fill from intrusive activities that are potentially contaminated (i.e. are visually stained, discolored or produce elevated PID readings) and awaiting analytical results should be covered with tarps or polyethylene membranes at the end of each day's work activities; and
- All fill materials leaving the site will be hauled in properly covered containers or trucks.

Additional dust suppression efforts may be required as discussed below.

2.2.1 Particulate Monitoring

Particulate concentrations should be monitored by temporary particulate monitoring stations periodically (i.e., not less than two times per day) at the upwind and downwind perimeters of the work zone during all work activities. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

If the downwind PM-10 particulate level is 100 micrograms per cubic meter (ug/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 ug/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 ug/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures, such as those described in Section 2.2.3, are successful in reducing the downwind PM-10 particulate concentration to within 150 ug/m^3 of the upwind level and in preventing visible dust migration.

All readings will be recorded and be made available for State (NYSDEC and NYSDOH) personnel to review.

2.2.2 Visual Assessment

In conjunction with the real-time monitoring program, the contractor, the County, or their agents will be responsible for visually assessing fugitive dust migration from the project site. If airborne dust is observed leaving undeveloped portions of the project site (i.e., migrating onto off-site properties or redeveloped areas of the project site), the work will be stopped and supplemental dust suppression techniques will be employed.

2.2.3 Supplemental Dust Suppression

Supplemental dust suppression techniques may include but are not necessarily limited to the following measures:

- Reducing the excavation size, number of excavations or volume of material handled;
- Restricting vehicle speeds;
- Applying water on buckets during excavation and dumping;
- Wetting haul roads;
- Restricting work during extreme wind conditions; and
- Using a street sweeper on paved haul roads, where feasible.

Work can resume using supplemental dust suppression techniques provided that the measures are successful in reducing the downwind particulate concentration to below 150 ug/m^3 above background, and in preventing visible dust migration off-site.

3.0 MONITORING EQUIPMENT

3.1 Organic Vapor Monitoring Equipment

Organic vapor monitoring will be performed using a photoionization detector (PID). The device will be calibrated on a daily basis or as necessary. Minimum equipment specifications are:

Minimum Operating Range:	0.5 ppm
Accuracy:	± 10%, or ± 2 ppm
Precision:	1% of calibration to 100 ppm
Response Time:	Less than 3 seconds to 90%
UV Lamp (PID):	10.6 eV
Battery Rating:	8-hour continuous operation
Operating Conditions:	
Temperature:	0-40°C
Humidity:	0-99% relative humidity

An adjustable audible alarm will be provided to indicate exceedance of the action levels prescribed in Section 2.1.

3.2 Particulate Monitoring Equipment

Particulate monitoring will be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM-10) with the following minimum performance standards:

Size Range:	<0.1 to 10 microns
Sensitivity:	1 ug/m^3
Range:	0.001 to 10 mg/m^3
Overall Accuracy:	± 10% as compared to gravimetric analysis of stearic acid or reference dust
Battery Ratings:	8-hour continuous operation
Operating Conditions:	
Temperature:	0-40°C
Humidity:	0-99% relative humidity

The device will be fitted with a microprocessor capable of calculating 15-minute moving average concentrations. An adjustable audible alarm will be provided to indicate exceedance of the action levels prescribed in Section 2.2.1.

4.0 QA/QC REQUIREMENTS

Quality Assurance/Quality Control (QA/QC) requirements for the particulate meter and organic vapor monitoring equipment include instrument calibration, training, and documentation/record keeping.

4.1 Instrument Calibration

Instrument calibration shall be performed in accordance with the manufacturer's instructions at the beginning of each workday. Following calibration and initial (upwind) measurement of background conditions, audio alarms shall be set to activate at the appropriate action levels based on a 15-minute moving average (i.e., short term exposure limit) concentration.

4.2 Training

All persons responsible for calibrating, handling and/or interpreting the meters or meter output data should be experienced with such work. As a minimum, the following training and experience will be required:

- 24-hour OSHA Hazwoper Training per 29 CFR 1910.120(e)(3) and 1910.120.(e)(8);
- Site-specific training, as required by the Site Health and Safety Plan; and
- Prior field experience in the operation of same or similar equipment.

The Site Safety and Health Officer will designate the person(s) responsible for performing air-monitoring work. Construction activities involving disruption or handling of site fill soils will not be performed unless a qualified individual is available on site to perform the community air monitoring specified in this document.

4.3 Documentation and Reporting

Documentation of community air monitoring information will be required to provide written record of the air monitoring results and response actions taken, and to allow for verification that the program was followed in accordance with this Community Air Monitoring Plan. Monitoring information will be recorded on form presented in Attachment A1-1 or on similar loose-leaf forms to facilitate photocopying. The following documentation schedule will be followed during typical site conditions (i.e., organic vapor and particulate concentrations below action levels).

Item	**Documentation Schedule**
Instrument Calibration Results	Whenever calibration is performed (minimum once daily).
Background Monitoring Results	At beginning of work day and once every 4 hours thereafter.
Downwind Monitoring Results (15-minute moving average)	Hourly

All documentation records will be maintained in the project file for inspection by the NYSDEC and/or the NYSDOH upon request. The NYSDEC will be provided copies of the monitoring results recorded during intrusive activities upon substantial completion of said activities.

During intrusive activities, NYSDEC and NYSDOH will be contacted if major vapor emissions occur as stipulated under the Major Vapor Emission Response Plan. In addition, the NYSDEC Division of Air Resources will be contacted in writing within five days of exceeding the 150 ug/m^3 respirable dust action level. These notifications will include a description of the control measures implemented to prevent further exceedances.

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ATTACHMENT 1 - CAMP INSPECTION FORM

GPI

DIRECT READING AIR MONITORING FORM

DATE: ______________________

PROJECT: ______________________

PROJECT #: ______________________

WEATHER CONDITIONS: ______________________

WIND DIRECT/SPEED: ______________________

USER: ______________________

CALIBRATION TIME: ______________________

CALIBRATED BY: ______________________

COMMENTS: ______________________

ACTIVITY	INSTRUMENT	WORKING RANGE	TIME	READING	COMMENTS

APPENDIX H - MONITORING WELL BORING/CONSTRUCTION LOGS

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS
CAZENOVIA NEW YORK

Boring/Well ID: MW-18S

Project Name: Farwell Landfill- Cattaraugus County
Job No: 80189FA
Start Date & Time: 8/5/98-1445
Finish Date & Time: 8/5/98-1645
Drilling Co: Parratt-Wolff, Inc
Driller: R. Bush, M. Marshall
S&W Inspector: S. Graham
Drill Rig Type: CME-75
Drilling Method: Roller Bit
Weather: Overcast, 70

Groundwater Observations

Time:
Casing Depth:
Boring Depth: 30'
Depth to Water:
below surface ______ below meas. pt. 14.16'
Surface Elevation:
Measuring Point Elevation: 1502.53'
Groundwater Elevation: 1488.37'

Sample Log Key: Sent for Lab Analysis
NAPL Key: NAPL Observed
Depth to Groundwater

Depth (ft)	Blow Counts	PID (PPM)	Sample Log	Recovery (ft)	NAPL	Lithology	Sample Description	Depth (ft)	Well Diagram
1	18,22	0		1.3			Brown, Dry, Coarse Gravel, Fine Sand, Silt, (Fill)	1	
2	16,20	0					Brown, Dry, Coarse Gravel, Fine Sand, Silt, (Fill)	2	Bentonite Grout
3								3	2" ID PVC Riser
4								4	
5								5	
6	5,5	0		1.3			Brown, Dry/Damp, Silt, Some C/M Gravel, Some Sand	6	
7	3,3						Brown, Dry/Damp, Silt, Some C/M Gravel, Some Sand	7	
8								8	
9								9	
10								10	
11	1,1	0		1.6			Brown, Damp, Mottled, Silt, Clay.	11	
12	1,2						11.8' Grey, Clay, Some Silt, Moist	12	
13								13	
14								14	
15								15	
16	5,10	0		2			Brown, Moist, Silt, (F-M-C) Sand, M-Gravel, Clay, Till	16	Bentonite Pellets
17	14,19						Water @ 15'	17	
18								18	#00 Choker Sand
19								19	#0 Sand Pack
20								20	
21	6,8	0		1.2			Dry, Brown, Silt, F-Gravel, Sand	21	
22	5,4						21' Wet, Grey, Silty-Sand w/ Rock Fragments	22	
23	6,10	0		0.3			S.A.A. Very Little Recovery	23	
24	7,10							24	
25	15,24	0		1.5			Wet, Grey, Silt, F-M-C Sand, M-C Gravel	25	
26	30, 25						Wet, Grey, Silt, F-M-C Sand, M-C Gravel	26	
27	30,40	0		1.5			S.A.A. W/ Sandy Seams	27	2" ID PVC
28	50/.4						S.A.A. W/ Sandy Seams	28	.01" Slot, Screen
29	21,50/.4	0		0.6			S.A.A. Boulder/Cobble@ 29'	29	
30	50/.4							30	

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS
CAZENOVIA NEW YORK

Boring/Well ID: MW-18D

Project Name: Farwell Landfill- Cattaraugus County
Job No: 80189FA
Start Date & Time: 8/3/98-1435
Finish Date & Time: 8/20/98-1530
Drilling Co: Parratt-Wolff, Inc
Driller: R. Bush, M. Marshall
S&W Inspector: S. Graham
Drill Rig Type: CME-75
Drilling Method: Roller Bit
Weather: Overcast, 70

Groundwater Observations

Time:
Casing Depth: 98'
Boring Depth: 114'
Depth to Water:
below surface ______ below meas. pt. 14.23'
Surface Elevation:
Measuring Point Elevation: 1502.21'
Groundwater Elevation: 1488.28'

Sample Log Key: Sent for Lab Analysis
NAPL Key: NAPL Observed
Depth to Groundwater

Depth (ft)	Blow Counts	PID (PPM)	Sample Log	Recovery (ft)	NAPL	Lithology	Sample Description	Depth (ft)	Well Diagram
1	18,22	0		1.3		1	Brown, Dry, Coarse Gravel, Fine Sand, Silt, (Fill)	1	
2	16,20	0				2	Brown, Dry, Coarse Gravel, Fine Sand, Silt, (Fill)	2	Bentonite Grout
3						3		3	2" ID PVC Riser
4						4		4	
5						5		5	
6	5,5	0		1.3		6	Brown, Dry/Damp, Silt, Some C/M Gravel, Some Sand	6	
7	3,3					7	Brown, Dry/Damp, Silt, Some C/M Gravel, Some Sand	7	
8								8	
9								9	
10								10	
11	1,1	0		1.6			Brown, Damp, Mottled, Silt, Clay.	11	
12	1,2						11.8' Grey, Clay, Some Silt, Moist	12	
13								13	
14								14	
15								15	
16	5,10	0		2			Brown, Moist, Silt, (F-M-C) Sand, M-Gravel, Clay, Till	16	
17	14,19						Water @ 15'	17	
18								18	
19								19	
20								20	
21	6,8	0		1.2			Dry, Brown, Silt, F-Gravel, Sand	21	
22	5,4						21' Wet, Grey, Silty-Sand w/ Rock Fragments	22	
23	6,10	0		0.3			S.A.A. Very Little Recovery	23	
24	7,10							24	
25	15,24	0		1.5			Wet, Grey, Silt, F-M-C Sand, M-C Gravel	25	
26	30, 25						Wet, Grey, Silt, F-M-C Sand, M-C Gravel	26	
27	30,40	0		1.5			S.A.A. W/ Sandy Seams	27	
28	50/.4						S.A.A. W/ Sandy Seams	28	
29	21,50/.4	0		0.6			S.A.A. Boulder/Cobble@ 29'	29	
30	50/.4							30	

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS
CAZENOVIA, NEW YORK

Boring/Well ID: 18D

Sample Log Key: Sent for Lab Analysis
NAPL Key: NAPL Observed
Depth to Groundwater

Depth (ft)	Blow Counts	PID (PPM)	Sample Log	Recovery (ft)	NAPL	Lithology	Description	Depth (ft)	Well Diagram
31	13,21	0		1.2			Wet, Grey, Silt, F-M-C Sand, Rock Fragments	31	
32	18,16							32	
33								33	
34								34	
35								35	
36	10,15	0		1			S.A.A. Wet Grey Silty Sand, Till	36	
37	22,21							37	
38								38	
39								39	
40								40	
41	18,32	0		1			S.A.A.	41	
42	37,35							42	
43								43	
44								44	
45								45	
46	20,27	0		0.5				46	
47	24,26						S.A.A. Rock Fragments	47	
48								48	
49								49	
50								50	
51	24,27	0		0.5			Wet Grey Silty Sand, Till, Rock Fragments	51	
52	18							52	
53								53	
54								54	
55								55	
56	50,50/.1	0		0.2			S.A.A. Increased Rock Fragments Decrease Silty Sand	56	
57								57	
58								58	
59								59	
60								60	
61	40,50/.2	0		0.5			S.A.A. Wet Grey Silty Sand, Rock Fragments	61	
62								62	
63								63	
64								64	
65								65	

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS
CAZENOVIA, NEW YORK

Boring/Well ID: 18D

Sample Log Key: Sent for Lab Analysis
NAPL Key: NAPL Observed
Depth to Groundwater

Depth (ft)	Blow Counts	PID (PPM)	Sample Log	Recovery (ft)	NAPL	Lithology	Description	Depth (ft)	Well Diagram
66	31,45	0		1.2			Wet, Grey, Silt, F-M-C Sand, Rock Fragments	66	
67	65	0		0.8				67	
68								68	
69								69	
70								70	
71	60,80	0		0.7			S.A.A. Increase M-C Sand, Large Rock Fragments	71	
72								72	
73								73	
74								74	
75								75	
76	50,65	0		0.5			S.A.A.	76	
77								77	
78								78	
79								79	
80								80	
81	53,70	0		0.5			S.A.A. Grey/Green Silty Sand, Rock Fragments	81	
82								82	
83								83	
84								84	
85	100/.3	0		0.3			Wet Grey Silty Sand. Till, Rock Fragments	85	
86								86	
87								87	
88								88	
89								89	
90								90	
91	75	0		0.2			S.A.A. Wet Grey, Increased Silty Sand, Some Clay	91	
92								92	
93								93	
94								94	
95							Grey M-C Grained Sandstone	95	
96		0		1.4				96	
97								97	
98		0		1.8				98	
99								99	Bentonite Pellets
100								100	

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS
CAZENOVIA, NEW YORK

Boring/Well ID: 18D

Sample Log Key: Sent for Lab Analysis
NAPL Key: NAPL Observed
Depth to Groundwater

Depth (ft)	Blow Counts	PID (PPM)	Sample Log	Recovery (ft)	NAPL	Lithology	Description	Depth (ft)	Well Diagram	
101		0		3			Fine Grained Sandstone, Clayey Silt Seams	101		Bentonite Pellets
102								102		#00 Choker Sand
103								103		
104								104		
105								105		
106		0		5			S.A.A.	106		#0 Sand Pack
107								107		
108								108		
109								109		
110								110		
111		0		5			S.A.A.	111		2" ID PVC
112								112		
113								113		.01" Slot, Screen
114		0		3				114		
115								115		
116								116		
117								117		
118								118		
119								119		
120								120		
121								121		
122								122		
123								123		
124								124		
125								125		
126								126		
127								127		
128								128		
129								129		
130								130		
131								131		
132								132		
133								133		
134								134		
135								135		

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS
CAZENOVIA NEW YORK

Boring/Well ID: MW-19S

Project Name: Farwell Landfill- Cattaraugus County
Job No: 80189FA
Start Date & Time: 8/6/98-1030
Finish Date & Time: 8/19/98-1445
Drilling Co: Parratt-Wolff, Inc
Driller: R. Bush, M. Marshall
S&W Inspector: D. Sorbello
Drill Rig Type: CME-75
Drilling Method: Roller Bit
Weather: Overcast, 70

Groundwater Observations

Time: 1300
Casing Depth:
Boring Depth: 120'
Depth to Water:
below surface ______ below meas. pt. 56.64'
Surface Elevation:
Measuring Point Elevation: 1543.31'
Groundwater Elevation: 1486.67'

Sample Log Key: Sent for Lab Analysis
NAPL Key: NAPL Observed
Depth to Groundwater

Depth (ft)	Blow Counts	PID (PPM)	Sample Log	Recovery (ft)	NAPL	Lithology	Sample Description	Depth (ft)	Well Diagram
1							Brown, Dry, Silt, Some Gravel	1	
2	4,9	0		2			Brown, Dry, Silt, Some Gravel	2	
3	9,25	0						3	
4								4	
5								5	
6	9,19	0		0.8			Brown, Damp, Silt, Some M Gravel, Little Sand	6	
7	50/.4						Brown, Damp, Silt, Some M Gravel, Little Sand	7	
8								8	
9								9	
10								10	
11	50/.3	0		0.8			Increase Silt, Brown Dry, M Gravel	11	
12								12	Bentonite grout
13								13	
14								14	2" ID PDC Riser
15								15	
16	6,24	0		2			Brown, Dry, Silt, Some M-C Gravel	16	
17	32,35							17	
18								18	
19								19	
20								20	
21	60/.5	0		0.5			Brown, Dry, Silt, Some M-C Gravel	21	
22								22	
23		0		0.3				23	
24								24	
25								25	
26	55	0		0.3			Brown, Wet, Silt, Some M-C Gravel and Rock Fragments	26	
27								27	
28								28	
29								29	
30								30	

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS
CAZENOVIA NEW YORK

Boring/Well ID: MW-19S

Sample Log Key: Sent for Lab Analysis
NAPL Key: NAPL Observed
Depth to Groundwater

Depth (ft)	Blow Counts	PID (PPM)	Sample Log	Recovery (ft)	NAPL	Lithology	Description	Depth (ft)	Well Diagram	
31	22,32	0		1.5			Brown, Dry, Silt, Some M-C Gravel, Some larger rock fragments	31		
32	41						Brown, Dry, Silt, Some M-C Gravel, Some larger rock fragments	32		
33								33		
34								34		
35								35		
36	20,28	0		1.5			Brown, Dry, Silt, Some M-C Gravel, Some larger rock fragments	36		
37	37,44						Water Table	37		
38								38		
39								39		
40								40		Bentonite Grout
41	60	0		0.8			Brown, Dry, Silt, Some M-C Gravel, Many smooth rounded pebbles	41		
42								42		2" ID PVC Riser
43								43		
44								44		
45								45		
46	23,34	0		0.9			Moist Till (Silt and sand, some rock fragments)	46		
47	45/.5							47		
48								48		
49								49		
50								50		
51	24,21	0		0.9			Moist Till (Silt and sand, some rock fragments)	51		
52	32,40							52		
53								53		
54								54		
55								55		
56	35,55/.5	0		0.6			Moist Till (Silt and sand, some rock fragments)	56		
57								57		
58								58		
59								59		
60								60		
61	33,41							61		
62	70/.5	0		0.6			Till (Silty F-M Sand)	62		
63								63		
64								64		
65								65		

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS
CAZENOVIA, NEW YORK

Boring/Well ID: MW-19S

Sample Log Key: Sent for Lab Analysis
NAPL Key: NAPL Observed
Depth to Groundwater

Depth (ft)	Blow Counts	PID (PPM)	Sample Log	Recovery (ft)	NAPL	Lithology	Description	Depth (ft)	Well Diagram
66	31,50/3	0		0.9			Moist Sand, Silt, Cobbles, Rock Fragments, Till	66	
67								67	
68								68	
69								69	
70								70	
71	50,60	0		0.6			Moist Sand, Silt, Cobbles, Rock Fragments, Till	71	
72								72	
73								73	
74								74	
75								75	
76	100/6	0		0.1			Sand, Silt, Cobbles, Rock Fragments, Till	76	
77								77	
78								78	
79								79	
80								80	Bentonite Grout
81	65,58	0		0.6			Moist Sand, Silt, Cobbles, Rock Fragments, Till	81	
82								82	
83								83	2" ID PVC Riser
84								84	
85								85	
86	65,50/1	0		0.7			Moist Sand, Silt, Cobbles, Rock Fragments, Till	86	
87								87	
88								88	
89								89	
90								90	
91	50,50/3	0		0.8			Moist Sand, Silt, Cobbles, Rock Fragments, Till	91	
92								92	
93								93	
94								94	
95	65,85	0		0.8			Sand, Silt, gravel, some rock fragments, Till	95	
96								96	
97								97	
98								98	
99								99	
100								100	

Stearns&Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS
CAZENOVIA, NEW YORK

Boring/Well ID: MW-19S

Sample Log Key: Sent for Lab Analysis
NAPL Key: NAPL Observed
Depth to Groundwater

	Blow Counts	PID (PPM)	Sample Log	Recovery (ft)	NAPL	Lithology		Depth (ft)	Well Diagram
101	36,51	0		0.3			Moist Sand, Silt, Cobbles, Rock Fragments, Till	101	
102								102	
103								103	
104								104	
105								105	Bentonite Pellets
106	55,65	0		0.6			Moist Sand, Silt, Cobbles, Rock Fragments, Till	106	
107								107	#00 Choker Sand
108								108	
109								109	#0 Sand Pack
110								110	
111	100/.2	0		0.2			Sand, Silt, Cobbles, Rock Fragments, Till	111	
112								112	
113								113	
114								114	
115								115	
116	68,85	0		0.9			Grey Wet Silt, M-C Sand, Some **gravel**	116	
117								117	
118								118	
119								119	2" ID PVC
120								120	.01" slot, screen
121	65,50/.1	0		0.7			Grey Wet Silt, M-C Sand, Some **gravel**	121	
122								122	
123								123	
124								124	
125								125	
126								126	
127								127	
128								128	
129								129	
130								130	
131								131	
132								132	
133								133	
134								134	
135								135	

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Boring/Well ID: MW-20D

Project Name: Farwell Landfill- Cattaraugus County
Job No: 90180.70
Start Date & Time: 8/23/99-1130
Finish Date & Time: 9/1/99-1830
Drilling Co: Parratt-Wolff, Inc
Driller: R. Bush, B. Waters
S&W Inspector: D. Sorbello
Drill Rig Type: Mobile B-57
Drilling Method: Roller Bit
Weather:

Groundwater Observations

Time: 1300
Casing Depth: 19'
Boring Depth: 135'
Depth to Water:
below surface ______ below meas. pt. 47.71'
Surface Elevation:
Measuring Point Elevation:
Groundwater Elevation:

Sample Log Key: Sent for Lab Analysis
Depth to Groundwater

Depth (ft)	Blow Counts	PID (PPM)	Sample Log	Recovery (ft)	NAPL	Lithology	Sample Description	Depth (ft)	Well Diagram	
1								1		
2								2		
3								3		
4								4		
5								5		
6								6		
7								7		
8								8		
9								9		
10								10		
11								11		
12								12		Bentonite grout
13								13		
14								14		2" ID PVC Riser
15								15		
16								16		
17								17		
18								18		
19								19		
20								20		
21								21		
22								22		
23								23		
24								24		
25								25		
26								26		
27								27		
28								28		
29								29		
30								30		

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Boring/Well ID: MW-20D

Sample Log Key: Sent for Lab Analysis; Depth to Groundwater

Depth (ft)	Blow Counts	PID (PPM)	Sample Log	Recovery (ft)	NAPL	Lithology	Description	Depth (ft)	Well Diagram
31								31	
32								32	
33								33	
34								34	
35								35	
36								36	
37								37	
38								38	
39								39	
40								40	Bentonite Grout
41								41	
42								42	2" ID PVC Riser
43								43	
44								44	
45								45	
46								46	
47								47	
48								48	
49	55,60						Begin Sampling	49	
50	40,26			2			Till. Gravel and medium cobbles. Some silt and sand.	50	
51								51	
52								52	
53								53	
54								54	
55								55	
56								56	
57								57	
58								58	
59	180/.5			0				59	
60								60	
61								61	
62								62	
63								63	
64								64	
65								65	

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Boring/Well ID: MW-20D

Sample Log Key: ■ Sent for Lab Analysis

▼ Depth to Groundwater

Depth (ft)	Blow Counts	PID (PPM)	Sample Log	Recovery (ft)	NAPL	Lithology	Description	Depth (ft)	Well Diagram
66								66	
67								67	
68								68	
69	75,68						F/C Sand, Silt, and Gravel. Many Rock Fragments	69	
70							Grade to Brown silty Fine sand some clay trace gravel.	70	
71								71	
72								72	
73								73	
74								74	
75								75	
76								76	
77								77	
78								78	
79	115,135			6"			F/C Sand, Silt, and Gravel. Many Rock Fragments	79	
80								80	Bentonite Grout
81								81	
82								82	
83								83	2" ID PVC Riser
84								84	
85								85	
86								86	
87								87	
88	135/6"						F/C Sand, Silt, and Gravel. Many Rock Fragments	88	
89								89	
90								90	
91								91	
92								92	
93								93	
94								94	
95								95	
96								96	
97	200/.4			0				97	
98								98	
99								99	
100								100	

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Boring/Well ID: MW-20D

Sample Log Key: ■ Sent for Lab Analysis; ▼ Depth to Groundwater

Depth	Blow Counts	PID (PPM)	Sample Log	Recovery (ft)	NAPL	Lithology	Description	Depth (ft)	Well Diagram
101								101	
102								102	
103								103	
104								104	Grout
105								105	
106								106	
107								107	
108	52,110			6"			Gray Gravel, sand, and silt. Many rock fragments	108	
109								109	
110								110	
111								111	
112								112	
113								113	
114								114	6" steel casing
115								115	into bedrock
116							Bedrock	116	
117								117	
118								118	
119	200/4			2"				119	
120								120	Bentonite Pellets
121								121	
122								122	#00 Choker Sand
123								123	
124								124	
125								125	
126								126	
127								127	
128								128	
129								129	#0 Sand Pack
130								130	
131								131	
132								132	
133								133	2" ID PVC
134								134	.01" slot, screen
135							Boring completed at 135'	135	

Stearns & Wheler, LLC
Environmental Engineers and Scientists

Cattaraugus County
Farwell Landfill
Compliance Monitoring Well Installation
Town of Ischua, New York

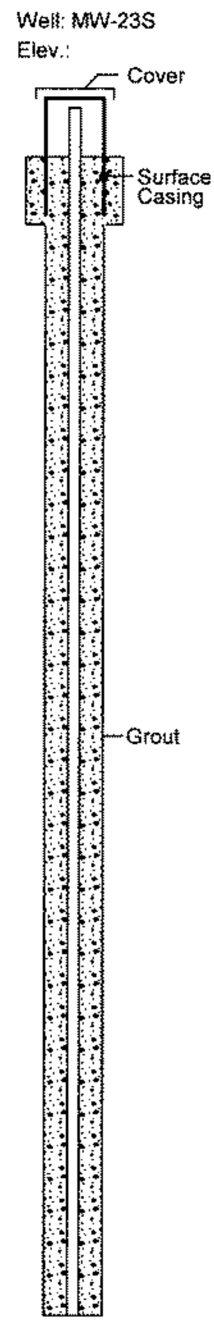
Job No. L10010.20.1400

Depth of Boring	: 54'
Drilling Contractor	: Parratt Wolff
Drill Rig Type	: Track Rig
Driller	: Glen Lansing
Drilling Method	: Wash Rotary
Hammer Wt./Drop	: 140 lb./30"
Sampling Method	: Split Spoon 1-3/8" ID
Logged By	: MSS
Surveyed By	: Cattaraugus County

LOG OF BORING MW-23S

Date Started	: 10/15/02
Time	: 1:15 PM
Date Completed	: 10/17/02
Time	: 10:00 AM
Weather	: overcast, 45F
Boring Location	: downgradient of landfill

Depth in Feet	Blow Count	PID (ppm)	Recovery (inches)	DESCRIPTION	Depth in Feet	REMARKS
0					0	
2					2	
4					4	
5				Drill using wash rotary method to 15' bgs. Will begin sampling 5-foot intervals @15' bgs		
6					6	
8					8	
10					10	
12					12	
14					14	5" steel casing inserted to 15' bgs
16	10 10 12 11			moist gray/brown slightly dense silt with some clay and f-c gravel	16	
18					18	
20	40 43 28 30			moist dense silt and sand with coarse gravel	20	
22					22	
24					24	
26	8 9 10 8			wet dense silt and sand with coarse gravel	26	Till
28					28	
30				moist brown silt with sand and coarse gravel	30	



Notes:

LOG OF BORING MW-23S

(Page 1 of 2)

Stearns & Wheler, LLC
Environmental Engineers and Scientists

Cattaraugus County
Farwell Landfill
Compliance Monitoring Well Installation
Town of Ischua, New York

Job No. L10010.20.1400

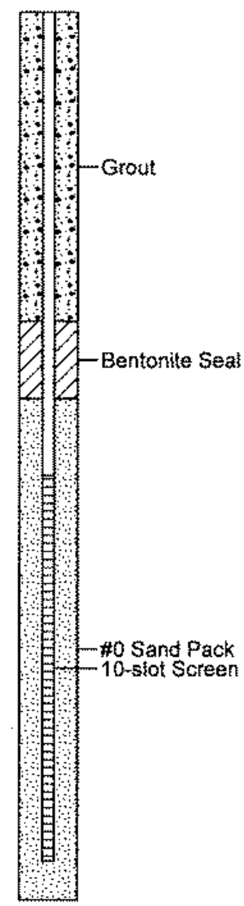
Depth of Boring	: 54'
Drilling Contractor	: Parratt Wolff
Drill Rig Type	: Track Rig
Driller	: Glen Lansing
Drilling Method	: Wash Rotary
Hammer Wt./Drop	: 140 lb./30"
Sampling Method	: Split Spoon 1-3/8" ID
Logged By	: MSS
Surveyed By	: Cattaraugus County

LOG OF BORING MW-23S

Date Started	: 10/16/02
Time	: 1:15 PM
Date Completed	: 10/17/02
Time	: 10:00 AM
Weather	: overcast, 45F
Boring Location	: downgradient of landfill

Depth in Feet	Blow Count	PID (ppm)	Recovery (inches)	DESCRIPTION	Depth in Feet	REMARKS
30	15 13 11 11			moist silt and sand with coarse gravel	30	
32					32	
34				Begin continuous sampling	34	5" steel casing inserted to 35' bgs
36	13 14 20 18			moist dense gray silt and sand with coarse gravel	36	Till
38	12 10 11 13				38	
40	13 21 13 18				40	
42	10 10 13 17			moist dense gray silt and sand with f-c gravel with litte clay	42	5" steel casing inserted to 45' bgs
44	12 11 9 10				44	
46	14 14 14 16			moist gray m/c sand with silt and fine-coarse gravel	46	Glaciofluvial
48	18 22 15 15			moist gray sand with f-c gravel and rounded pebbles	48	5" steel casing inserted to 50' bgs
50	19 35 28 23			moist gray dense silt with coarse gravel and little clay	50	
52	14 38 60 60			dense clayey silt with coarse gravel	52	Till E.O.B. @ 54'
54					54	
56					56	
58					58	
60					60	

Well: MW-23S
Elev.:



Notes:

LOG OF BORING MW-23S

(Page 2 of 2)

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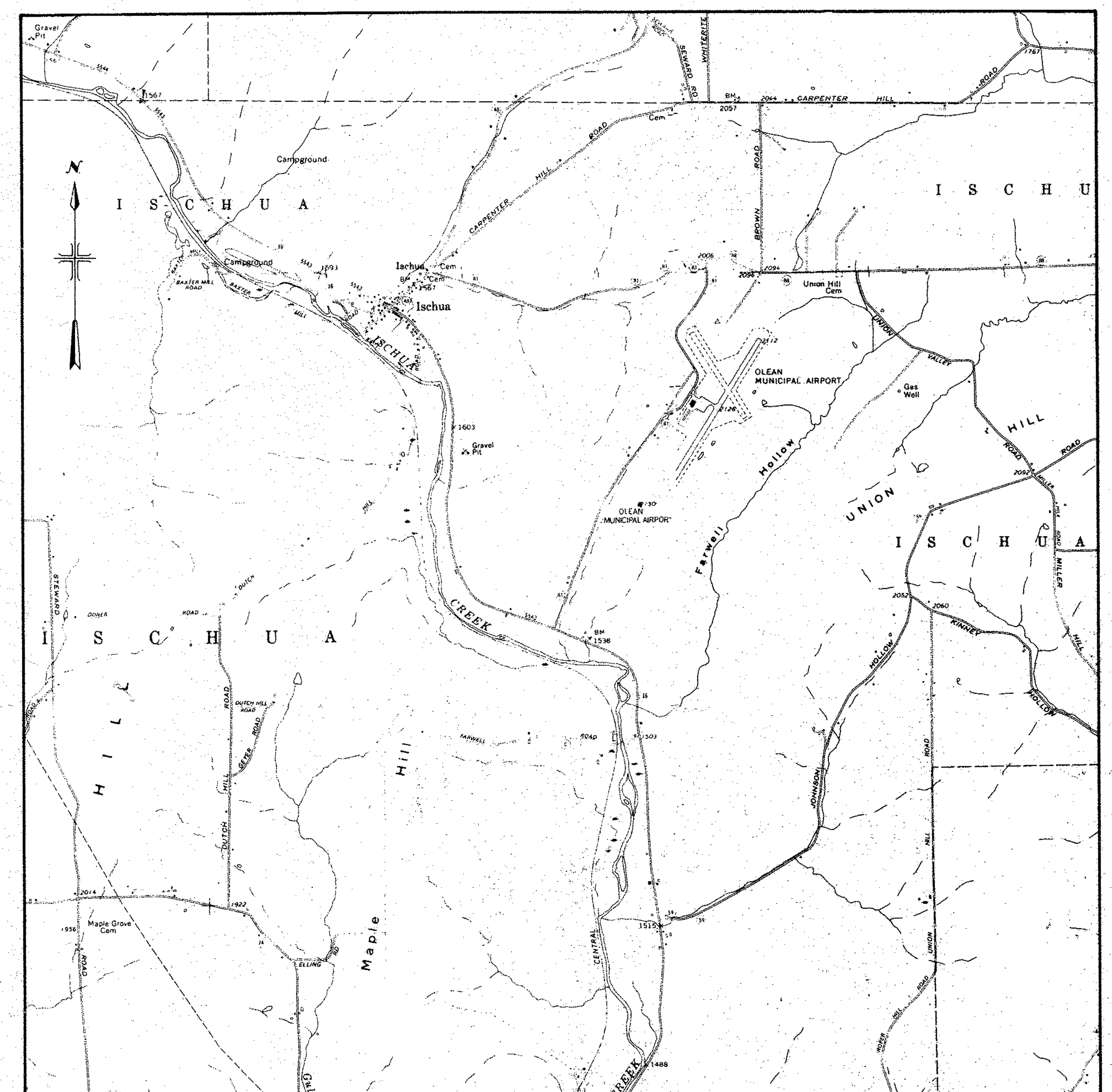
APPENDIX I - RECORD DRAWINGS FOR THE LEACHATE COLLECTION SYSTEM

GPI

CATTARAUGUS COUNTY DEPARTMENT OF PUBLIC WORKS

FARWELL LANDFILL CAPPING PLAN

SEPTEMBER 1987



LOCATION PLAN

SCALE: 1" = 2000'

INDEX TO SHEETS	
SHEET NO.	DESCRIPTION
1	EXISTING SITE TOPOGRAPHY
2	EXISTING SITE TOPOGRAPHY
3	PROPOSED GRADING PLAN
4	PROPOSED GRADING PLAN
5	MISCELLANEOUS SECTIONS AND DETAILS
6	LEACHATE COLLECTION SYSTEM
7	MISCELLANEOUS SECTIONS AND DETAILS
8	MISCELLANEOUS SECTIONS AND DETAILS

COMMITTEE CHAIRMAN
RONALD PRIEST

COMMITTEE MEMBERS
GERALD FITZPATRICK
ROBERT M. KENT, SR.
ROBERT W. MATSON
BRUCE J. MOODY
THORNTON A. NEWHOUSE
BENJAMIN J. CALABRO
DANIEL McCARTHY
WILLIAM E. SPRAGUE

COMMISSIONER
R. M. JOHNSON

CIVIL ENGINEER
SCOT W. HIRSCHMAN

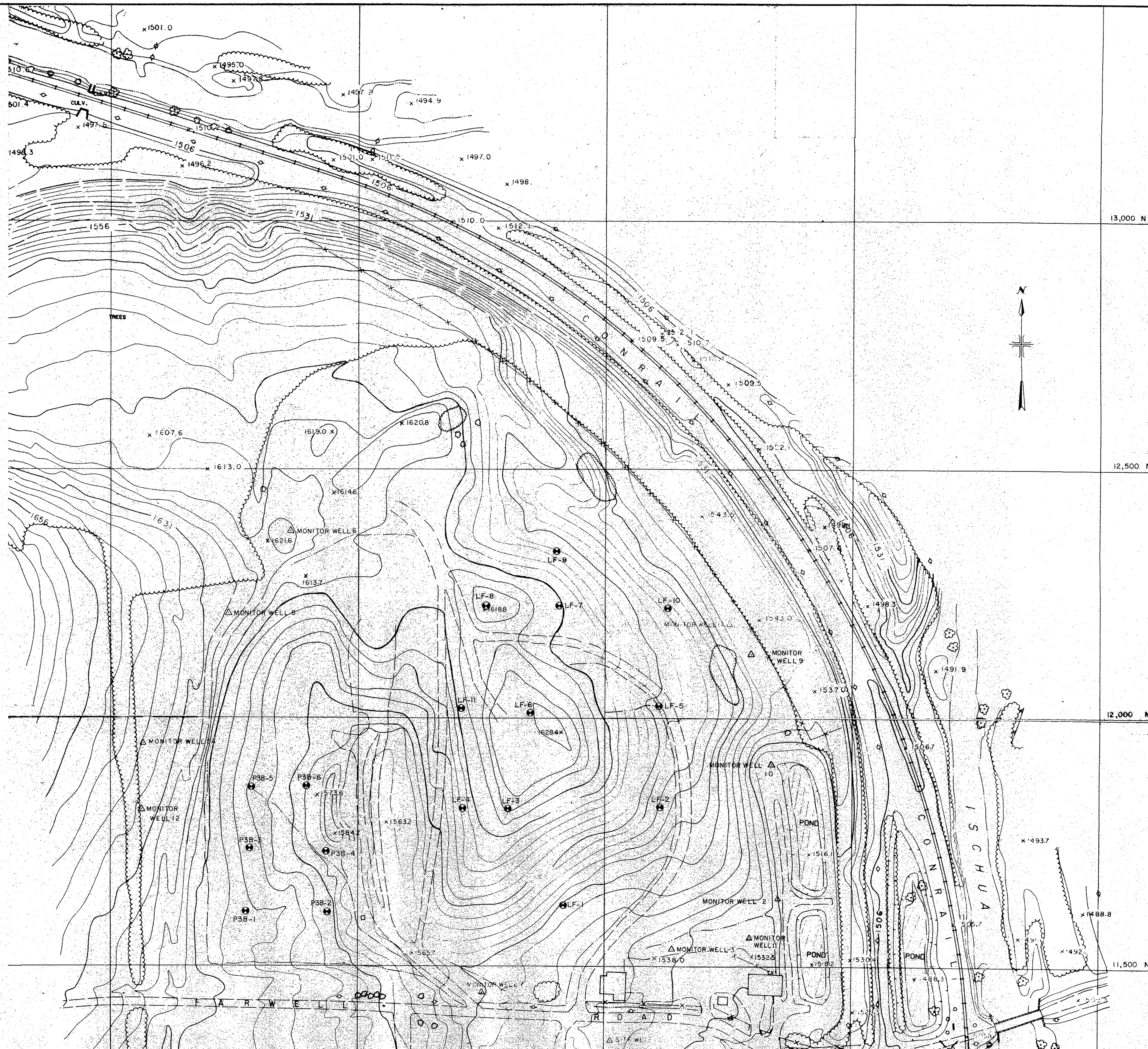
REVIEW COPY

DRAFT

STATE OF NEW YORK
LICENSED PROFESSIONAL ENGINEER

APPROVED ______________________
MALCOLM PIRNIE, INC.

APPROVED ______________________
CATTARAUGUS COUNTY
DEPARTMENT OF PUBLIC WORKS



LEGEND

- TEST PIT
- LF LANDFILL AREA
- P3B PHASE III B AREA

WARNING - IT IS A VIOLATION OF NEW YORK EDUCATION LAW, SECTION 7209.2, FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER OR LAND SURVEYOR, TO ALTER THIS DOCUMENT IN ANY WAY. IF ALTERED, THE ALTERING PERSON SHALL COMPLY WITH THE REQUIREMENTS OF NEW YORK EDUCATION LAW, SECTION 7209.2.

MALCOLM PIRNIE

STATE OF NEW YORK — ROBERT K. MARTENS — NO. 047979 — LICENSED PROFESSIONAL ENGINEER

REVISIONS

NO.	BY	DATE	REMARKS

DES
DWN
CKD

CATTARAUGUS COUNTY
DEPARTMENT OF PUBLIC WORKS

FARWELL LANDFILL CAPPING PLAN

FARWELL LANDFILL

EXISTING SITE TOPOGRAPHY

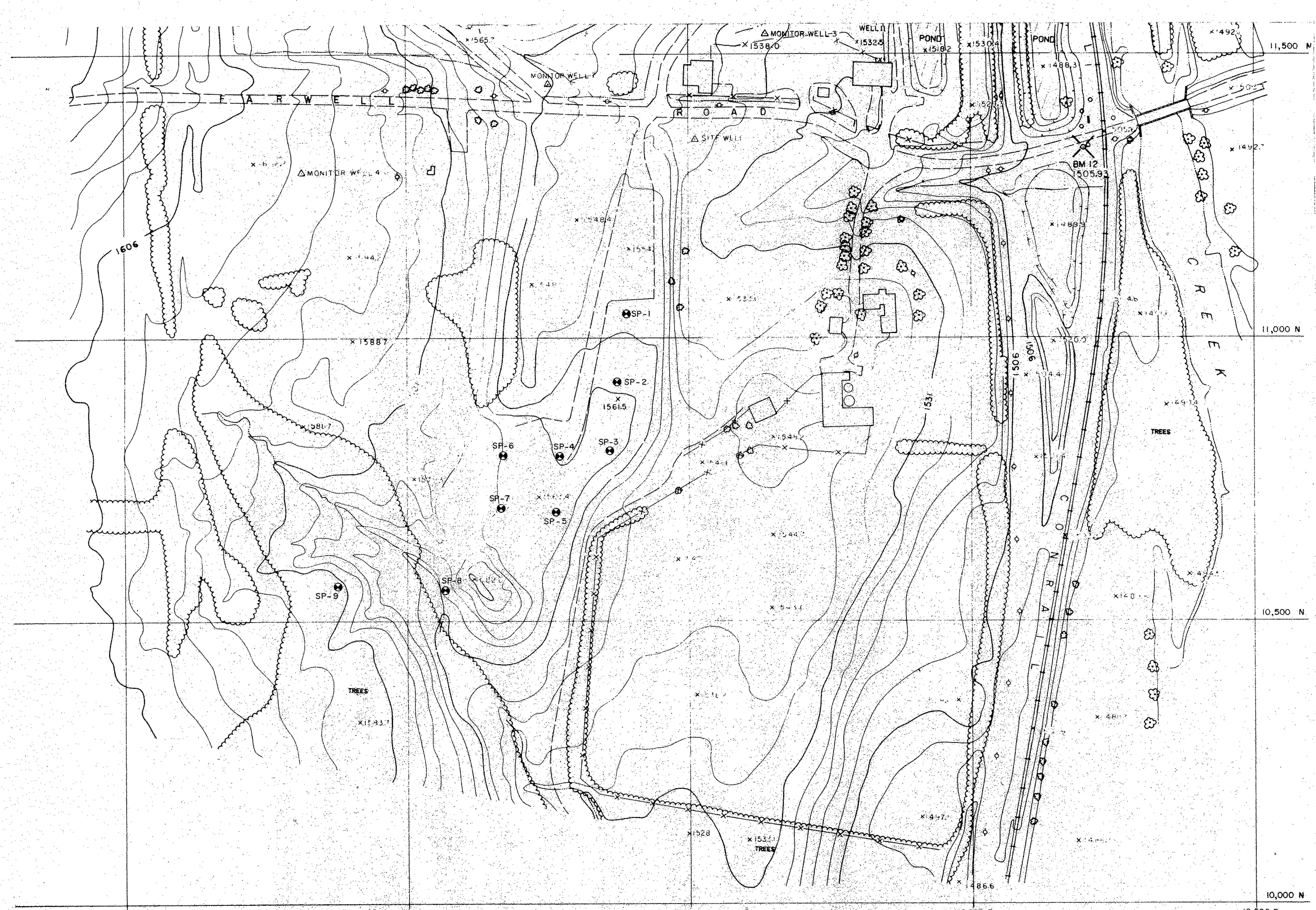
SCALE: 1" = 100'

MALCOLM PIRNIE, INC.

DATE SEPTEMBER, 1987

SHEET 1 OF 8

DWG NO.



N

LEGEND

- ⊗ TEST PIT
- SP STOCKPILE AREA

WARNING - IT IS A VIOLATION OF NEW YORK EDUCATION LAW, SECTION 7209.2, FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER OR LAND SURVEYOR, TO ALTER THIS DOCUMENT IN ANY WAY. IF ALTERED, THE ALTERING PERSON SHALL COMPLY WITH THE REQUIREMENTS OF NEW YORK EDUCATION LAW, SECTION 7209.2.

MALCOLM PIRNIE

STATE OF NEW YORK
LICENSED PROFESSIONAL ENGINEER

REVISIONS

NO.	BY	DATE	REMARKS

DES ....
DWN ....
CKD ....

CATTARAUGUS COUNTY
DEPARTMENT OF PUBLIC WORKS
FARWELL LANDFILL
CAPPING PLAN

FARWELL LANDFILL
EXISTING SITE TOPOGRAPHY
SCALE: 1" = 100'

MALCOLM PIRNIE, INC.
DATE SEPTEMBER 1987
SHEET 2 OF 8
DWG NO. ....

35840

LEGEND:

- LIMIT OF LANDFILL
- PROPERTY LINE
- EXISTING WATER COURSE
- GAS VENT
- DIRECTION OF DRAINAGE
- PROPOSED CONTOUR

CONTOUR INTERVAL = 5 FEET

NOTES:

1. FINAL COVER SHALL BE PLACED OVER EXISTING ROAD BASE.
2. PROPOSED ELEVATIONS SHOWN ARE TO TOP OF FINAL COVER.
3. FINAL COVER THICKNESS IS 2'-0".
4. CRUSHED STONE ACCESS DRIVE SHALL BE PLACED IN LIEU OF TOPSOIL WHERE SHOWN.
5. PROPOSED GRADES SHALL MATCH EXISTING GRADES AT LANDFILL BOUNDARY.
6. THE FINAL ELEVATIONS SHOWN ARE APPROXIMATE.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING THE SUBGRADE ELEVATION, EXCEPT WHERE OTHERWISE SHOWN OR ORDERED BY THE ENGINEER.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PLACING GENERAL FILL FROM THE STOCKPILE AREA WHERE NECESSARY TO ACHIEVE A MAXIMUM 1:3 SLOPE AND FOR PLACING THE FINAL COVER.
9. THE CONTRACTOR SHALL STRIP EXISTING VEGETATION FROM THE SUBGRADE, AS REQUIRED, PRIOR TO PLACING THE FINAL CAP. AREAS REQUIRING GENERAL FILL TO ACHIEVE A SUBGRADE SLOPE OF 1:3 SHALL NOT REQUIRE THE VEGETATION TO BE STRIPPED.
10. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING A UNIFORM SLOPE ON THE SUBGRADE PRIOR TO PLACING THE FINAL CAP. ANY ADDITIONAL EXCAVATION AND BACKFILL ORDERED BY THE ENGINEER SHALL BE PAID FOR IN ACCORDANCE WITH THE UNIT PRICES BID UNDER THIS CONTRACT.

MALCOLM PIRNIE

STATE OF NEW YORK · ROBERT R. MARTENS · No. 047993 · LICENSED PROFESSIONAL ENGINEER

REVISIONS

NO.	BY	DATE	REMARKS

DES.
DWN.
CKD.

CATTARAUGUS COUNTY
DEPARTMENT OF PUBLIC WORKS

FARWELL LANDFILL
CAPPING PLAN

FARWELL LANDFILL

PROPOSED GRADING PLAN

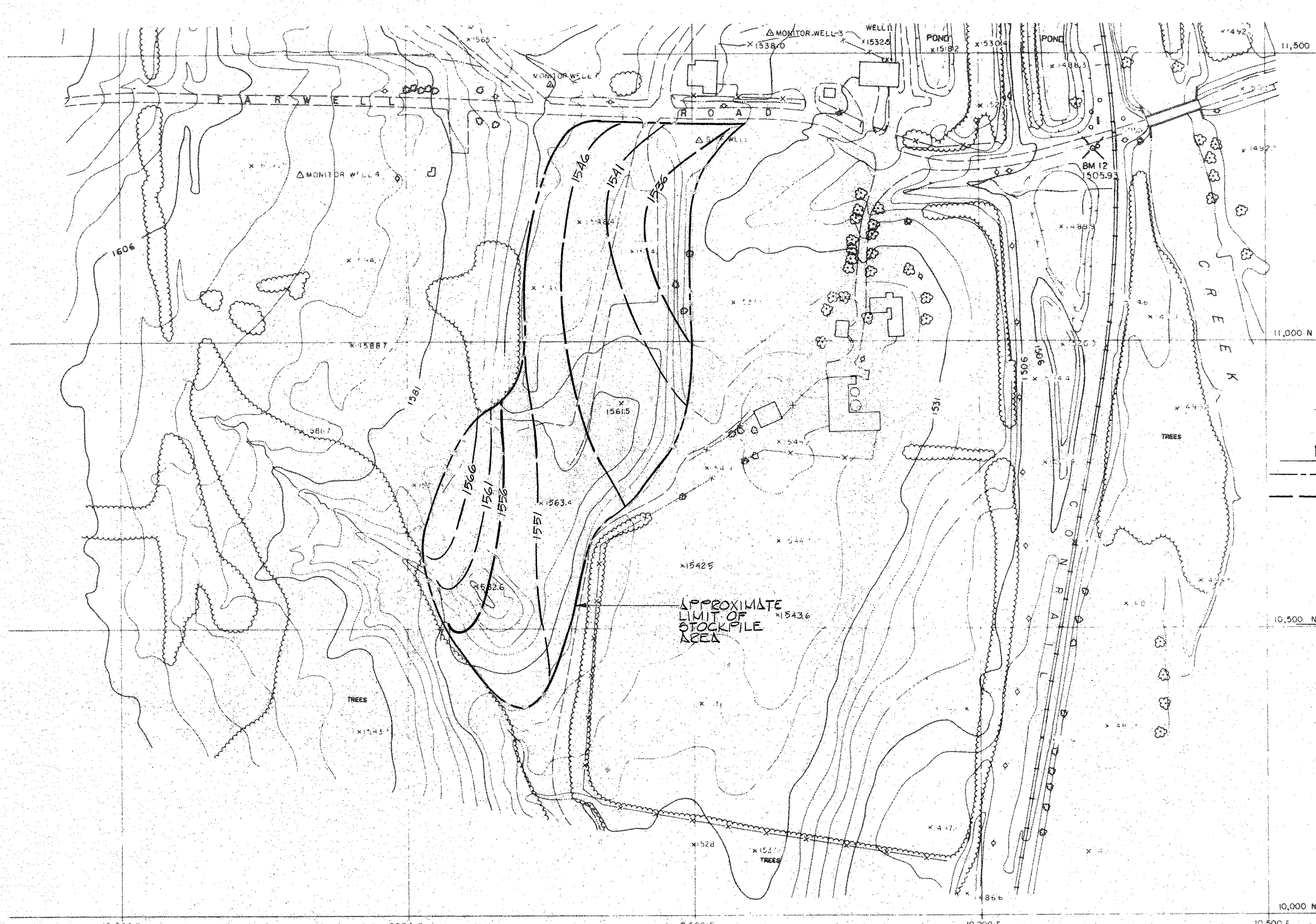
SCALE: 1" = 100'

MALCOLM PIRNIE, INC.

DATE SEPTEMBER 1987

SHEET 3 OF 8

DWG NO.



LEGEND:

- LIMIT OF STOCKPILE AREA
- PROPOSED CONTOUR

NOTES:

1. PROPOSED GRADES SHALL MATCH EXISTING GRADES AT STOCKPILE AREA BOUNDARY
2. STOCKPILE AREA SHALL BE SEEDED AFTER SOIL REMOVAL IS COMPLETED IN ACCORDANCE WITH CONTRACT SPECIFICATIONS.
3. FINAL ELEVATIONS SHOWN ARE APPROXIMATE

MALCOLM PIRNIE

STATE OF NEW YORK — ROBERT E. MASTERS — No. 047973 — LICENSED PROFESSIONAL ENGINEER

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DES ....
DWN ....
CKD ....

CATTARAUGUS COUNTY
DEPARTMENT OF PUBLIC WORKS

FARWELL LANDFILL CAPPING PLAN

FARWELL LANDFILL

PROPOSED GRADING PLAN

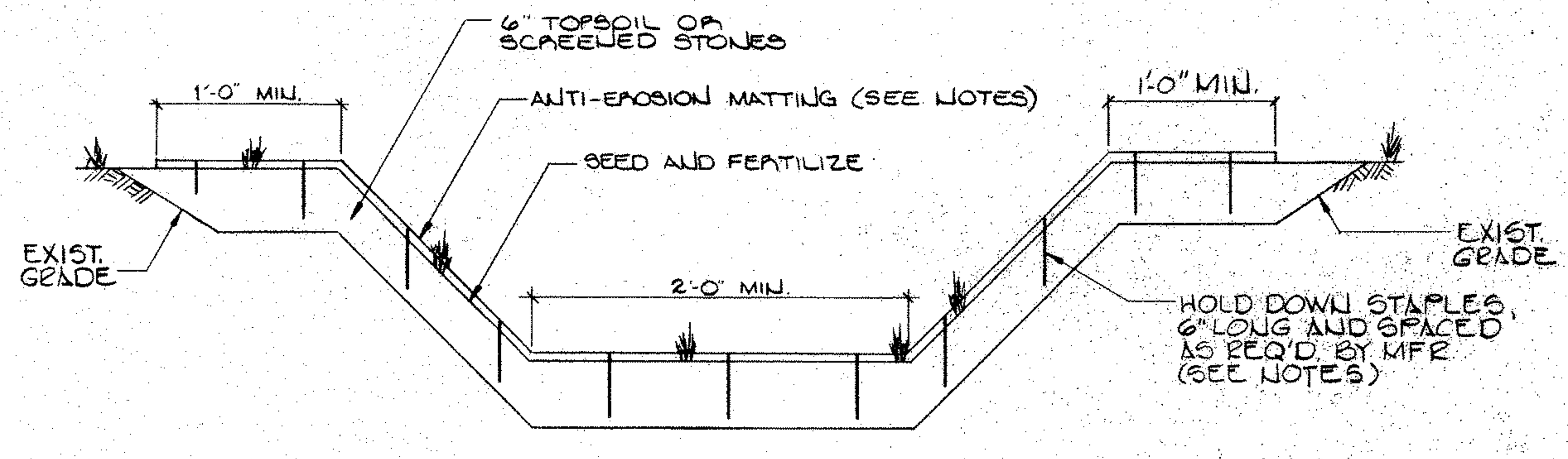
SCALE: 1" = 100'

MALCOLM PIRNIE, INC.

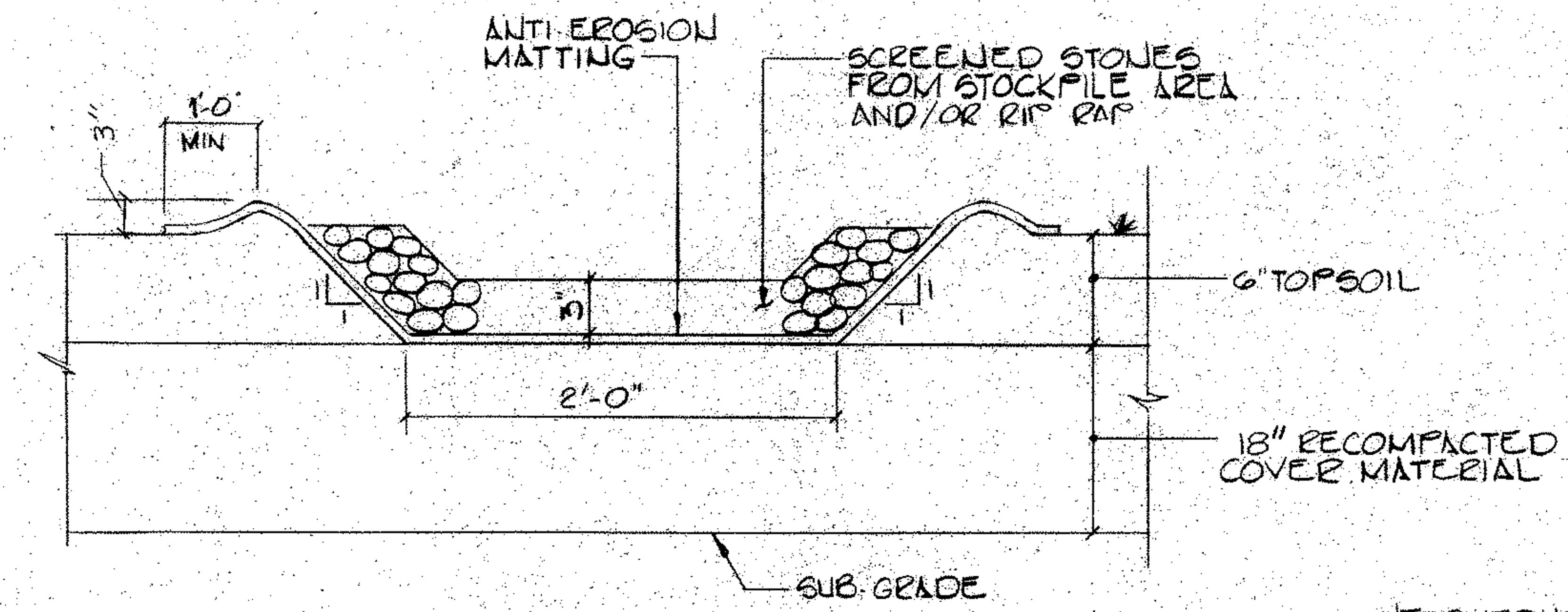
DATE SEPTEMBER 1987

SHEET 4 OF 8

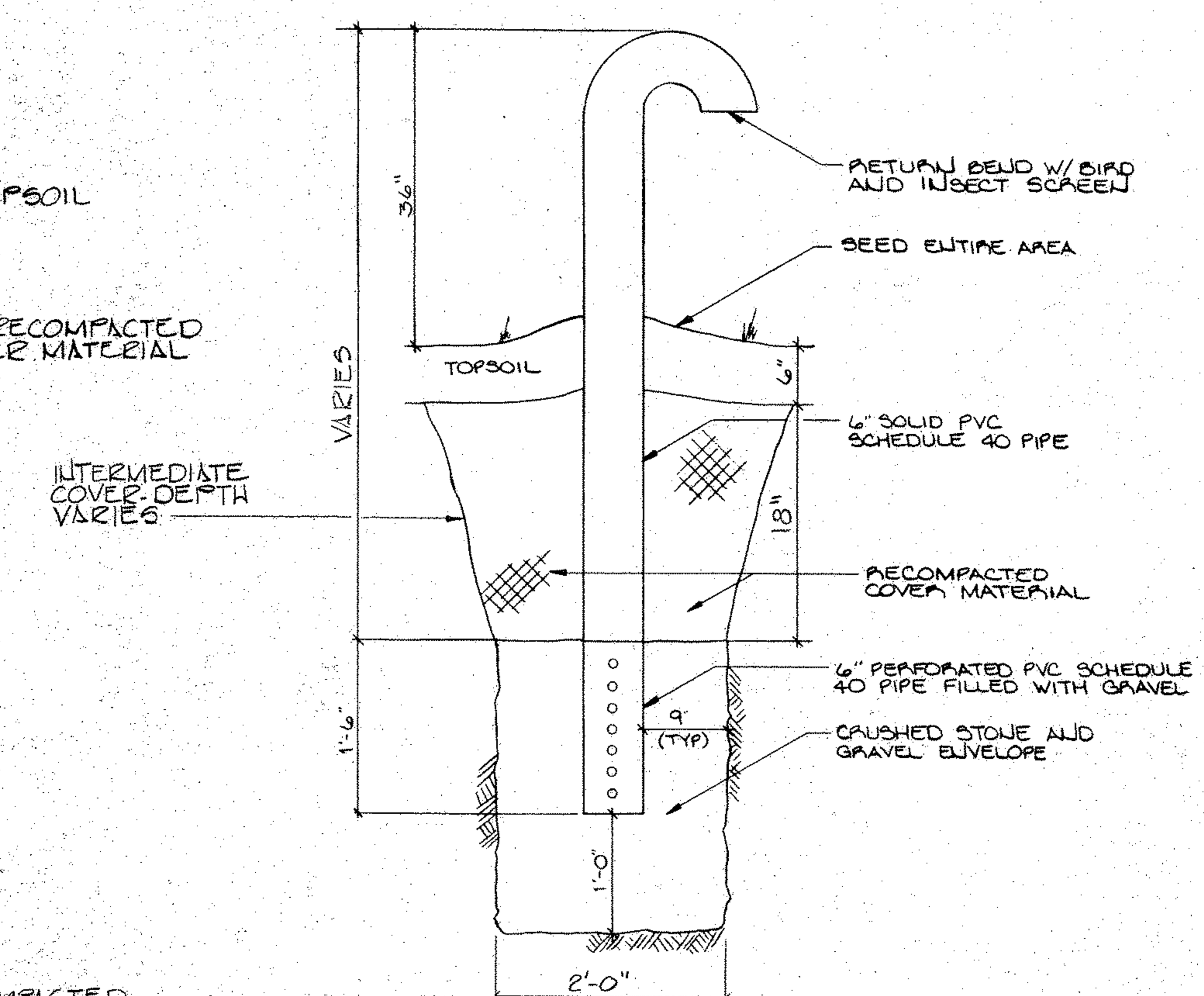
DWG NO.



TYPICAL PERIMETER DRAINAGE DITCH DETAIL 1/3 5



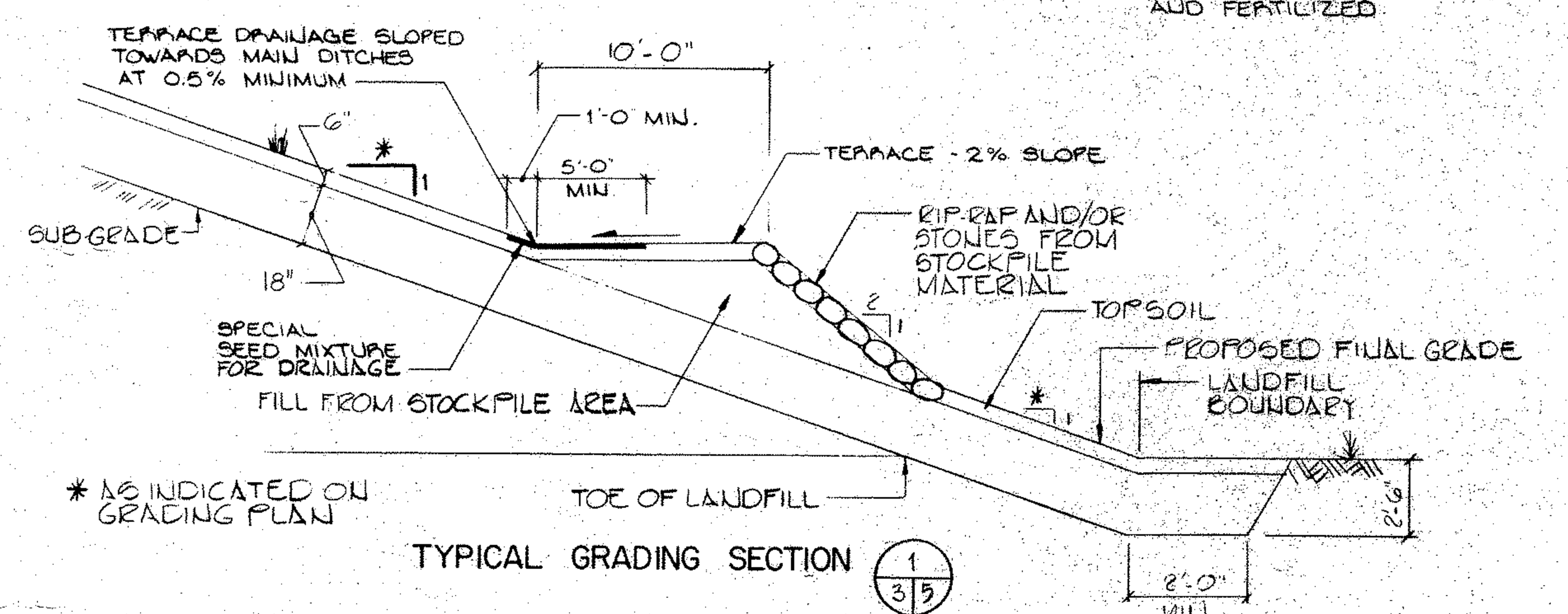
SIDE SLOPE DRAINAGE DITCH DETAIL 2/3 5



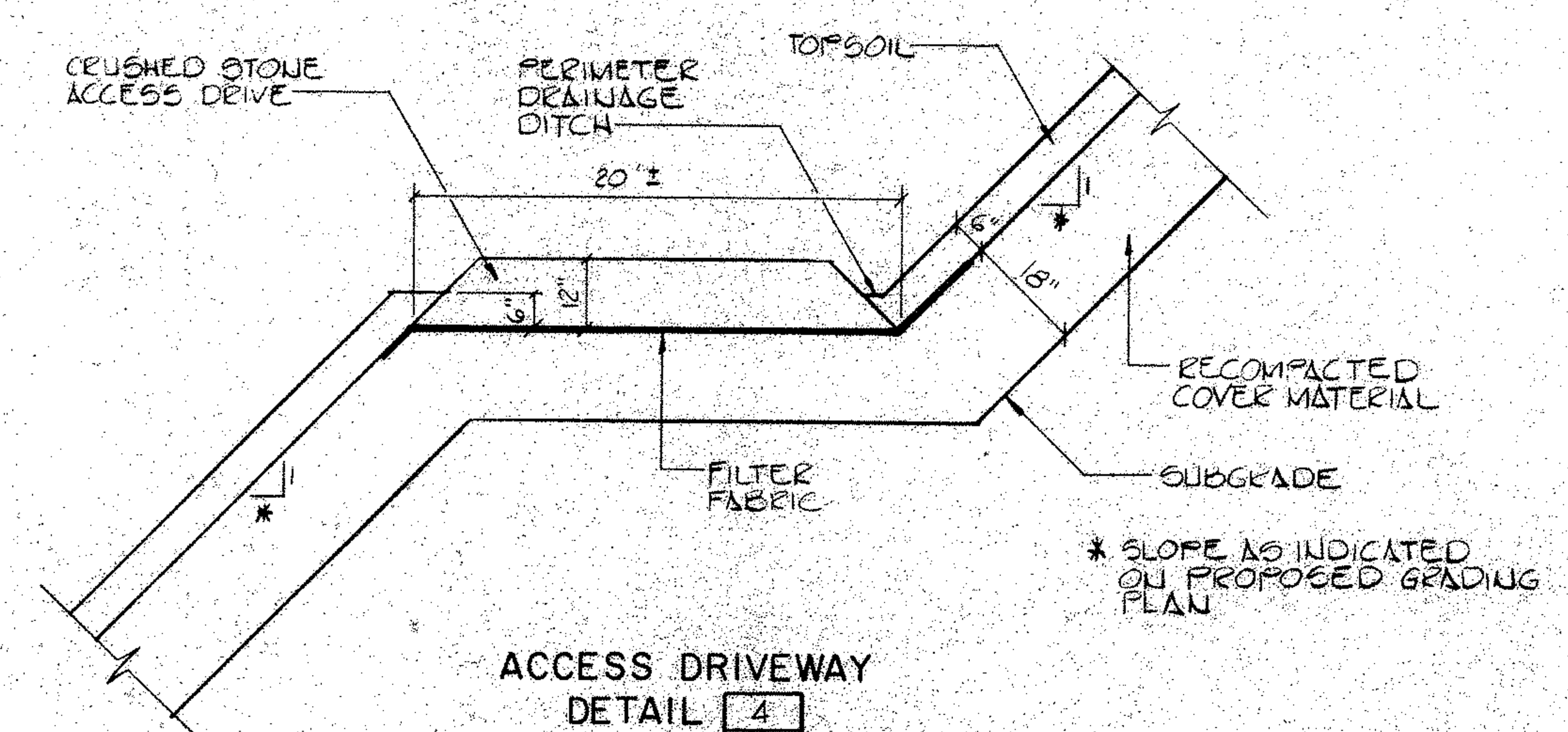
TYPICAL FINAL CAP AND GAS VENT DETAIL 3/3 5

NOTES FOR DRAINAGE DITCHES

1. DITCHES W/SLOPES GREATER THAN 5% WILL BE LINED W/ SCREENED STONES FROM THE STOCKPILE AREA TO THE FULLEST EXTENT POSSIBLE. IF INSUFFICIENT STONES ARE AVAILABLE, ANTI-EROSION MATTING W/ STAPLES SHALL BE USED TO LINE THE DITCHES.
2. DITCHES W/LESS THAN A 5% SLOPE WILL BE LINED WITH STONES FROM THE STOCKPILE AREA TO THE FULLEST EXTENT POSSIBLE.
3. DITCHES WITH LINING WILL NOT BE SEEDED AND FERTILIZED.

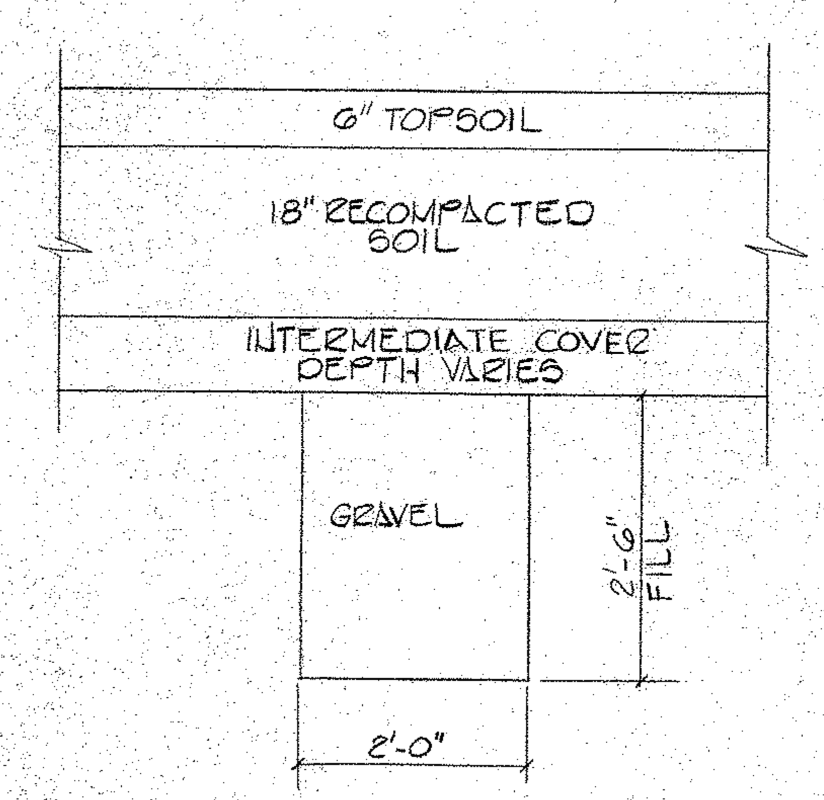


TYPICAL GRADING SECTION 1/3 5

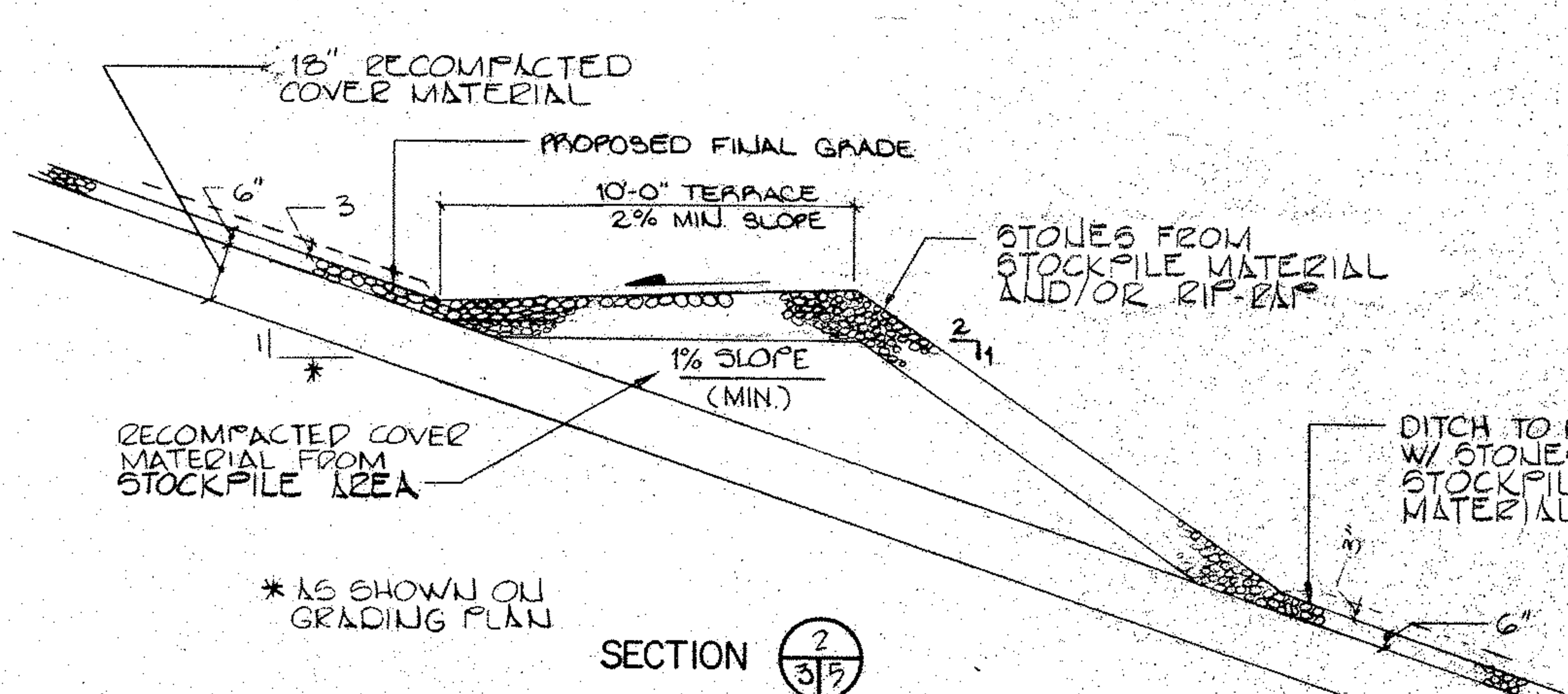


ACCESS DRIVEWAY DETAIL 4/3 5

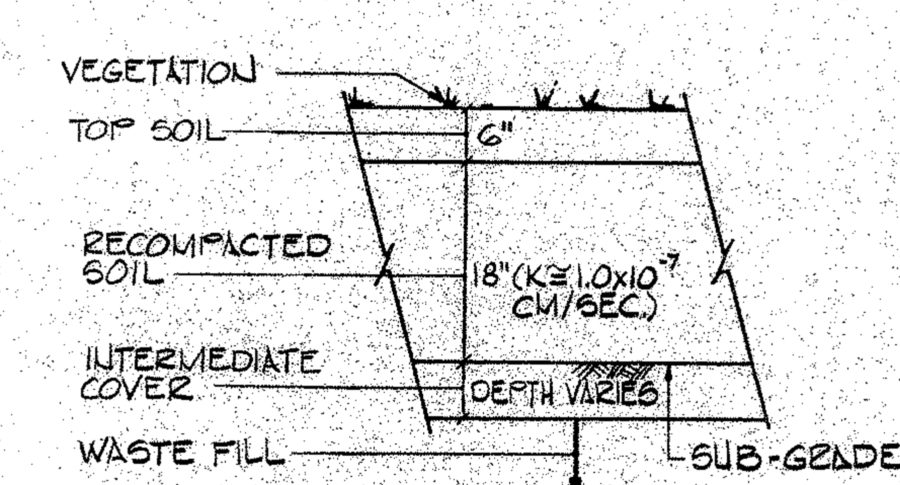
N.T.S.



TYPICAL GRAVEL VENTILATION TRENCH DETAIL 5/3 5



SECTION 2/3 5



TYPICAL CAP DETAIL

WARNING - IT IS A VIOLATION OF NEW YORK EDUCATION LAW, SECTION 7209 2, FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER OR LAND SURVEYOR, TO ALTER THIS DOCUMENT IN ANY WAY. IF ALTERED, THE ALTERING PERSON SHALL COMPLY WITH THE REQUIREMENTS OF NEW YORK EDUCATION LAW, SECTION 7209 2.

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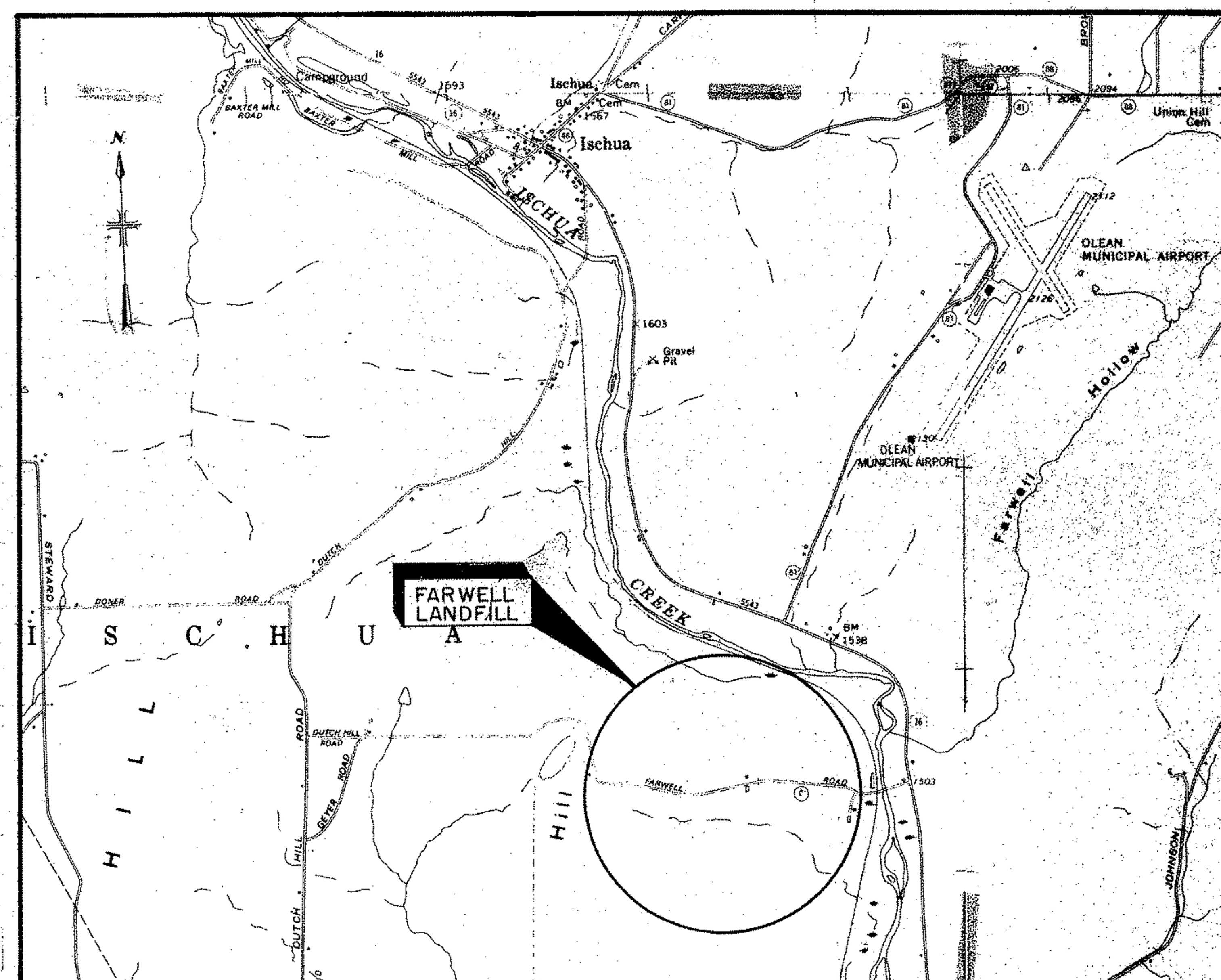
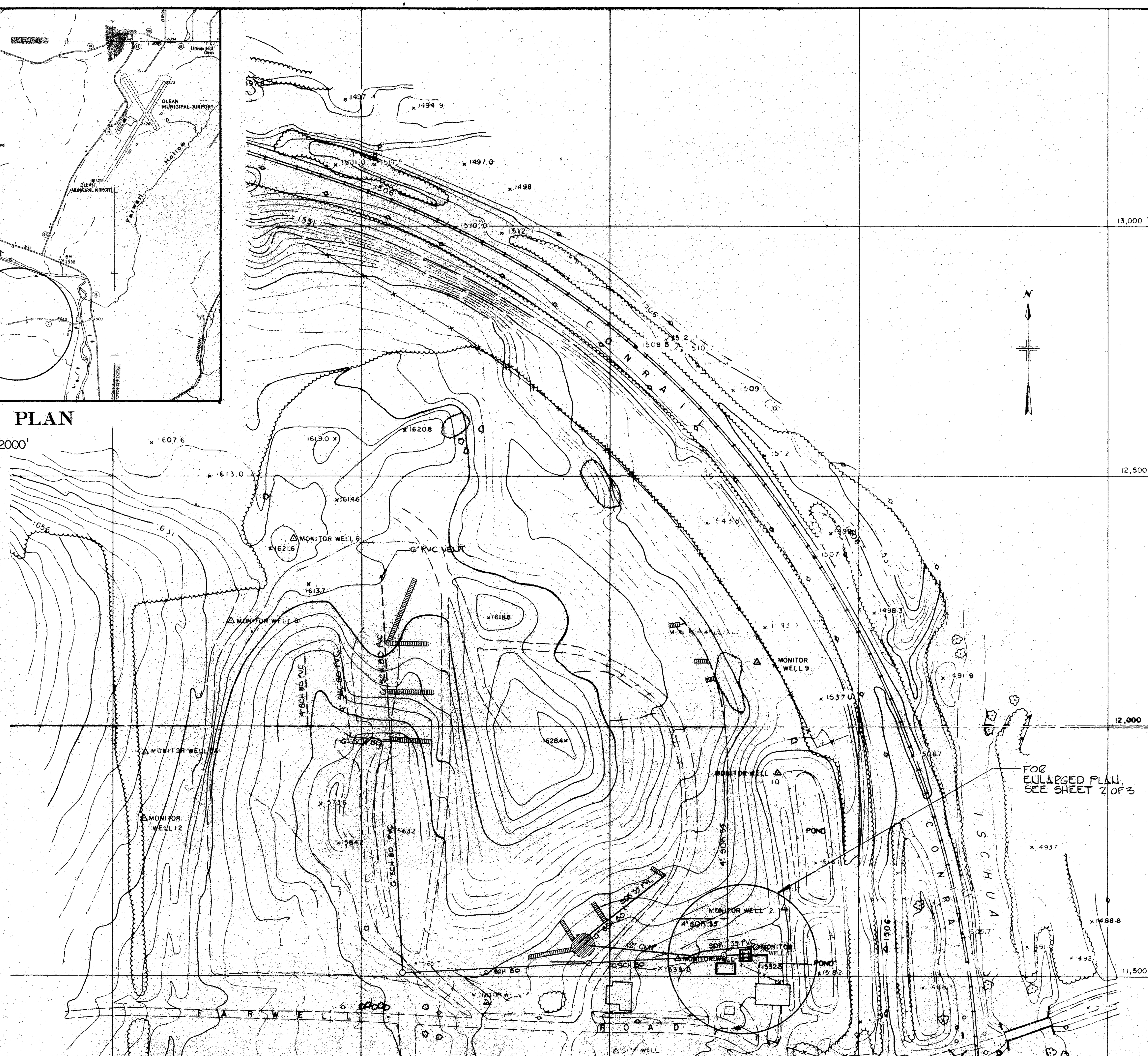
35840



LOCATION PLAN

SCALE: 1" = 2000'



LEGEND:

- PERFORATED PIPE
- SOLID PIPE
- MANHOLE
- GRAVEL LEACHATE COLLECTION TRENCH
- ABANDONED

WARNING - IT IS A VIOLATION OF NEW YORK EDUCATION LAW, SECTION 7209 2, FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER OR LAND SURVEYOR, TO ALTER THIS DOCUMENT IN ANY WAY. IF ALTERED, THE ALTERING PERSON SHALL COMPLY WITH THE REQUIREMENTS OF NEW YORK EDUCATION LAW, SECTION 7209 2

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STATE OF NEW YORK · MALCOLM PIRNIE, INC. · LICENSED PROFESSIONAL ENGINEER

REVISIONS

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CKD. PHO

CATTARAUGUS COUNTY
DEPARTMENT OF PUBLIC WORKS

FARWELL LANDFILL
CAPPING PLAN

FARWELL LANDFILL

LEACHATE COLLECTION SYSTEM

SCALE: 1" = 100'

MALCOLM PIRNIE, INC.

DATE SEPTEMBER 1987

SHEET 6 OF 8

DWG NO.

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MALCOLM PIRNIE

STATE OF NEW YORK — MALCOLM PIRNIE — LICENSED PROFESSIONAL ENGINEER

REVISIONS			
NO	BY	DATE	REMARKS
1	RAG	7-8-87	ADDED ADDENDUM 1

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DWN JEB
CKD PHW

CATTARAUGUS COUNTY
DEPARTMENT OF PUBLIC WORKS
FARWELL LANDFILL CAPPING PLAN

FARWELL LANDFILL
MISCELLANEOUS SECTIONS AND DETAILS
SCALE AS INDICATED

MALCOLM PIRNIE, INC.
DATE SEPTEMBER 1987
SHEET 7 OF 8
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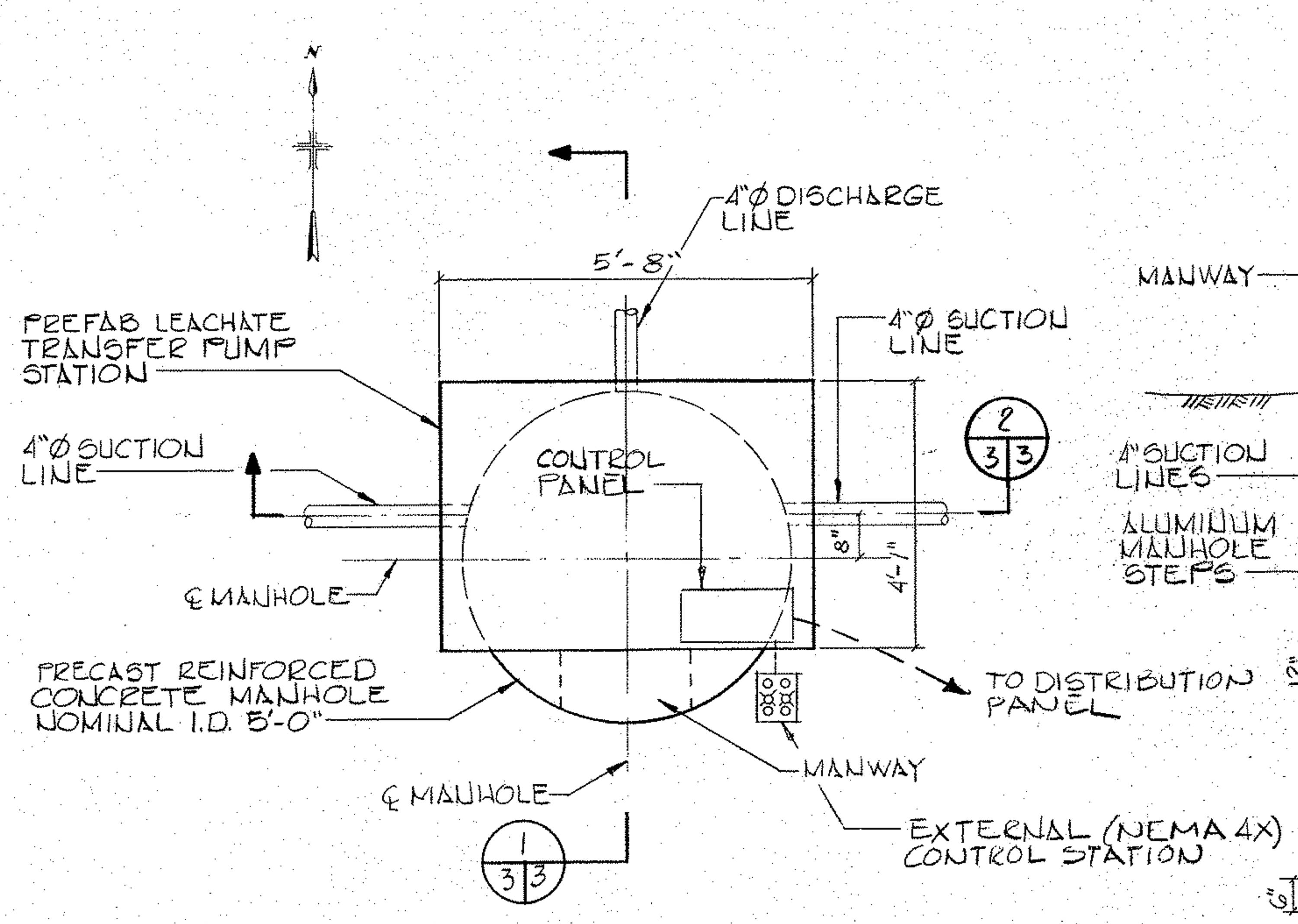
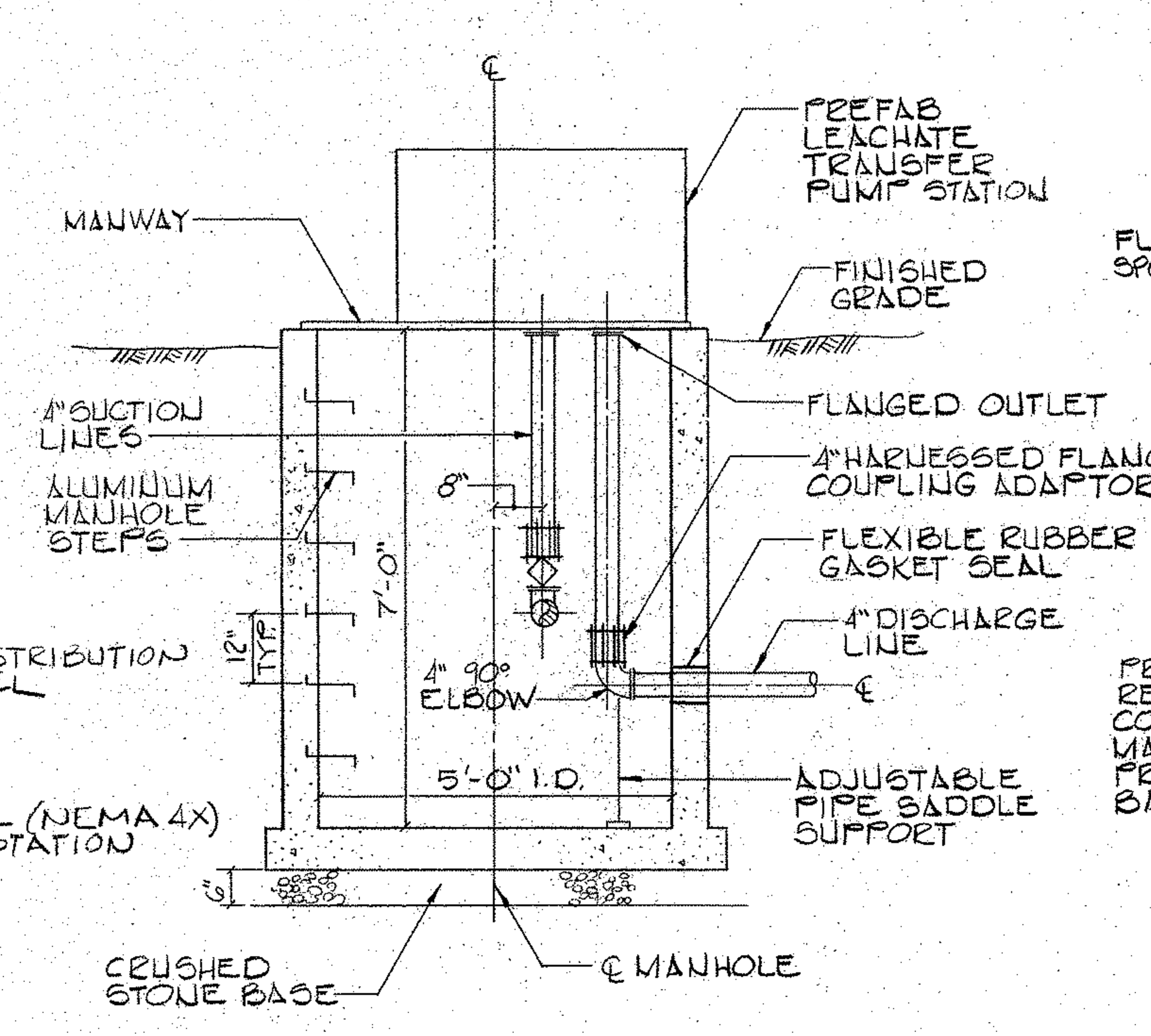
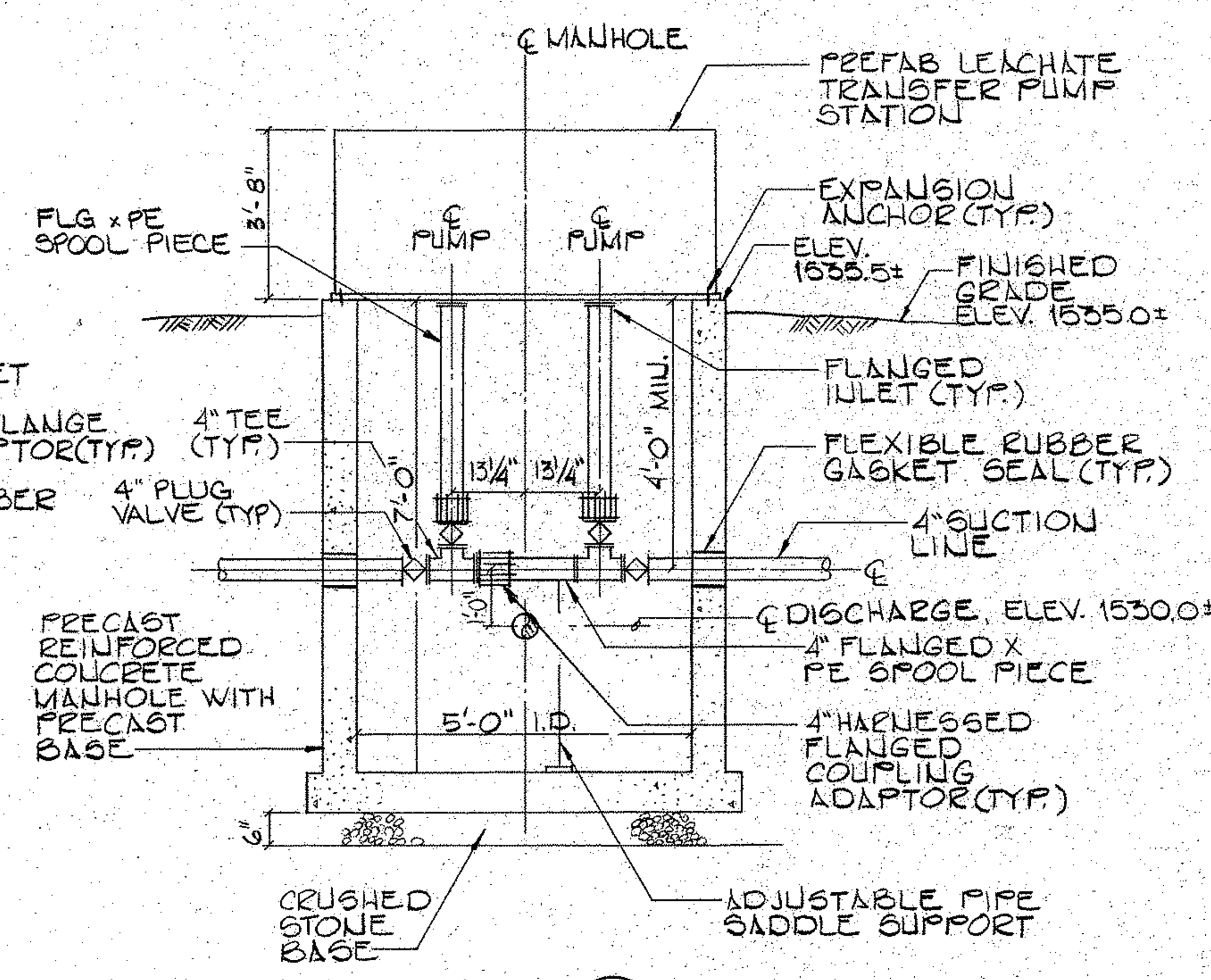


PLAN

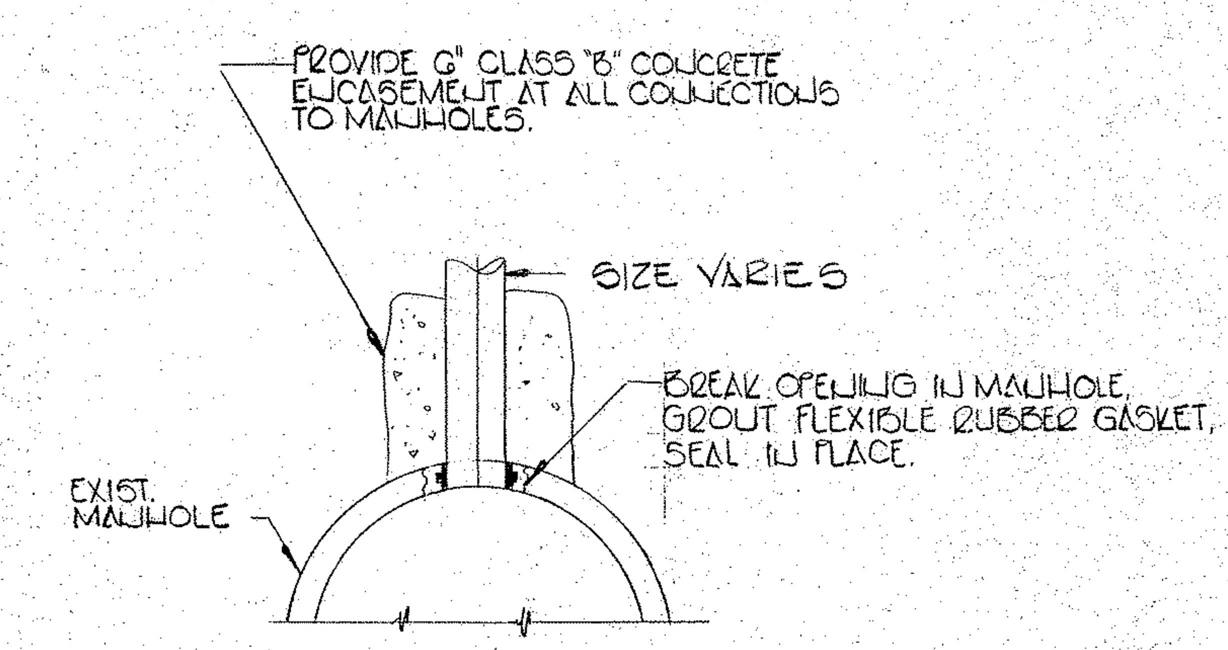


SECTION 1/3|3

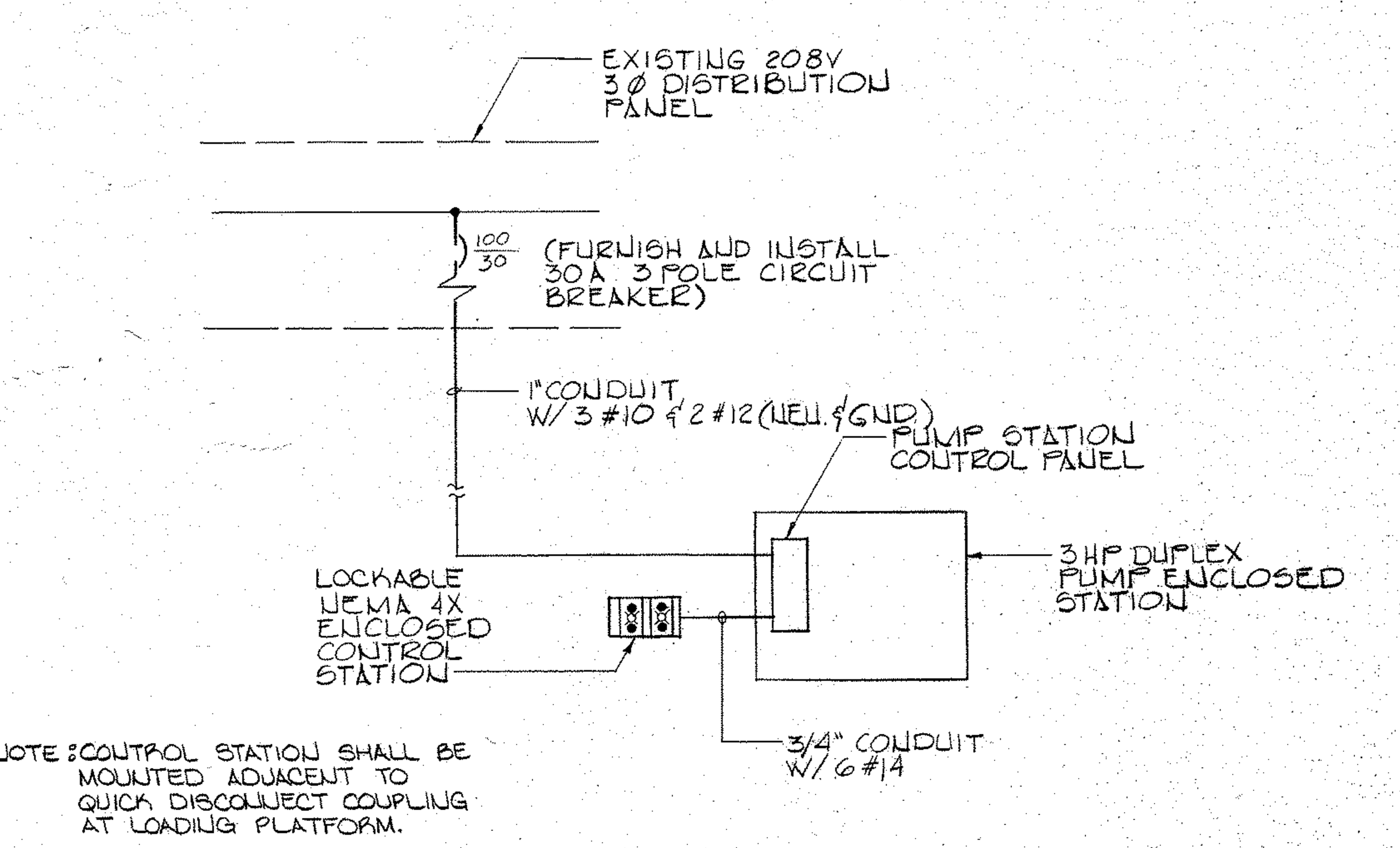


SECTION 2/3|3

LEACHATE TRANSFER PUMP STATION DETAIL 5/2|3

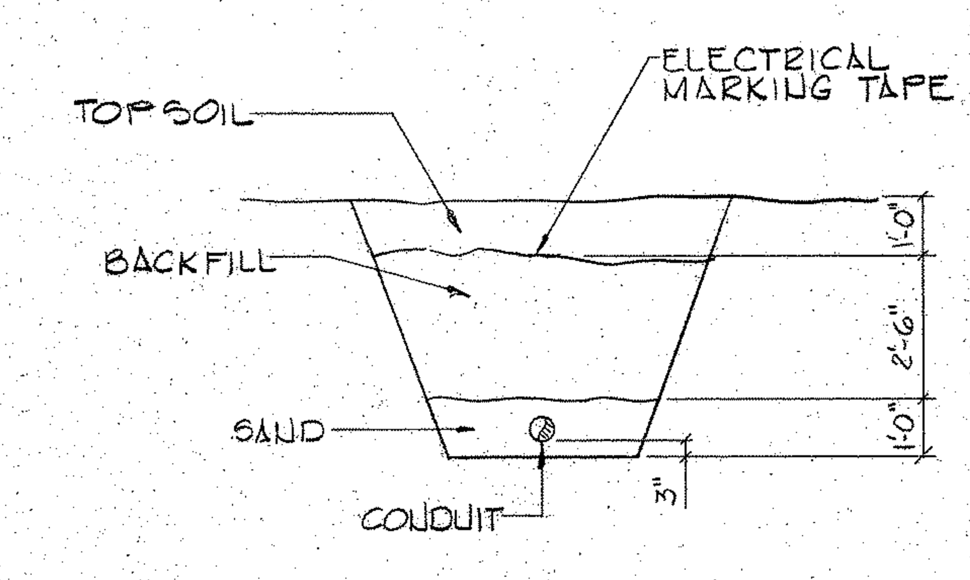


CONNECTION TO EXISTING MANHOLE DETAIL 7/2|3

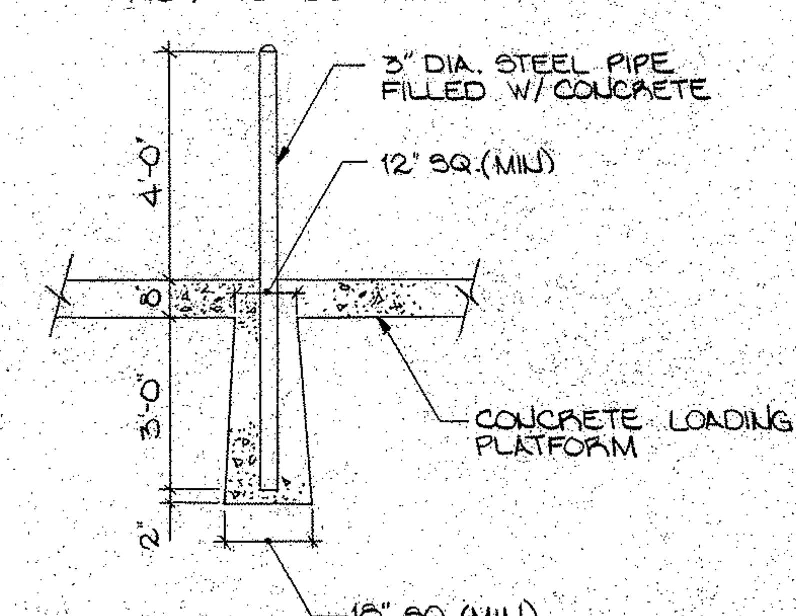


NOTE: CONTROL STATION SHALL BE MOUNTED ADJACENT TO QUICK DISCONNECT COUPLING AT LOADING PLATFORM.

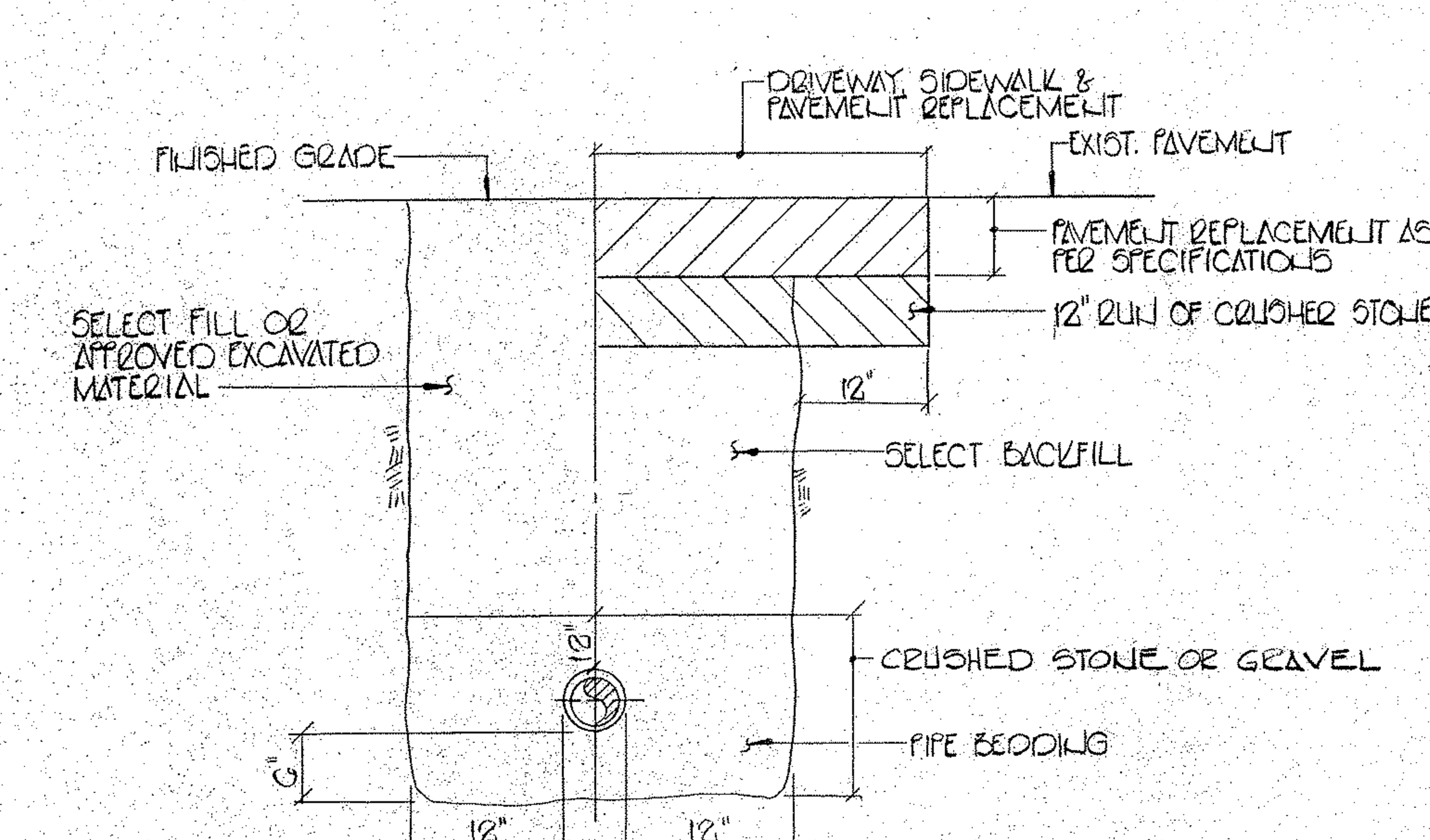
ONE LINE
NOT TO SCALE



UNDERGROUND CONDUIT DETAIL
NOT TO SCALE



PIPE BOLLARD DETAIL 8/2|3
NOT TO SCALE



TYPICAL TRENCH AND PAVEMENT REPLACEMENT DETAIL
NOT TO SCALE

MALCOLM PIRNIE

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CATTARAUGUS COUNTY
DEPARTMENT OF PUBLIC WORKS
FARWELL LANDFILL
CAPPING PLAN

FARWELL LANDFILL
MISCELLANEOUS SECTIONS AND DETAILS
SCALE AS INDICATED

MALCOLM PIRNIE, INC.
DATE SEPTEMBER 1987
SHEET 8 OF 8
DWG NO.

35840

APPENDIX J - SITE WIDE INSPECTION FORM

GPI

Cattaraugus County Department of Public Works
Farwell Landfill
Site Wide Inspection Form

DATE OF INSPECTION	
INSPECTOR (PRINT)	
INSPECTOR (SIGNATURE)	

A. Landfill Cover	
Visible Refuse	
Signs of vector activity	
Signs of erosion	
Signs of stressed vegetation	
Leachate seeps	
Detectable odor	
Areas of settling	

B. Waterways and Ditches	
Signs of erosion	
Blockage of drainage pathway	
Culverts clear of obstructions	
Ponded water areas	

C. Monitoring Wells (well casing, cap, and locks in place and in good condition)	

D. Gas Venting System (vent screens in place, no damage to vent risers and return bends)	

E. Access Control	
Gates and locks operable	
Access road condition	
Access is restricted	
Condition of vegetative barrier "wall"	

Action Required:

____

____

____

____

____

____

Follow Up--Corrective Action Taken:

____

____

____

____

____

____

APPENDIX K - FIELD SAMPLING LOG

GPI

Telephone: ___________
Fax: ___________
Email: ___________________

LANDFILL MONITORING FIELD LOG SHEET

Facility: Farwell Landfill

Sample Point ID:

Field Personnel: ___________________

Sample Matrix: ___________________

Leachate Tank Inspection: Date: ___________________ Time: ___________

Condition of Casing/Riser:

( ) Unlocked ( ) Good ( ) Loose ( ) Damaged ( ) Flush Mount

Condition of Seal:

( ) Good ( ) Cracked ( ) None ( ) Buried

Comments: ____

____

Leachate Sampling: Date: ___________________ Time: ___________

Sampling Method: ___________ **Dedicated: ( )Y ( )N** Weather/Temp: ______

Field Data

Temp Celsius	pH Std Units	Conductivity mS	Turbidity NTU	ORP	D.O. mg/L	Observations/Characteristics

Parameters Sampled For: ____

____

Comments: ____

____

____

PROJECT MANAGER SIGNATURE

____

APPENDIX L - LEACHATE HANDLING PROCEDURES

CATTARAUGUS COUNTY

DEPARTMENT OF PUBLIC WORKS

Development – Progress – Workmanship

Kathleen M. Ellis, Commissioner
Michael J. Prinino, Deputy Commissioner
William A. Fox, PE, Director of Engineering

8810 Route 242, Jack Ellis Drive
Little Valley, New York 14755
Phone (716) 938 9121 | Fax (716) 938 2753

February 24, 2022

FARWELL LEACHATE TANK TRAILER

LOADING PROCEDURE

The following procedures are to be followed for loading leachate into tank trailer:

- **Pull tank trailer onto loading pad until wheels are about one foot onto pad.**
- **Release air from airbags to level tanker**
- **Hook one end of leachate loading hose to fill valve on tank trailer; and the other end to stand pipe on loading pad.**
- **Open both the fill valve and vent on tank trailer.**
- **Turn pump #1 and pump #2 switches at standpipe to "ON" position, and listen for pumps to prime from doghouse. Lights over switches will come on when pumps are primed.**
- **Fill tanker until water is heavily flowing from vent to get a complete load.**
- **If pumps fail to prime, turn pump switches to "OFF" position and close both vents on tank trailer.**
- **Open ball valve at bottom of standpipe to relieve pressure from loading hose.**
- **Replace both covers on vents on tank trailer.**
- **Climb on top of tank trailer and ensure all six latches are closed on manhole cover.**
- **Measure leachate collection tanks and write remaining volume in leachate log.**
- **Phone Numbers:**

  Jim Drain, Hauling Supervisor: 716-801-2534
  Mark Shaw, Waste Management Coordinator: 716-904-0419
  Joe Baker, Maintenance Mechanic: 716-378-1096
  Austin Kimes, Director of Weights & Measures: 716-378-5676

CATTARAUGUS COUNTY

DEPARTMENT OF PUBLIC WORKS

Development – Progress – Workmanship

Kathleen M. Ellis, Commissioner
Michael J. Prinino, Deputy Commissioner
William Fox, PE, Director of Engineering

8810 Route 242, Jack Ellis Drive
Little Valley, New York 14755
Phone (716) 938 9121 | Fax (716) 938 2752

LEACHATE HAULING PROTOCOL FARWELL

<u>Leachate Hauling Thresholds</u>

1. High Alarm: 88 true inches / 15,138 gallons

2. High/High Alarm: 98 true inches / 16,938 gallons

<u>Callout List</u>

1. In House/In Title – Hauling Supervisor - *Salamanca*
2. In House/In Title – CDLA Hauler
    a. Mike Perrington – *Little Valley*
3. In House/In Title – CDL A Hauler
    a. Bob McKraken - *Salamanca*
    b. Eric Moshier - *Salamanca*
4. In House/Out of title – Refuse Maintenance Mechanic, SR TSO
    a. Joe Baker – Maint Mech – *Little Valley*
    b. Chad Brewer – SR TSO – *Salamanca*
    c. Ken Quinn – SR TSO – Portville
5. Volunteer Hauling List[1]
    a. Class A License Holder
    b. Tanker Endorsement
    c. Tanker Hauling Experience
    d. DPW Leachate Hauling Trained

<u>WWTP Contact Information</u>

Olean WWTP
716-376-5694
Contact: Jeremy Meerdink
Limit: 22,500 gallons/24hrs
Emergency Dispatch: 716-376-5677

Jamestown WWTP
716-450-2334
Contact: Keith Vanstrom
Limit: 30,000 gallons/24hrs

Salamanca WWTP
716-945-1691
Contact: Jeffrey Shurilla
Limit: 15,000 gallons/24hrs

<u>Procedure – High Alarm</u>

1. Upon receipt of a high alarm, the Hauling Supervisor will utilize the Callout List and assign leachate hauling duty to the appropriate driver. A sufficient amount of leachate must be removed as to clear the high alarm.
2. The assigned hauler will utilize the WWTP Listing to identify the appropriate facility for leachate disposal.

<u>Procedure – High /High Alarm</u>

1. High High Alarms are indicative of not removing leachate promptly after a high alarm and are to be avoided.
2. Upon receipt of a high/high alarm the Hauling Supervisor will utilize the Callout List and assign leachate hauling duty to the appropriate driver. The Hauling Supervisor shall activate the callout list and affect an immediate response to the pump station to load a tanker. Leachate volumes must decrease within 4 hours of receipt of a high/high alarms (leachate volume measured using the RAFA).[2]

<u>Monitoring</u>

The Hauling Supervisor will monitor leachate levels so that scheduling can be done for moderate tank levels. If afternoon tank levels suggest an alarm is inevitable, the Hauling Supervisor will force overtime to reduce tank levels to avoid an alarm.

<u>Notification</u>

The Waste Management Coordinator is to be notified of all call outs to Refuse personnel. Any callout to out of title personnel shall not cause a Transfer Station to be left uncovered or understaffed.

---

[1] See Attached listing

[2] Utilizing a 400 gallons / hour fill rate

CATTARAUGUS COUNTY

DEPARTMENT OF PUBLIC WORKS

Development – Progress – Workmanship

Kathleen M. Ellis, Commissioner
Michael J. Prinino, Deputy Commissioner
William Fox, PE, Director of Engineering

8810 Route 242, Jack Ellis Drive
Little Valley, New York 14755
Phone (716) 938 9121 | Fax (716) 938 2752

Leachate Hauling Drivers

Name	Position	Seniority Date	Primary Location	Phone Number
Crowley, Jeremy	Class A	11/19/2002	Allegany Hwy Barn	716-307-6629
Lyons, Brock	Class B	3/19/2012	Franklinville Hwy Barn	716-307-5102
Morales-Healy, Mykel	Class A	7/18/2016	Franklinville Hwy Barn	716-307-4020
Poitras, Timothy	Class A	5/27/2008	Highway Maintenance	716-499-8225
Shuster, Edward	Class A	1/20/2009	West Valley Hwy Barn	716-244-2367
Smith, Benjamin	Class B	12/27/2010	West Valley Hwy Barn	716-472-8267

CATTARAUGUS COUNTY

DEPARTMENT OF PUBLIC WORKS

Development – Progress – Workmanship

Kathleen M. Ellis, Commissioner
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8810 Route 242, Jack Ellis Drive
Little Valley, New York 14755
Phone (716) 938 9121 | Fax (716) 938 2753

February 11, 2021

FARWELL LEACHATE

POWER FAILURE PROCEDURES

If Farwell leachate pumps fail to engage during startup attempt, the following procedures shall be followed:

- **Push Reset button on control panel in doghouse.**
- **If pumps continue to fail to engage, turn pumps to "OFF" position at loading pad.**
- **Check power in transfer station building to ensure power is on at facility.**
- **If no power to building, go to main breaker on panel outside building and confirm breaker is in "ON" position.**
- **If no power to building and main breaker on panel is in "ON" position, call Director of Weights and Measures at 716-378-5676. Director of Weights and Measures will check with National Grid to see if there is a wide spread power outage and if so, anticipated time of restoration. If Director of Weights and Measures is not available, call Little Valley DPW front desk at 716-938-9121 and request they inquire about any power outages in the Ischua area, or call National Grid at 1-800-867-5222.**
- **If issue cannot be resolved before leaving site, turn all circuit breakers on the front of the leachate pump control panel to the "OFF" position and secure "DO NOT OPERATE" tag to the cover of the pump control box at the loading pad.**
- **"DO NOT OPERATE" tag may only be removed by Maintenance Mechanic or in the presence of Director of Weights & Measures, Waste Management Coordinator, or Hauling Supervisor.**
- **Prior to leaving the site the CDL-A Driver shall follow the "Farwell Leachate Hauling Requirements"**
- **In the event that leachate hauling is required before a power outage is resolved, a 2-inch waste transfer pump will be used to load the tank trailer directly from the leachate tanks. The pump will be borrowed from either the Franklinville Highway Barn or the Allegany Highway Barn. Contact the Operations Manager to request use of a pump. Tank levels will be measured at least once daily with the tank gauge stick until power outage is resolved**

If RAFA1 sends out a text notifying that it has lost connection to the RAFA controller, the following procedures will be followed:

- **Contact Hauling Supervisor and Director of Weights & Measures to ascertain last known tank volume. If necessary, check tank level manually with tank gauge stick.**

- **Check the controller at Farwell. If it still has power, unplug the controller from the outlet in the doghouse, wait ten seconds, then plug the controller back in. Wait 5 minutes then check the RAFA1 website. If the tank levels are visible on the website, the problem should be resolved. If the tank levels are still unavailable, contact RAFA Systems. Tank level will have to be measured daily with the tank gauge stick until the remote monitoring system is operational.**
- **If the controller does not have power, reset the breaker in the doghouse. If the controller does not turn on, check power in transfer station building to ensure power is on at facility.**
- **If no power to building, follow the Farwell Leachate Power Failure Procedures.**

- **<u>Phone Numbers:</u>**

  Austin Kimes, Director of Weights & Measures: 716-378-5676
  Mark Shaw, Waste Management Coordinator: 716-904-0419
  Jim Drain, Hauling Supervisor: 716-801-2534
  Joe Baker, Maintenance Mechanic: 716-378-1096
  Scott Andrews, Operations Manager: 716-392-2453

  NYS 24 Hour Spill Hotline: 1-800-457-7362
  NYS DEC: 716-851-7220 (Ben McPherson)
  National Grid Power Outage Information: 1-800-867-5222

  RAFA Systems: 716-258-9396

RAFA600
Water Treatment Controller

Instruction Manual

RAFA Systems, Inc.
5 Park Avenue, Ellicottville, NY 14731
(716) 258-9396 | info@rafasystems.com | www.rafasystems.com

Notice

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Statement of Limited Warranty

WALCHEM warrants equipment of its manufacture, and bearing its identification to be free from defects in workmanship and material for a period of 24 months for electronics and 12 months for mechanical parts and electrodes from date of delivery from the factory or authorized distributor under normal use and service and otherwise when such equipment is used in accordance with instructions furnished by WALCHEM and for the purposes disclosed in writing at the time of purchase, if any. WALCHEM's liability under this warranty shall be limited to replacement or repair, F.O.B. Holliston, MA U.S.A. of any defective equipment or part which, having been returned to WALCHEM, transportation charges prepaid, has been inspected and determined by WALCHEM to be defective. Replaceable elastomeric parts and glass components are expendable and are not covered by any warranty.

THIS WARRANTY IS IN LIEU OF ANY OTHER WARRANTY, EITHER EXPRESS OR IMPLIED, AS TO DESCRIPTION, QUALITY, MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE OR USE, OR ANY OTHER MATTER.

180722 Rev. D Nov 2019

Contents

1.0 INTRODUCTION

The RAFA Series controllers offer a high level of flexibility in controlling water treatment applications.

One or two sensor inputs are available that are compatible with a variety of sensors:

- Contacting conductivity
- Electrodeless conductivity
- pH
- ORP
- Any Walchem disinfection sensor
- Generic sensor (Ion Selective Electrodes or any type of sensor with a linear voltage output between -2 VDC and 2 VDC)

An analog (4-20 mA) sensor input card with two input circuits is also available for use with 2,3 or 4-wire transmitters. Or a sensor card that combines one sensor (contacting conductivity, pH, ORP, disinfection or generic) plus one analog (4-20 mA) input is available.

Six relay outputs may be set to a variety of control modes:

- On/Off set point control
- Time Proportional control
- Pulse Proportional control (when purchased with Pulse solid state opto outputs)
- PID control (when purchased with Pulse solid state opto outputs)
- Lead/Lag control of up to 6 relays
- Dual set point
- Timer
- Bleed or Feed based on a Water Contactor or Paddlewheel flow meter input
- Feed and Bleed
- Feed and Bleed with Lockout
- Feed as a percent of Bleed
- Feed as a percent of elapsed time
- Daily, Weekly, 2-week or 4-week Biocide timers with pre-bleed and post-add lockout of bleed
- Intermittent sampling for boilers with proportional blowdown, controlling on a trapped sample
- Always on unless interlocked
- Probe Wash timer
- Spike to alternate set point on timed basis
- Diagnostic Alarm triggered by:
    - High or Low sensor reading
    - No Flow
    - Relay output timeout
    - Sensor error

An option card with two isolated analog outputs may be installed to retransmit sensor input signals to a chart recorder, datalogger, PLC or other device. They may also be connected to valves, actuators or metering pumps for linear proportional control or PID control.

An Ethernet option provides remote access to the controller's programming via a PC connected directly, via a local area network, or via Walchem's VTouch account management server. It also allows emailing of datalog files (in CSV format, compatible with spreadsheets like Excel) and alarms, to up to eight email addresses.

Our USB features provide the ability to upgrade the software in the controller to the latest version. The Config file feature allows you to save all the set points from a controller onto a USB flash disk, and then import them into another controller, making the programming of multiple controllers fast and easy. The data logging feature allows you to save the sensor readings and relay activation events to a USB flash disk.

2.0 SPECIFICATIONS

2.1 Measurement Performance

0.01 Cell Contacting Conductivity	
Range	0-300 µS/cm
Resolution	0.01 µS/cm, 0.0001 mS/cm, 0.001 mS/m, 0.0001 S/m, 0.01 ppm
Accuracy	± 1% of reading
0.1 Cell Contacting Conductivity	
Range	0-3,000 µS/cm
Resolution	0.1 µS/cm, 0.0001 mS/cm, 0.01 mS/m, 0.0001 S/m, 0.1 ppm
Accuracy	± 1% of reading
1.0 Cell Contacting Conductivity	
Range	0-30,000 µS/cm
Resolution	1 µS/cm, 0.001 mS/cm, 0.1 mS/m, 0.0001 S/m, 1 ppm
Accuracy	± 1% of reading
10.0 Cell Contacting Conductivity	
Range	0-300,000 µS/cm
Resolution	10 µS/cm, 0.01 mS/cm, 1 mS/m, 0.001 S/m, 10 ppm
Accuracy	± 1% of reading
pH	**ORP/ISE**
Range -2 to 16 pH units Resolution 0.01 pH units Accuracy ± 0.01% of reading	Range -1500 to 1500 mV Resolution 0.1 mV Accuracy ± 1 mV
Disinfection Sensors	
Range (mV) -2000 to 1500 mV	Range (ppm) 0-2 ppm to 0-20,000 ppm
Resolution (mV) 0.1 mV	Resolution (ppm) Varies with range and slope
Accuracy (mV) ± 1 mV	Accuracy (ppm) Varies with range and slope
Temperature	**Analog (4-20 mA)**
Range 23 to 500°F (-5 to 260°C)	Range 0 to 22 mA
Resolution 0.1°F (0.1°C)	Resolution 0.01 mA
Accuracy ± 1% of reading	Accuracy ± 0.5% of reading

Electrodeless Conductivity

Range	Resolution	Accuracy
500-12,000 µS/cm	1 µS/cm, 0.01 mS/cm, 0.1 mS/m, 0.001 S/m, 1 ppm	1% of reading
3,000-40,000 µS/cm	1 µS/cm, 0.01 mS/cm, 0.1 mS/m, 0.001 S/m, 1 ppm	1% of reading
10,000-150,000 µS/cm	10 µS/cm, 0.1 mS/cm, 1 mS/m, 0.01 S/m, 10 ppm	1% of reading
50,000-500,000 µS/cm	10 µS/cm, 0.1 mS/cm, 1 mS/m, 0.01 S/m, 10 ppm	1% of reading
200,000-2,000,000 µS/cm	100 µS/cm, 0.1 mS/cm, 1 mS/m, 0.1 S/m, 100 ppm	1% of reading

Temperature °C	Range Multiplier
0	181.3
10	139.9
15	124.2
20	111.1
25	100.0
30	90.6
35	82.5
40	75.5
50	64.3
60	55.6
70	48.9

Temperature °C	Range Multiplier
80	43.5
90	39.2
100	35.7
110	32.8
120	30.4
130	28.5
140	26.9
150	25.5
160	24.4
170	23.6
180	22.9

Note: Conductivity ranges on page 2 apply at 25°C. At higher temperatures, the range is reduced per the range multiplier chart.

2.2 Electrical: Input/Output

Input Power	100 to 240 VAC, 50 or 60 Hz, 7 A maximum Fuse: 6.3 A
Inputs	
Sensor Input Signals (0, 1 or 2 depending on model code):	
Contacting Conductivity	0.01, 0.1, 1.0, or 10.0 cell constant OR
Electrodeless Conductivity	(not available on the combination sensor/analog input card) OR
Disinfection	OR
Amplified pH, ORP or ISE	Requires a preamplified signal. Walchem WEL or WDS series recommended. ±5VDC power available for external preamps.
Each sensor input card contains a temperature input	
Temperature	100 or 1000 ohm RTD, 10K or 100K Thermistor
Analog (4-20 mA) Sensor Input (0, 1, 2 or 4 depending on model code):	2-wire loop powered or self-powered transmitters supported 3 or 4 –wire transmitters supported Each dual sensor input board has two channels Channel 1, 130 ohm input resistance Channel 2, 280 ohm input resistance The combination input board has one channel, 280 ohm input resistance Available Power: One independent isolated 24 VDC ± 15% supply per channel 1.5 W maximum for each channel 2W (83 mA at 24 VDC) total power consumption for all channels (four total channels possible if two dual boards are installed; 2W is equivalent to 2 Little Dipper sensors)
Digital Input Signals (6):	
State-Type Digital Inputs	Electrical: Optically isolated and providing an electrically isolated 9V power with a nominal 2.3mA current when the digital input switch is closed Typical response time: < 2 seconds Devices supported: Any isolated dry contact (i.e. relay, reed switch) Types: Interlock

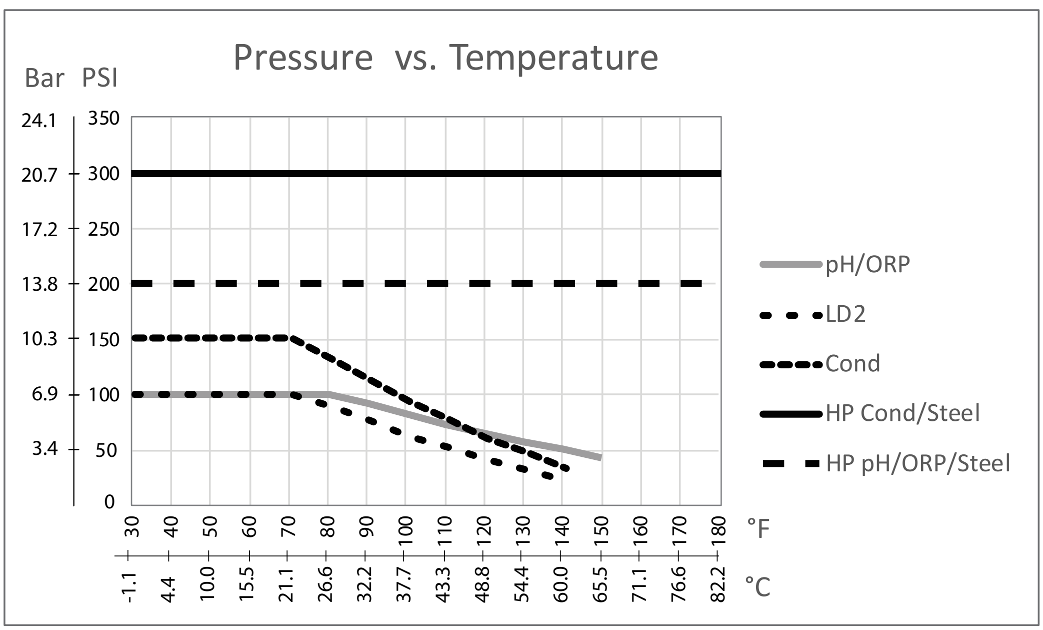
Low Speed Counter-Type Digital Inputs	Electrical: Optically isolated and providing an electrically isolated 9V power with a nominal 2.3mA current when the digital input switch is closed 0-10 Hz, 50 msec minimum width Devices supported: Any device with isolated open drain, open collector, transistor or reed switch Types: Contacting Flowmeter
High Speed Counter-Type Digital Inputs	Electrical: Optically isolated and providing an electrically isolated 9V power with a nominal 2.3mA current when the digital input switch is closed, 0-500 Hz, 1.00 msec minimum width Devices supported: Any device with isolated open drain, open collector, transistor or reed switch Types: Paddlewheel Flowmeter
Outputs	
Powered mechanical relays (0 or 6 depending on model code):	Pre-powered on circuit board switching line voltage 6 A (resistive), 1/8 HP (93 W) All six relays are fused together as one group, total current for this group must not exceed 6A
Dry contact mechanical relays (0, 2 or4 depending on model code):	6 A (resistive), 1/8 HP (93 W) Dry contact relays are not fuse protected
Pulse Outputs (0, 2 or4 depending on model code):	Opto-isolated, Solid State Relay 200mA, 40 VDC Max. VLOWMAX = 0.05V @ 18 mA
4 - 20 mA (0 or 2)	Internally powered Fully isolated 600 Ohm max resistive load Resolution 0.0015% of span Accuracy ± 0.5% of reading
Ethernet	10/100 802.3-2005 Auto MDIX support Auto Negotiation
Agency Approvals:	
Safety	UL 61010-1:2012 3rd Ed. CSA C22.2 No. 61010-1:2012 3rd Ed. IEC 61010-1:2010 3rd Ed. EN 61010-1:2010 3rd Ed.
EMC	IEC 61326-1:2012 EN 61326-1:2013
Note: For EN61000-4-6, EN61000-4-3 the controller met performance criteria B. *Class A equipment: Equipment suitable for use in establishments other than domestic, and those directly connected to a low voltage (100-240 VAC) power supply network which supplies buildings used for domestic purposes.	

2.3 Mechanical

Enclosure Material	Polycarbonate
Enclosure Rating	NEMA 4X (IP65)
Dimensions	9.5” x 8” x 4” (241 mm x 203 mm x 102 mm)
Display	320 x 240 pixel monochrome backlit display with touchscreen
Operating Ambient Temp	-4 to 131 °F (-20 to 55 °C)
Storage Temperature	-4 – 176°F (-20 – 80°C)

Mechanical (Sensors) (*see graph)

Sensor	Pressure	Temperature	Materials	Process Connections
Electrodeless conductivity	0-150 psi (0-10 bar)*	CPVC: 32-158°F (0 to 70°C)* PEEK: 32-190°F (0 to 88°C)	CPVC, FKM in-line o-ring PEEK, 316 SS in-line adapter	1" NPTM submersion 2" NPTM in-line adapter
pH	0-100 psi (0-7 bar)*	50-158°F (10-70°C)*	CPVC, Glass, FKM o-rings, HDPE, Titanium rod, glass-filled PP tee	1" NPTM submersion 3/4" NPTF in-line tee
ORP	0-100 psi (0-7bar)*	32-158°F (0-70°C)*		
Contacting conductivity (Condensate)	0-200 psi (0-14 bar)	32-248°F (0-120°C)	316SS, PEEK	3/4" NPTM
Contacting conductivity Graphite (Cooling Tower)	0-150 psi (0-10 bar)*	32-158°F (0-70°C)*	Graphite, Glass-filled PP, FKM o-ring	3/4" NPTM
Contacting conductivity SS (Cooling Tower)	0-150 psi (0-10 bar)*	32-158°F (0-70°C)*	316SS, Glass-filled PP, FKM o-ring	3/4" NPTM
Contacting conductivity (Boiler)	0-250 psi (0-17 bar)	32-401°F (0-205°C)	316SS, PEEK	3/4" NPTM
Contacting conductivity (High Pressure Tower)	0-300 psi (0-21 bar)*	32-158°F (0-70°C)*	316SS, PEEK	3/4" NPTM
pH (High Pressure)	0-300 psi (0-21 bar)*	32-275°F (0-135°C)*	Glass, Polymer, PTFE, 316SS, FKM	1/2" NPTM gland
ORP (High Pressure)	0-300 psi (0-21 bar)*	32-275°F (0-135°C)*	Platinum, Polymer, PTFE, 316SS, FKM	1/2" NPTM gland
Free Chlorine/Bromine	0-14.7 psi (0-1 bar)	32-113°F (0-45°C)	PVC, Polycarbonate, silicone rubber, SS, PEEK, FKM, Isoplast	1/4" NPTF Inlet 3/4" NPTF Outlet
Extended pH Range Free Chlorine/Bromine	0-14.7 psi (0-1 bar)	32-113°F (0-45°C)		
Total Chlorine	0-14.7 psi (0-1 bar)	32-113°F (0-45°C)		
Chlorine Dioxide	0-14.7 psi (0-1 bar)	32-131°F (0-55°C)		
Ozone	0-14.7 psi (0-1 bar)	32-131°F (0-55°C)		
Peracetic Acid	0-14.7 psi (0-1 bar)	32-131°F (0-55°C)		
Hydrogen Peroxide	0-14.7 psi (0-1 bar)	32-113°F (0-45°C)		
Flow switch manifold	0-150 psi (0-10 bar) up to 100°F (38°C)* 0-50 psi (0-3 bar) at 140°F (60°C)	32-140°F (0-60°C)	GFRPP, PVC, FKM, Isoplast	3/4" NPTF
Flow switch manifold (High Pressure)	0-300 psi (0-21 bar)*	32-158°F (0-70°C)*	Carbon steel, Brass, 316SS, FKM	3/4" NPTF



2.4 Variables and their Limits

Sensor Input Settings	Low Limit	High Limit
Alarm limits	Low end of sensor range	High end of sensor range
Input alarm dead band	Low end of sensor range	High end of sensor range
Cell constant (conductivity only)	0.01	10
Smoothing Factor	0%	90%
Temp Comp Factor (conductivity linear ATC only)	0%	20.000%
Installation Factor (Electrodeless conductivity only)	0.5	1.5
Cable length	0.1	3,000
PPM conversion factor (only if units = PPM)	0.001	10.000
Default temperature	-20	500
Deadband	Low end of sensor range	High end of sensor range
Calibration Required Alarm	0 days	365 days
Sensor Slope (Generic sensor only)	-1,000,000	1,000,000
Sensor Offset (Generic sensor only)	-1,000,000	1,000,000
Low Range (Generic sensor only)	-1,000,000	1,000,000
High Range (Generic sensor only)	-1,000,000	1,000,000
4 mA value (Transmitter, AI Monitor analog input only)	0	100
20 mA value (Transmitter, AI Monitor analog input only)	0	100
Max Sensor Range (Fluorometer analog input only)	0 ppb	100,000 ppb
Dye/Product Ratio (Fluorometer analog input only)	0 ppb/ppm	100 ppb/ppm
Flow meter input settings	**Low Limit**	**High Limit**
Totalizer alarm	0	100,000,000
Volume/contact for units of Gallons or Liters	1	100,000
Volume/contact for units of m^3	0.001	1,000
K Factor for units of Gallons or Liters	0.01	100,000
K Factor for units of m^3	1	1,000,000
Paddlewheel rate alarm limits	0	High end of sensor range
Paddlewheel rate alarm deadband	0	High end of sensor range
Smoothing Factor	0%	90%
Set Flow Total	0	1,000,000,000
Feed Monitor Input Settings	**Low Limit**	**High Limit**
Totalizer Alarm	0 vol. units	1,000,000 vol. units
Set Flow Total	0 vol. units	1,000,000,000 vol. units
Flow Alarm Delay	00:10 Minutes	59:59 Minutes
Flow Alarm Clear	1 Contact	100,000 Contacts
Dead Band	0%	90%
Reprime Time	00:00 Minutes	59:59 Minutes
Volume/Contact	0.001 ml	1,000.000 ml
Smoothing Factor	0%	90%
Relay output settings	**Low Limit**	**High Limit**
Output Limit Time	1 second	86,400 seconds (0 = unlimited)
Hand Time Limit	1 second	86,400 seconds (0 = unlimited)
Min Relay Cycle	0 seconds	300 seconds
Set Point	Low end of sensor range	High end of sensor range
Spike Set Point (Spike mode)	Low end of sensor range	High end of sensor range
Onset Time (Spike mode)	0 seconds	23:59:59 HH:MM:SS

Duty Cycle Period (On/Off, Spike, Dual Setpoint modes)	0:00 minutes	59:59 minutes
Duty Cycle (On/Off, Spike, Dual Setpoint modes)	0%	100%
On Delay Time (Manual, On/Off, Dual Setpoint modes)	0 seconds	23:59:59 HH:MM:SS
Off Delay Time (Manual, On/Off, Dual Setpoint modes)	0 seconds	23:59:59 HH:MM:SS
Dead Band	Low end of sensor range	High end of sensor range
Feed duration (Flow Timer mode)	0 seconds	86,400 seconds
Accumulator volume (Flow Timer mode)	0	1,000,000
Feed Percentage (Bleed then Feed mode)	0%	100%
Feed Lockout Time Limit (Bleed & Feed, Bleed then Feed modes)	0 seconds	86,400 seconds
Prebleed To Conductivity (Biocide mode)	1 (0 = no prebleed)	High end of sensor range
Prebleed Time (Biocide mode)	0 seconds	86,400 seconds
Bleed Lockout(Biocide mode)	0 seconds	86,400 seconds
Event duration (Biocide, Timer modes)	0	30,000
Proportional band (Time/Pulse Proportional mode, Intermittent Sampling)	Low end of sensor range	High end of sensor range
Sample period (Time Proportional mode)	0 seconds	3600 seconds
Sample Time (Intermittent Sampling mode)	0 seconds	3600 seconds
Hold Time (Probe Wash, Intermittent Sampling modes)	0 seconds	3600 seconds
Maximum Blowdown (Intermittent Sampling mode)	0 seconds	86,400 seconds
Wait Time (Intermittent Sampling mode)	10 pulses/minute	480 pulses/minute
Max Rate (Pulse Proportional, Pulse PID modes, Flow Prop Modes)	0%	100%
Minimum Output (Pulse Proportional, Pulse PID modes)	0%	100%
Maximum Output (Pulse Proportional, Pulse PID modes)	0%	100%
Gain (Pulse PID Standard mode)	0.001	1000.000
Integral Time (Pulse PID Standard mode)	0.001 seconds	1000.000 seconds
Derivative Time (Pulse PID Standard mode)us	0 seconds	1000.000 seconds
Proportional Gain (Pulse PID Parallel mode)	0.001	1000.000
Integral Gain (Pulse PID Parallel mode)	0.001 /second	1000.000 /second
Derivative Gain (Pulse PID Parallel mode)	0 seconds	1000.000 seconds
Input Minimum (Pulse PID modes)	Low end of sensor range	High end of sensor range
Input Maximum (Pulse PID modes)	Low end of sensor range	High end of sensor range
Wear Cycle Time (Lag mode)	10 seconds	23:59:59 HH:MM:SS
Delay Time (Lag mode)	0 seconds	23:59:59 HH:MM:SS
Pump Capacity (Flow Prop mode)	0 gal/hour or l/hour	10,000 gal/hour or l/hour
Pump Setting (Flow Prop mode)	0%	100%
Specific Gravity (Flow Prop mode)	0 g/ml	9.999 g/ml
Target (Flow Prop mode)	0 ppm	1,000,000 ppm
Analog (4-20 mA) Output Settings	**Low Limit**	**High Limit**
4 mA Value (Retransmit mode)	Low end of sensor range	High end of sensor range
20 mA Value (Retransmit mode)	Low end of sensor range	High end of sensor range
Hand Output	0%	100%
Set Point (Proportional, PID modes)	Low end of sensor range	High end of sensor range
Proportional Band (Proportional mode)	Low end of sensor range	High end of sensor range
Minimum Output (Proportional, PID modes)	0%	100%
Maximum Output (Proportional, PID modes)	0%	100%
Off Mode Output (Proportional, PID modes, Flow Prop modes)	0 mA	21 mA
Error Output (not in Manual mode)	0 mA	21 mA

Hand Time Limit (not in Retransmit mode)	1 second	86,400 seconds (0 = unlimited)
Output Time Limit (Proportional, PID modes)	1 second	86,400 seconds (0 = unlimited)
Gain (PID, Standard mode)	0.001	1000.000
Integral Time (PID Standard mode)	0.001 seconds	1000.000 seconds
Derivative Time (PID Standard mode)	0 seconds	1000.000 seconds
Proportional Gain (PID Parallel mode)	0.001	1000.000
Integral Gain (PID Parallel mode)	0.001 /second	1000.000 /second
Derivative Gain (PID Parallel mode)	0 seconds	1000.000 seconds
Input Maximum (PID modes)	Low end of sensor range	High end of sensor range
Pump Capacity (Flow Prop mode)	0 gal/hour or l/hour	10,000 gal/hour or l/hour
Pump Setting (Flow Prop mode)	0%	100%
Specific Gravity (Flow Prop mode)	0 g/ml	9.999 g/ml
Target (Flow Prop mode)	0 ppm	1,000,000 pm
Pump Capacity (Flow Prop mode)	0 gal/hour or l/hour	10,000 gal/hour or l/hour
Pump Setting (Flow Prop mode)	0%	100%
Specific Gravity (Flow Prop mode)	0 g/ml	9.999 g/ml
Target (Flow Prop mode)	0 ppm	1,000,000 ppm
Configuration settings	**Low Limit**	**High Limit**
Local Password	0000	9999
VTouch update period	1 minute	1440 minutes
VTouch reply timeout	10 seconds	60 seconds
Alarm Delay	0:00 minutes	59:59 minutes
SMTP Port	0	65535
TCP Timeout	1 second	240 seconds
Auto Dim Time	0 seconds	23:59:59 HH:MM:SS
Graph settings	**Low Limit**	**High Limit**
Low axis limit	Low end of sensor range	High end of sensor range
High axis limit	Low end of sensor range	High end of sensor range

3.0 UNPACKING & INSTALLATION

3.1 Unpacking the unit

Inspect the contents of the carton. Please notify the carrier immediately if there are any signs of damage to the controller or its parts. Contact your distributor if any of the parts are missing. The carton should contain a RAFA Series controller and an instruction manual. Any options or accessories will be incorporated as ordered.

3.2 Mounting the electronic enclosure

The controller is supplied with mounting holes on the enclosure. It should be wall mounted with the display at eye level, on a vibration-free surface, utilizing all four mounting holes for maximum stability. Use M6 (1/4" diameter) fasteners that are appropriate for the substrate material of the wall. The enclosure is NEMA 4X (IP65) rated. The maximum operating ambient temperature is 131°F (55°C); this should be considered if installation is in a high temperature location. The enclosure requires the following clearances:

Top:	2" (50 mm)
Left:	8" (203 mm) (not applicable for prewired models)
Right:	4" (102 mm)
Bottom:	7" (178 mm)

3.3 Sensor Installation

Refer to the specific instructions supplied with the sensor being used, for detailed installation instructions.

General Guidelines

Locate the sensors where an active sample of water is available and where the sensors can easily be removed for cleaning. Position the sensor such that air bubbles will not be trapped within the sensing area. Position the sensor where sediment or oil will not accumulate within the sensing area.

In-Line Sensor Mounting

In-line mounted sensors must be situated so that the tee is always full and the sensors are never subjected to a drop in water level resulting in dryness. Refer to Figure 2 for typical installation.
Tap off the discharge side of the recirculation pump to provide a minimum flow of 1 gallon per minute through the flow switch manifold. The sample must flow into the bottom of the manifold in order to close the flow switch, and return to a point of lower pressure in order to ensure flow. Install an isolation valve on both sides of the manifold to stop flow for sensor maintenance.

IMPORTANT: To avoid cracking the female pipe threads on the supplied plumbing parts, use no more than 3 wraps of Teflon tape and thread in the pipe FINGER tight plus 1/2 turn! Do not use pipe dope to seal the threads of the flow switch because the clear plastic will crack!

Submersion Sensor Mounting

If the sensors are to be submersed in the process, mount them firmly to the tank, and protect the cable with plastic pipe, sealed at the top with a cable gland, to prevent premature failure. Place the sensors in an area of good solution movement.

Sensors should be located such that they respond rapidly to a well-mixed sample of the process water and the treatment chemicals. If they are too close to the chemical injection point, they will see spikes in concentration and cycle on and off too frequently. If they are too far away from the chemical injection point, they will respond too slowly to the concentration changes, and you will overshoot the set point.

The **contacting conductivity sensor** should be placed as close to the controller as possible, to a maximum distance of 250 ft. (76 m). Less than 25 ft. (8 m) is recommended. The cable must be shielded from background electrical noise. Always route low voltage (sensor) signals with at least a 6" (15 cm) separation from AC voltage wiring.

The **electrodeless conductivity sensor** should be placed as close to the controller as possible, to a maximum distance of 120 ft. (37 m). Less than 20 ft. (6 m) is recommended. The cable must be shielded from background electrical noise. Always route low voltage (sensor) signals with at least a 6" (15 cm) separation from AC voltage wiring. These sensors are affected by the geometry and conductivity of their surroundings, so either maintain 6 inches (15 cm) of sample around the sensor or ensure that any nearby conductive or non-conductive items are consistently positioned. Do not install the sensor in the path of any electrical current that may be flowing in the solution, as this will shift the conductivity reading.

The **amplified pH/ORP/ISE electrode** should be placed as close to the controller as possible, to a maximum distance of 1000 feet (305 m) from the controller. A junction box and shielded cable are available to extend the standard 20 foot (6 m) length. pH and ORP electrodes must be installed such that the measuring surfaces will always remain wet. A U-trap provided in the manifold design should achieve this, even if the sample flow stops. These electrodes also must be installed with the measuring surfaces pointing down; that is 5 degrees above the horizontal, at a minimum.

The **disinfection sensor** should be placed as close to the controller as possible, to a maximum distance of 100 feet (30 m) from the controller. A junction box and shielded cable are available to extend the standard 20 foot (6 m) length. The sensor should be mounted such that the measuring surfaces will always stay wet. If the membrane dries out, it will respond slowly to changing disinfectant values for 24 hours, and if dried out repeatedly, will fail prematurely. The flow cell should be placed on the discharge side of a circulation pump or downhill from a gravity feed. Flow into the cell must come from the bottom side that has the ¾" x ¼" NPT reducing bushing installed. The reducing bushing provides the flow velocity required for accurate readings and must not be removed! A "U" trap should be installed so that if the flow stops, the sensor is still immersed in the water. The outlet of the flow cell must be plumbed to open atmosphere unless the system pressure is at or below 1 atmosphere. If the flow through the line cannot be stopped to allow for cleaning and calibration of the sensor, then it should be placed in a by-pass line with isolation valves to allow for sensor removal. Install the sensor vertically, with the measuring surface pointing down, at least 5 degrees above horizontal. Flow rate regulation must be done upstream from the sensor, because any flow restriction downstream can increase the pressure above atmospheric and damage the membrane cap!

Important Boiler Sensor Installation Notes: (refer to typical installation drawing)

1. Make sure the minimum water level in the boiler is at least 4-6 inches above the skimmer blowdown line. If the skimmer line is closer to the surface, it is likely that steam will be drawn into the line instead of boiler water. The skimmer line must also be installed above the highest tube.
2. Maintain a 3/4 inch minimum pipe ID with no flow restrictions from the tap for the boiler skimmer blowdown line to the electrode. If the ID is reduced below 3/4 inch, then flashing will occur beyond that point and the conductivity reading will be low and erratic. Minimize the usage of tees, valves, elbows or unions between the boiler and the electrode.
3. A manual shut off valve should be installed so that the electrode can be removed and cleaned. This valve must be a full port valve in order to avoid a flow restriction.
4. Keep the distance between the tap for the boiler skimmer line to the electrode as short as possible, to a maximum of 10 feet.
5. Mount the electrode in the side branch of a cross in a horizontal run of pipe. This will minimize entrapment of steam around the electrode and will allow any solids to pass through.
6. There MUST be a flow restriction after the electrode and/or control valve in order to provide back pressure. This flow restriction will be either a flow control valve or an orifice union. The amount of the flow restriction will affect the blowdown rate as well, and should be sized accordingly.
7. Install the motorized ball valve or solenoid valve per the manufacturer's instructions.

For best results, align the hole in the conductivity electrode such that the direction of water flow is through the hole.

Guide to Sizing Blowdown Valves and Orifice Plates

1. **Determine the Rate of Steam Production in Pounds per Hour:**
   Either read off the boiler name plate (water-tube boilers) or Calculate from horsepower rating (fire-tube boilers): HP x 34.5 = lbs/hr. Example: 100 HP = 3450 lbs/hr.
2. **Determine the Concentration Ratio (BASED ON FEEDWATER)**
   A water treatment chemical specialist should determine the desired number of cycles of concentration. This is the ratio of TDS in the boiler water to TDS in the feedwater. Note that feedwater means the water that is fed to the boiler from the deaerator and includes makeup water plus condensate return. Example: 10 cycles of concentration has been recommended
3. **Determine the Required Blowdown Rate in Pounds Per Hour**
   Blowdown Rate = Steam Production / (Concentration Ratio –1) Example: 3450/(10-1) = 383.33 lbs./hr
4. **Determine if Continuous or Intermittent Sampling is Required**
   Use intermittent sampling when the boiler operation or loading is intermittent, or on boilers where the required blowdown rate is less than 25% of the smallest available flow control valve or less than the flow through the smallest orifice. See the graphs on the next page.

   Use continuous sampling when the boiler is operating 24 hours per day and the required blowdown rate is more than 25% of the smallest applicable flow control valve or orifice. See the graphs on the next page.

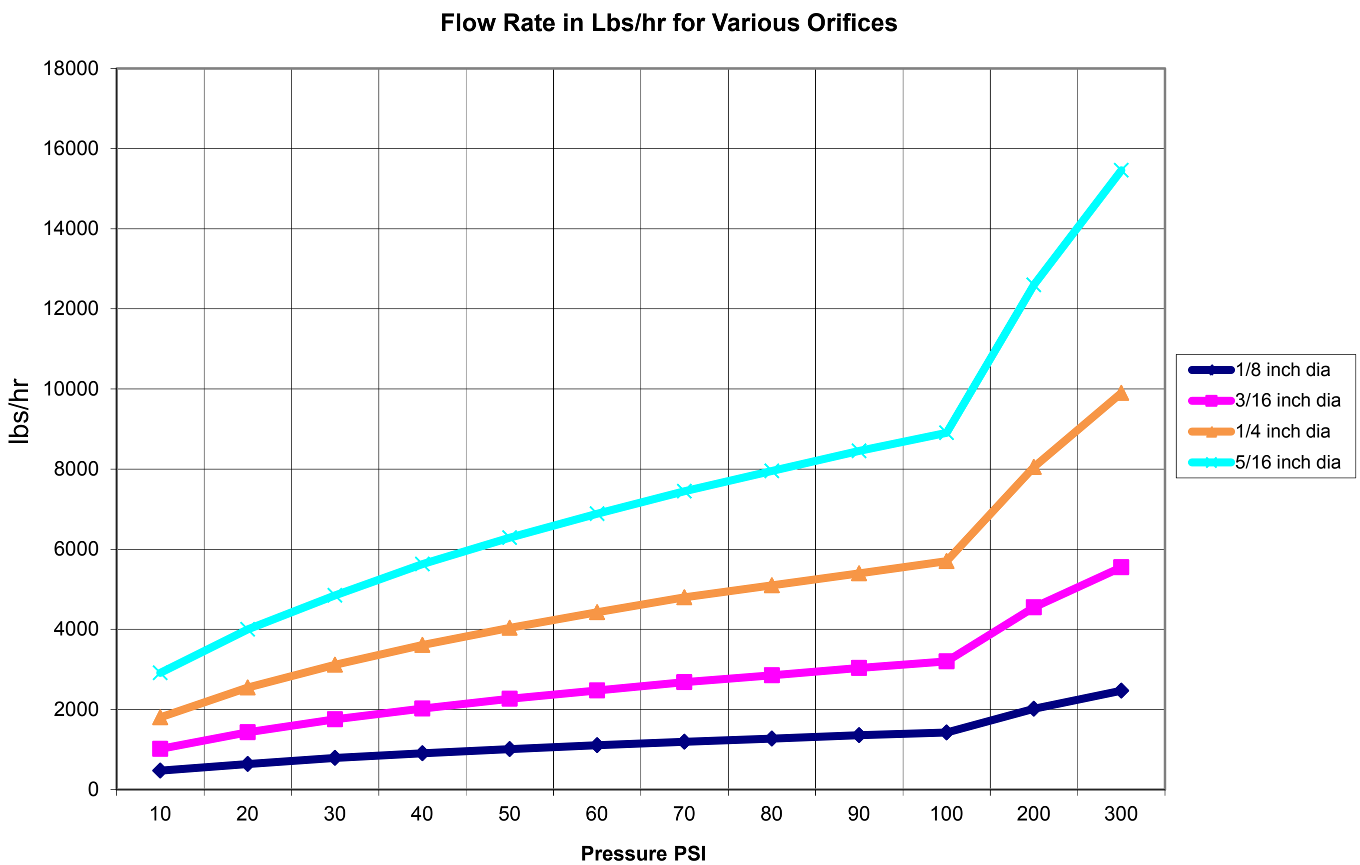
   Use of a flow control valve will give you the best control of the process, since the flow rate can be easily adjusted. The dial on the valve also gives you a visual indication if the flow rate has been changed. If the valve clogs, it can be opened to clear the obstruction, and closed to the previous position.

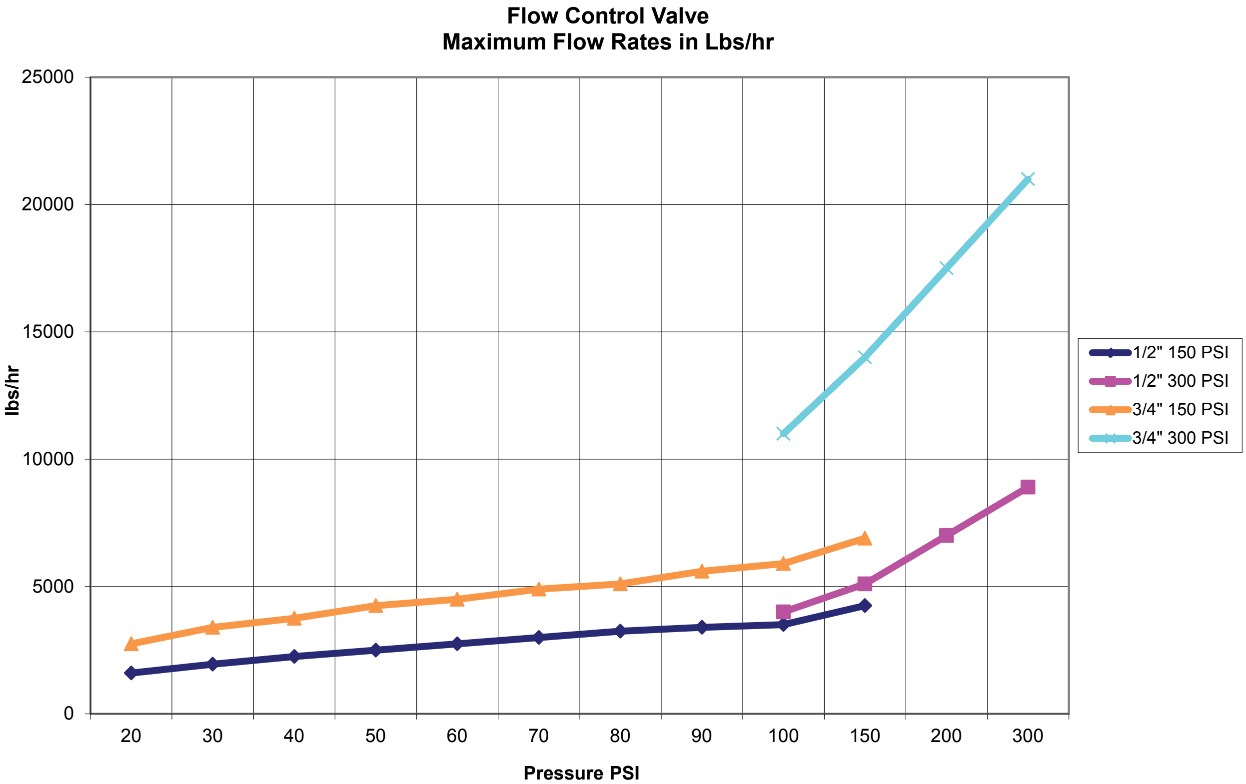
   If an orifice plate is used, you must install a valve downstream from the orifice in order to fine tune the flow rate and provide additional back pressure in many applications.

   Example: An 80 psi boiler has a Required Blowdown Rate of 383.33 lbs./hr. The maximum flow rate of the smallest flow control valve is 3250 lbs./hr. 3250 x 0.25 = 812.5 which is too high for continuous sampling. Using an orifice, the flow rate through the smallest diameter plate is 1275 lbs./hr. This is too high for continuous sampling.

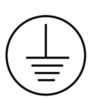
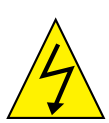
5. Determine the Orifice or Flow Control Valve Size for this Blowdown Rate

Use the following graphs to select a flow control device:





3.4 Icon Definitions

Symbol	Publication	Description
	IEC 417, No.5019	Protective Conductor Terminal
I	IEC 417, No. 5007	On (Supply)
O	IEC 417, No. 5008	Off (Supply)
	ISO 3864, No. B.3.6	Caution, risk of electric shock
	ISO 3864, No. B.3.1	Caution

3.5 Electrical installation

The various standard wiring options are shown in figure 1, below. Your controller will arrive from the factory pre-wired or ready for hardwiring. Depending on your configuration of controller options, you may be required to hard-wire some or all of the input/output devices. Refer to figures 6 through 17 for circuit board layout and wiring.

Note: when wiring the optional flow meter contactor input, the 4-20 mA outputs or a remote flow switch, it is advisable to use stranded, twisted, shielded pair wire between 22-26 AWG. Shield should be terminated at the controller at the most convenient shield terminal.

CAUTION

1.	There are live circuits inside the controller even when the power switch on the front panel is in the OFF position! The front panel must never be opened before power to the controller is REMOVED! If your controller is prewired, it is supplied with an 8 foot, 18 AWG power cord with USA style plug. A tool (#1 Phillips driver) is required to open the front panel.
2.	When mounting the controller, make sure there is clear access to the disconnecting device!
3.	The electrical installation of the controller must be done by trained personnel only and conform to all applicable National, State and Local codes!
4.	Proper grounding of this product is required. Any attempt to bypass the grounding will compromise the safety of persons and property.
5.	Operating this product in a manner not specified by Walchem may impair the protection provided by the equipment.

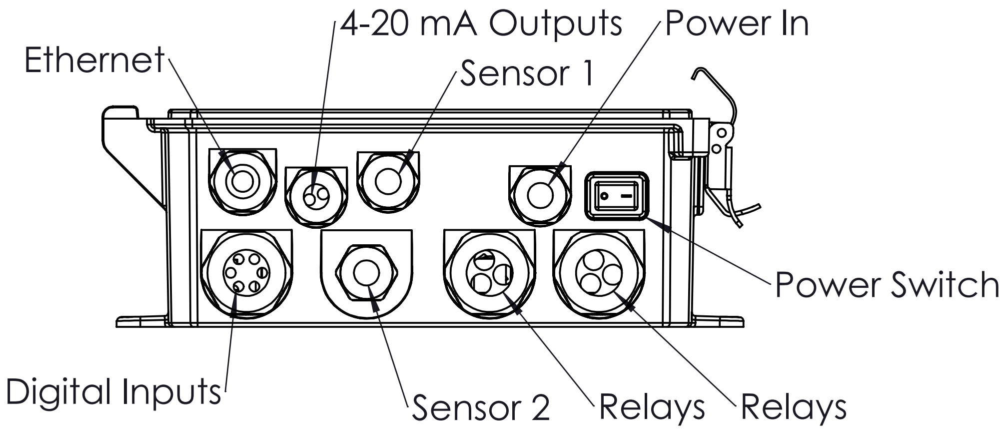


Figure 1 Conduit Wiring

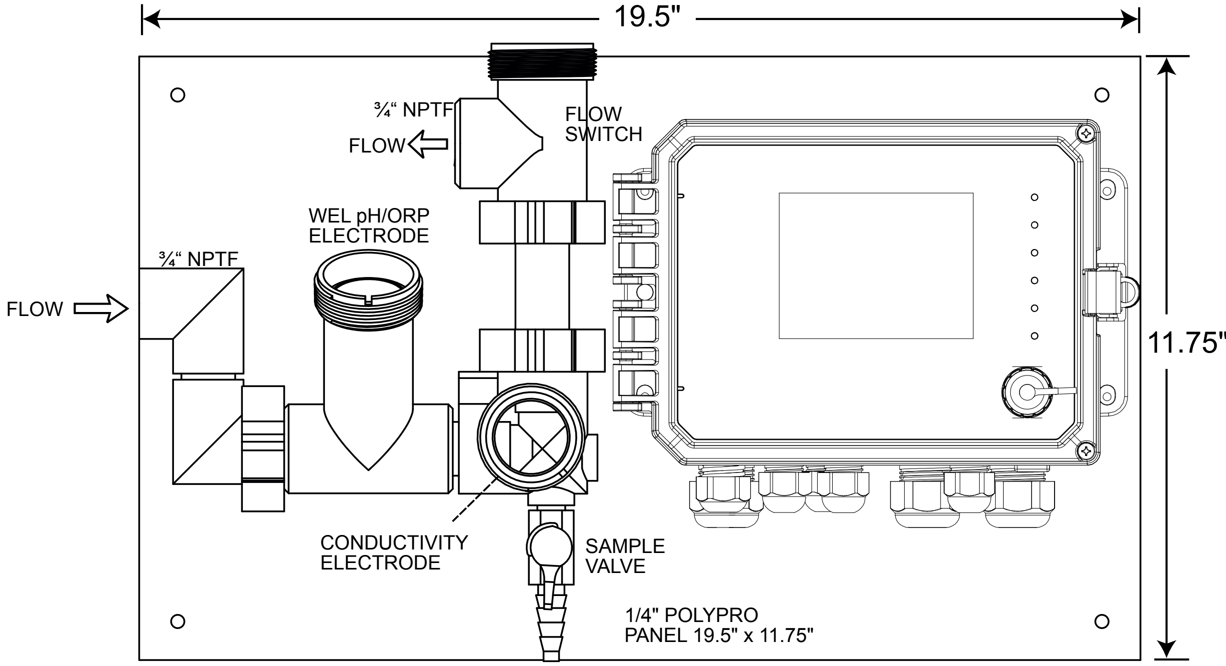


Figure 2 Typical Installation – Cooling Tower

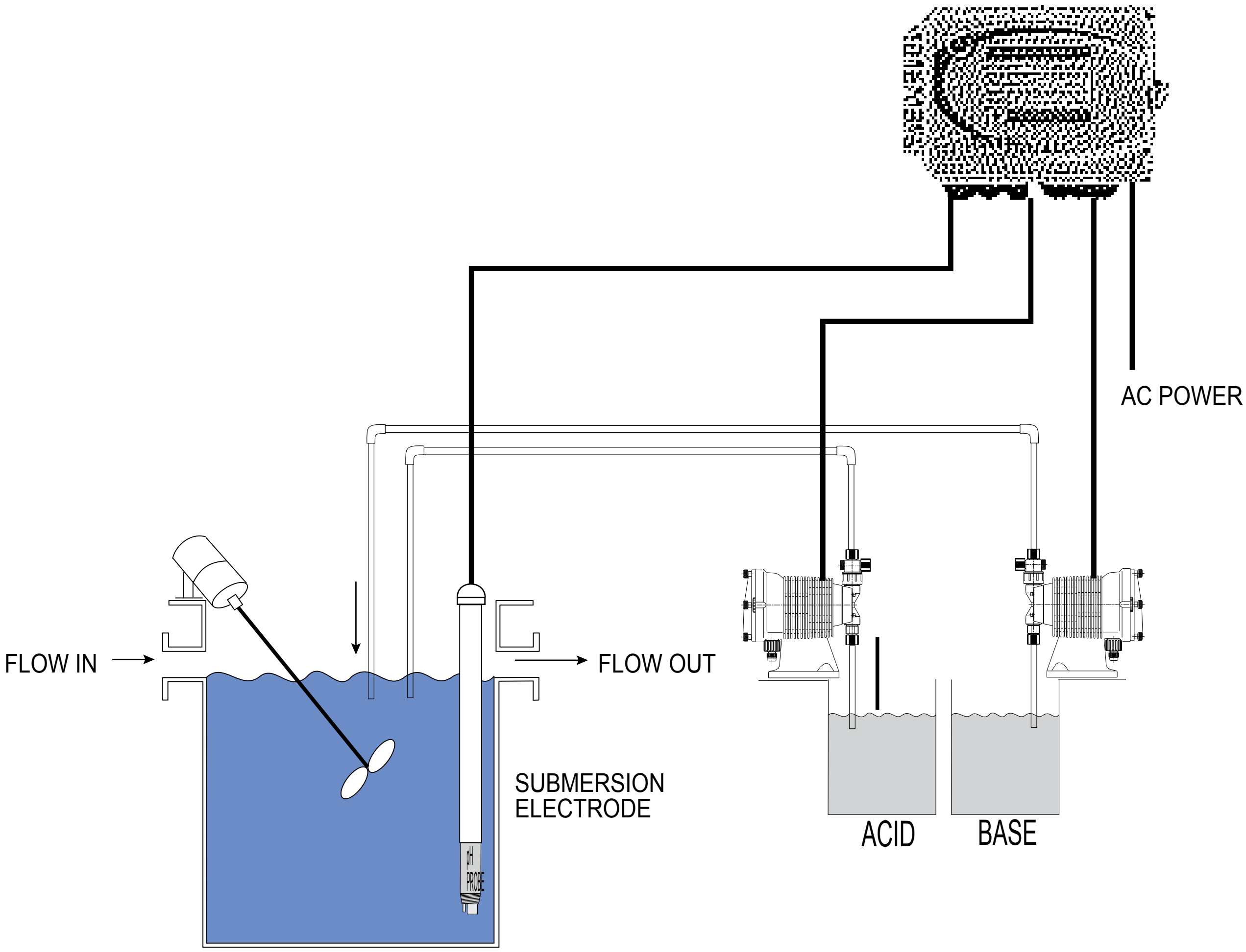


Figure 3 Typical Installation – Cooling Tower Submersion

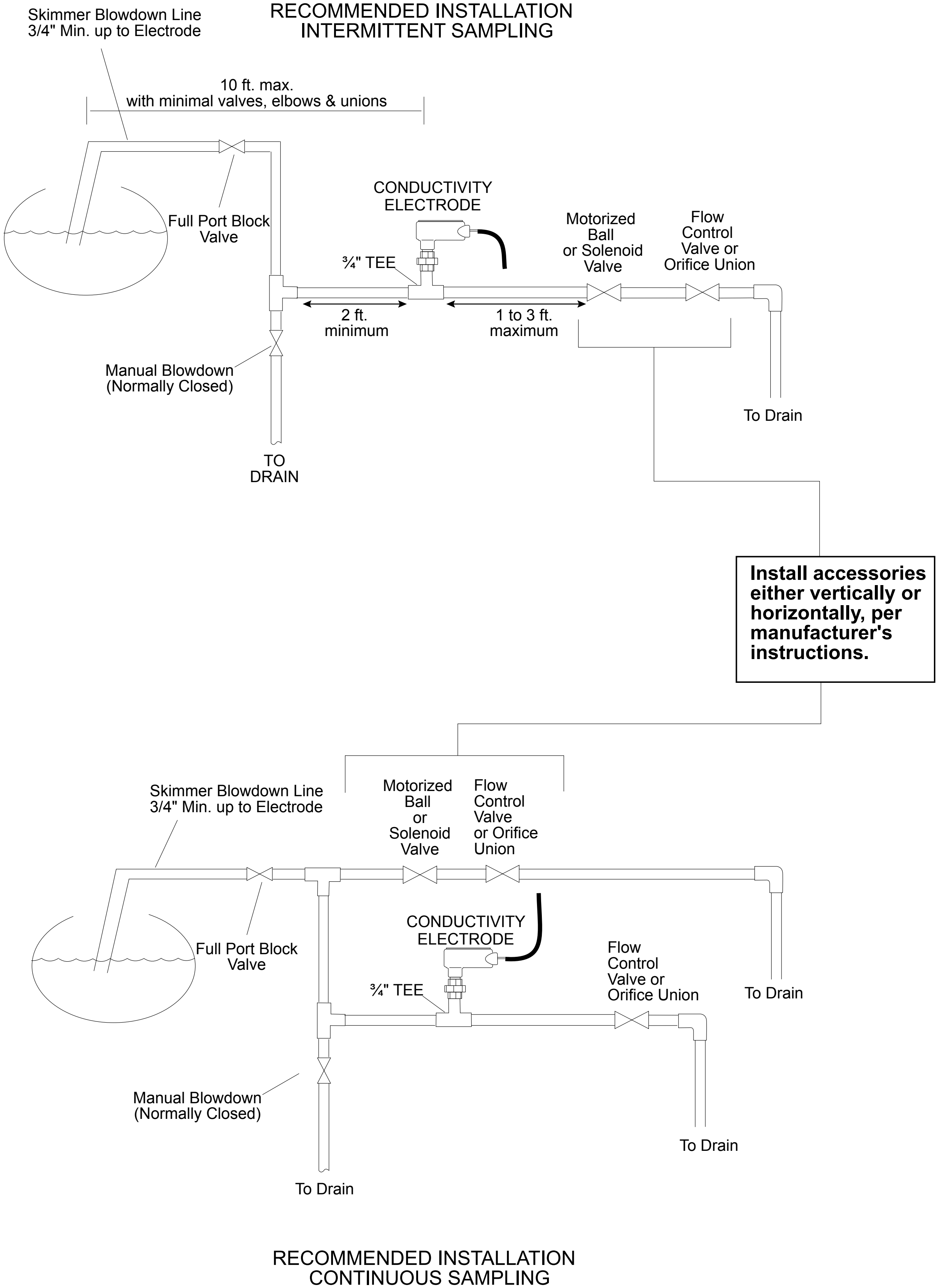


Figure 4 Typical Installation – Boiler

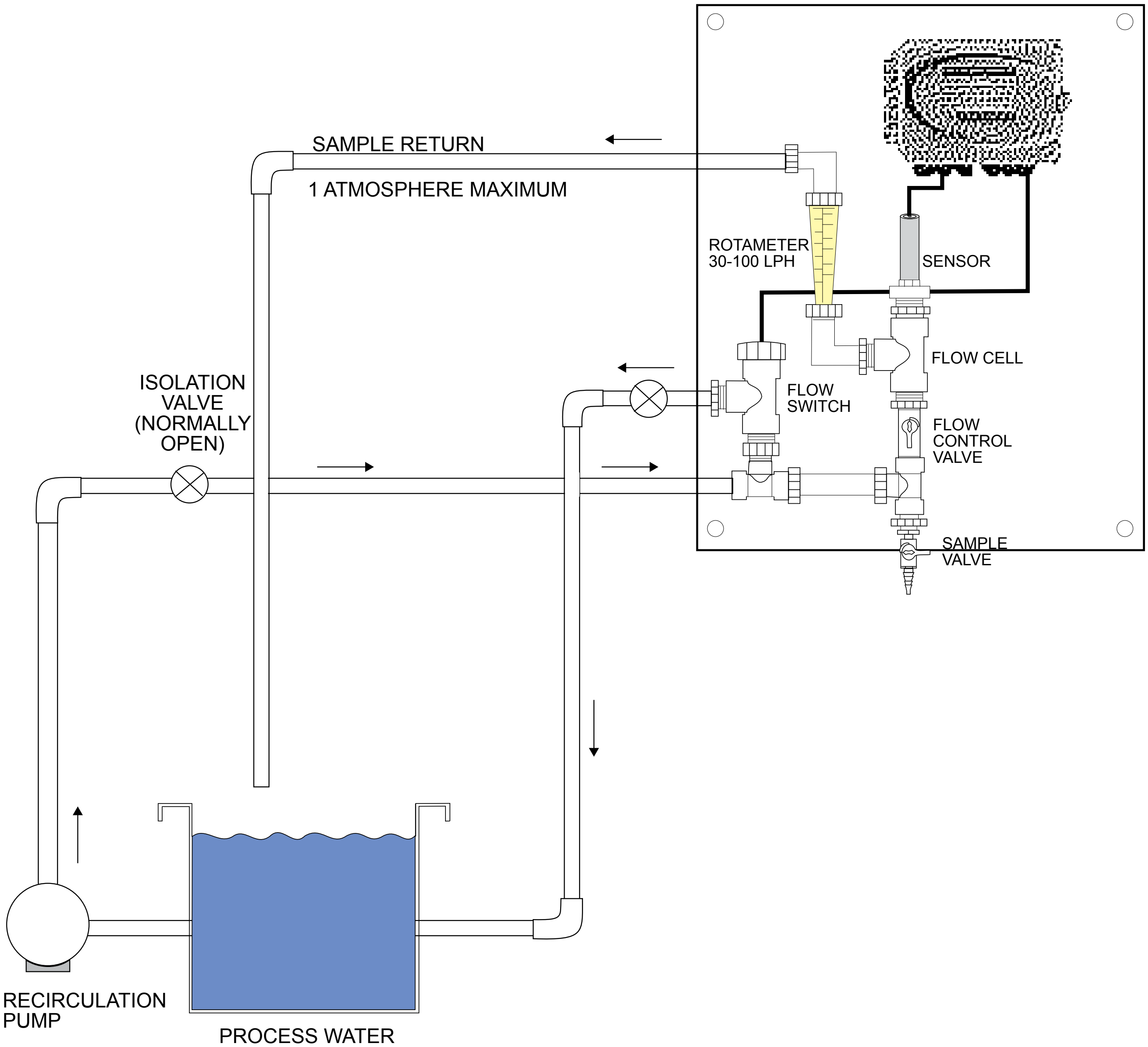


Figure 5 Typical Installation – Disinfection Sensor

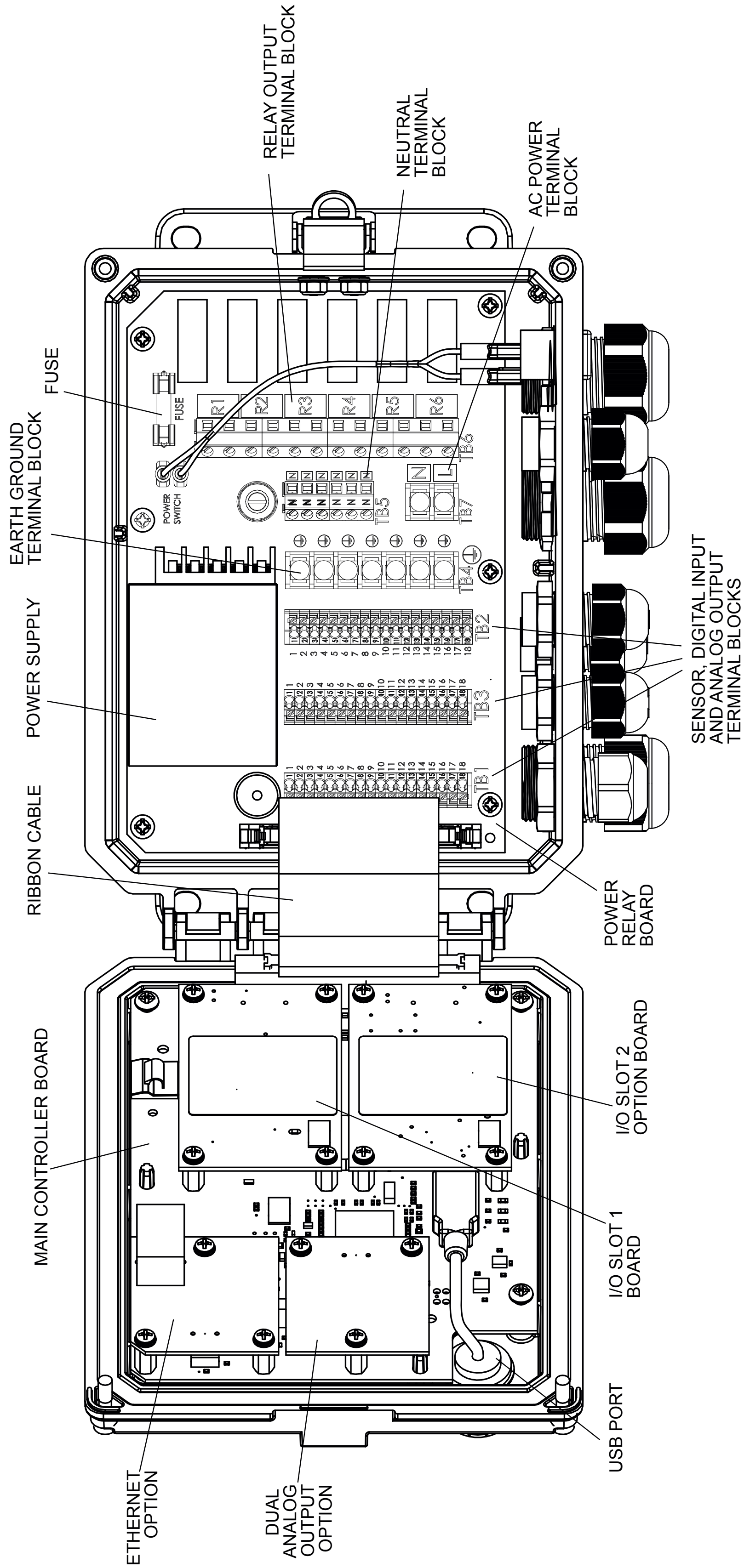
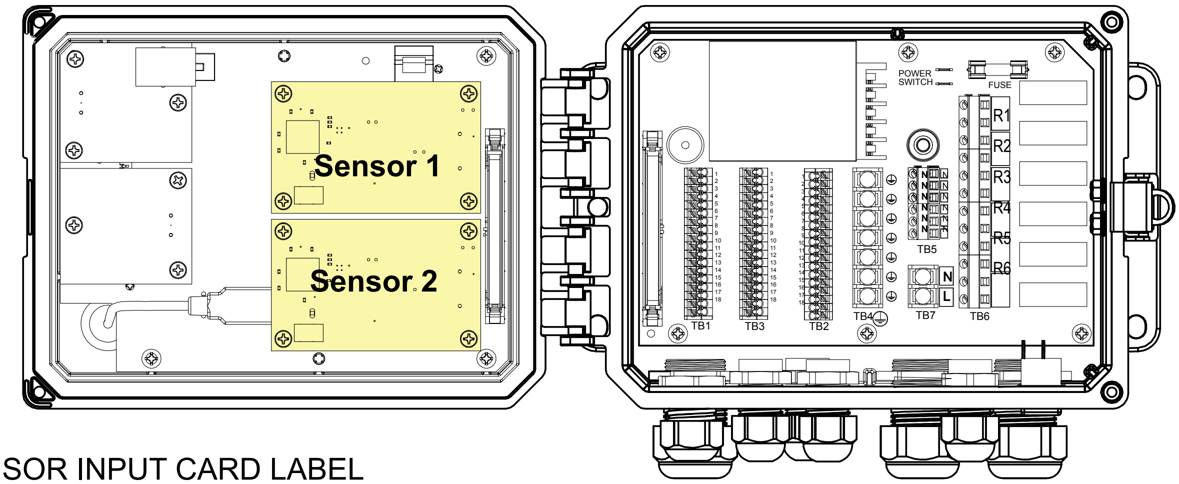
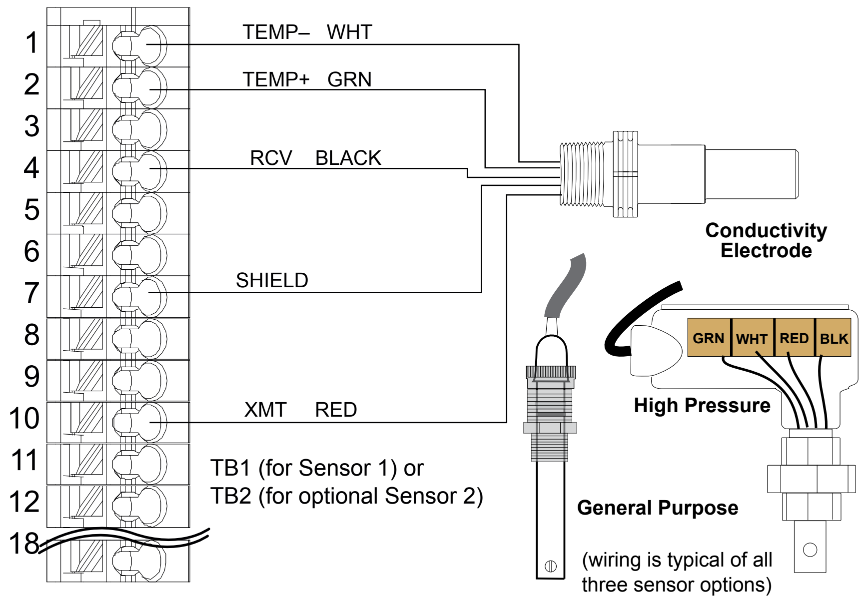


Figure 6 Parts Identification



SENSOR INPUT CARD LABEL

	ECOND	CCOND	pH/ORP DIS
1	TEMP–	TEMP–	TEMP–
2	TEMP+	TEMP+	TEMP+
3	R-SHLD		IN–
4		RCV	IN+
5	RCV–		
6	RCV+		
7	X-SHLD	SHIELD	SHIELD
8			+5V
9			–5V
10	XMT+	XMT	
11	XMT–		
12	⏚		



	CCOND	pH/ORP DIS	2 Wire Loop	2 Wire Pwrd	3 Wire	4 Wire
1	TEMP–	TEMP–				
2	TEMP+	TEMP+				
3	SHIELD	IN–				
4	RCV	IN+				
5		–5V				
6	XMT					
7		+5V				
8					COM(–)	24V(-)
9			+24V		+24V	+24V
10				XMTR–		XMTR–
11			XMTR–	XMTR+	XMTR+	XMTR+
12	SHIELD or use DI SHIELD (TB3 7-12)					

COMBINATION SENSOR/ANALOG CARD LABEL

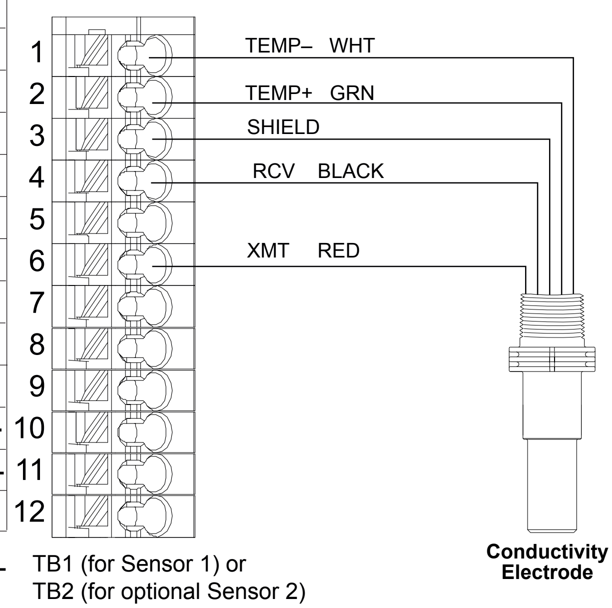
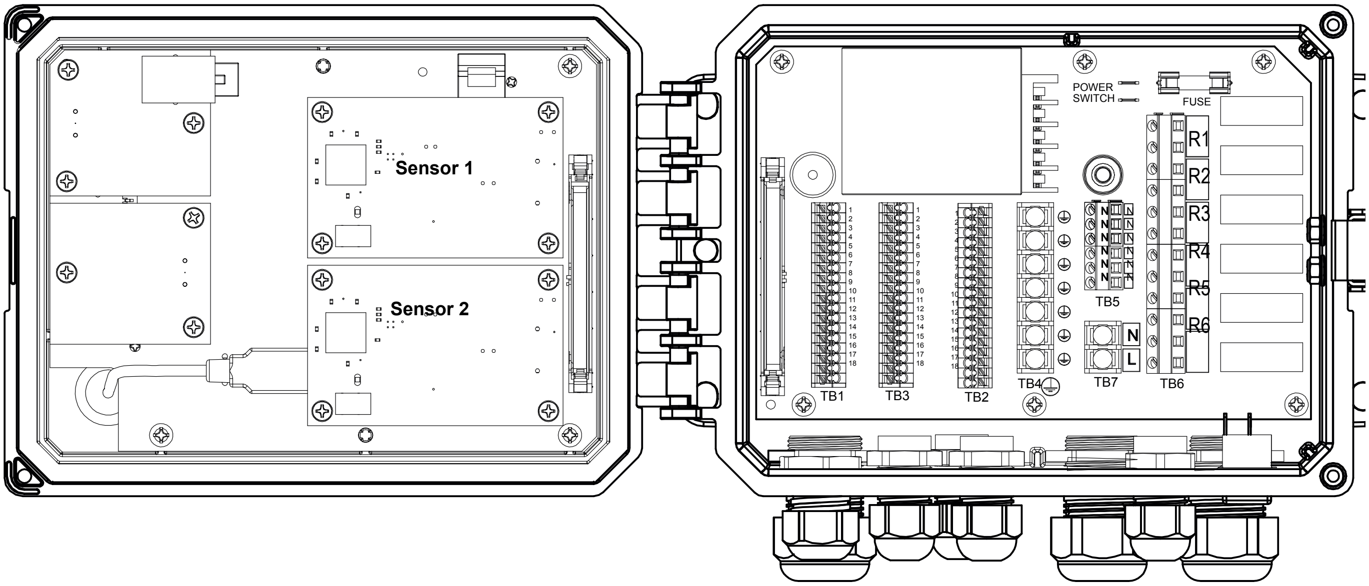


Figure 7 Contacting Conductivity Sensor Input Wiring



	ECOND	CCOND	pH/ORP DIS
1	TEMP–	TEMP–	TEMP–
2	TEMP+	TEMP+	TEMP+
3	R-SHLD		IN–
4		RCV	IN+
5	RCV–		
6	RCV+		
7	X-SHLD	SHIELD	SHIELD
8			+5V
9			–5V
10	XMT+	XMT	
11	XMT–		
12	⏚		

SENSOR LABEL

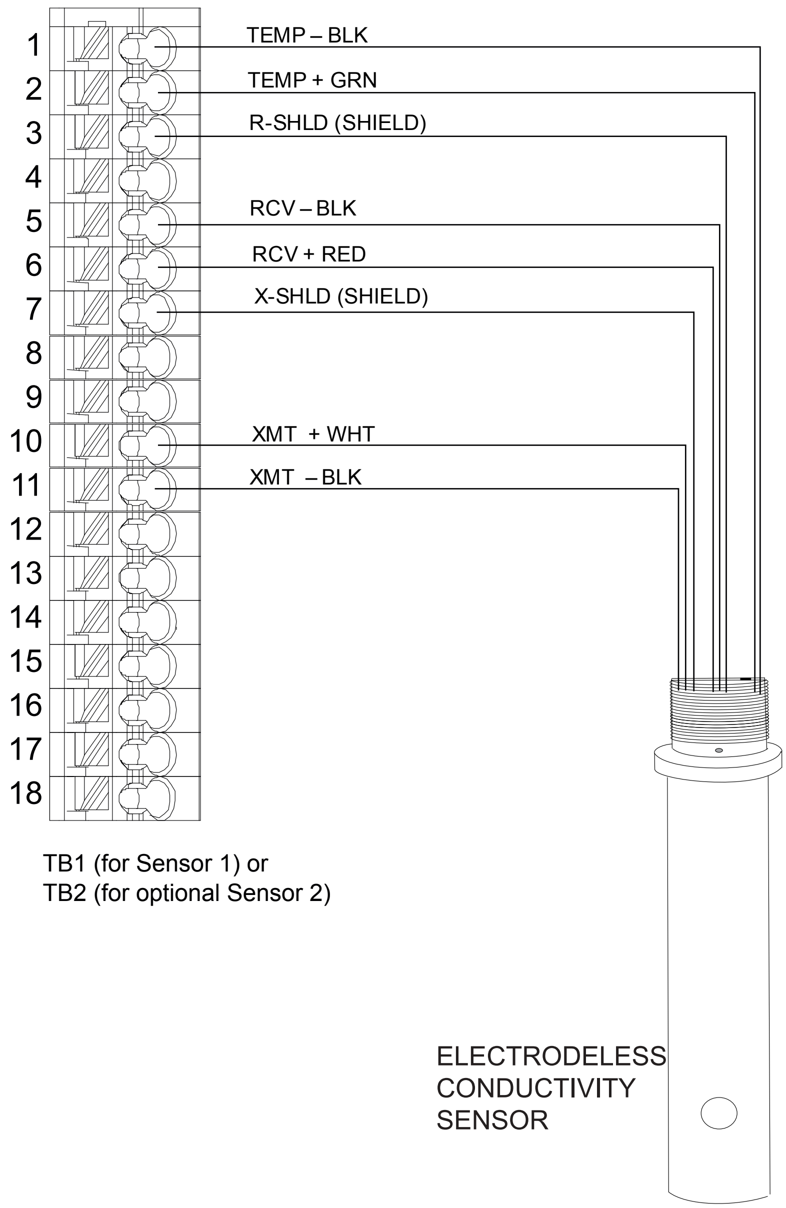
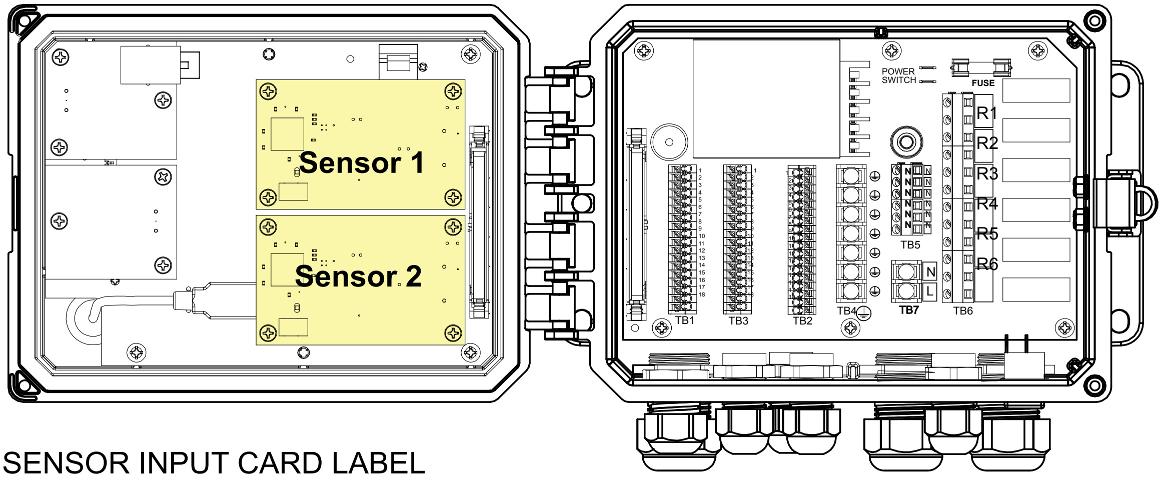
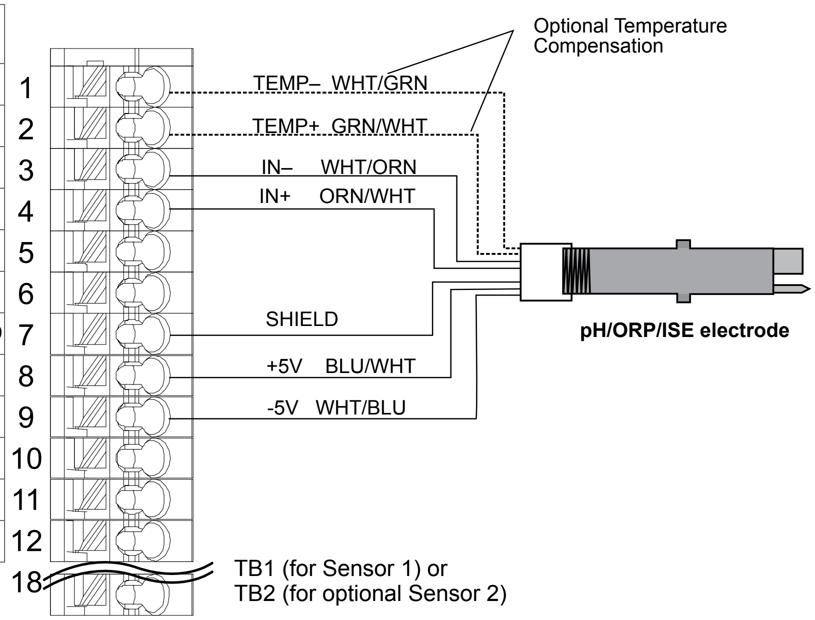


Figure 8 Electrodeless Conductivity Sensor Input Wiring



SENSOR INPUT CARD LABEL

	ECOND	CCOND	pH/ORP DIS
1	TEMP–	TEMP–	TEMP–
2	TEMP+	TEMP+	TEMP+
3	R-SHLD		IN–
4		RCV	IN+
5	RCV–		
6	RCV+		
7	X-SHLD	SHIELD	SHIELD
8			+5V
9			–5V
10	XMT+	XMT	
11	XMT–		
12	⏚		



	CCOND	pH/ORP DIS	2 Wire Loop	2 Wire Pwrd	3 Wire	4 Wire
1	TEMP–	TEMP–				
2	TEMP+	TEMP+				
3	SHIELD	IN–				
4	RCV	IN+				
5		–5V				
6	XMT					
7		+5V				
8					COM(–)	24V(-)
9			+24V		+24V	+24V
10				XMTR–		XMTR–
11			XMTR–	XMTR+	XMTR+	XMTR+
12		SHIELD or use DI SHIELD (TB3 7-12)				

COMBINATION SENSOR/ANALOG CARD LABEL

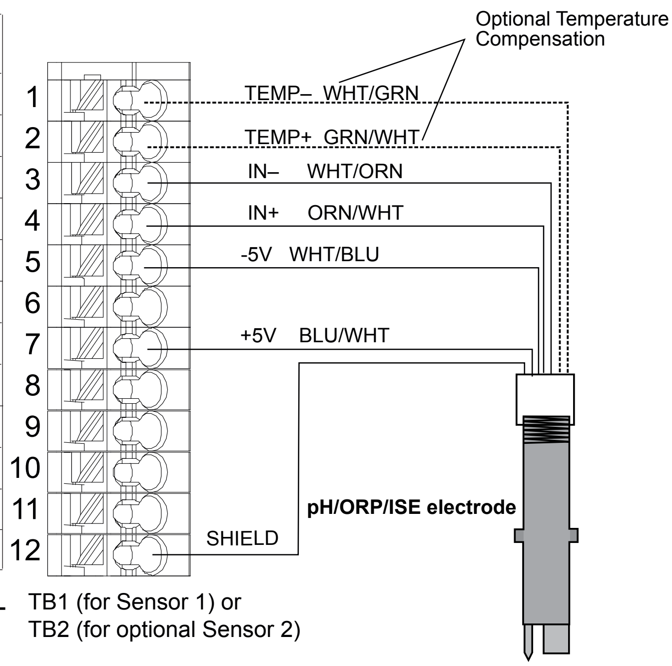
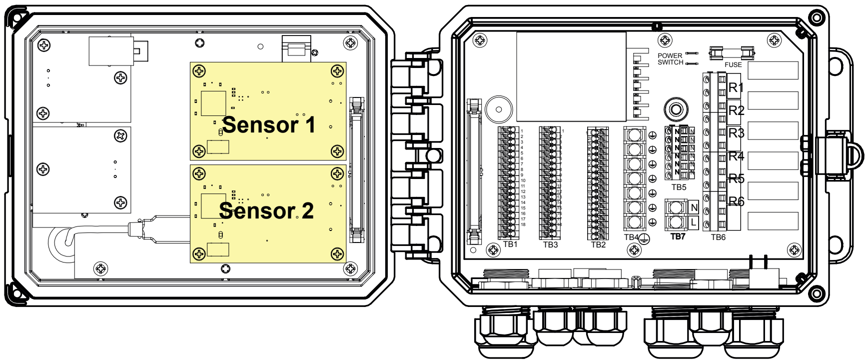
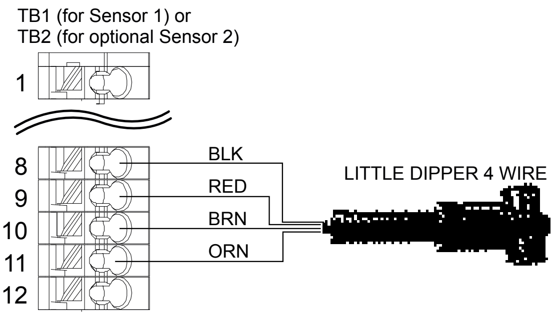


Figure 9 pH/ORP/ISE Sensor Input Wiring

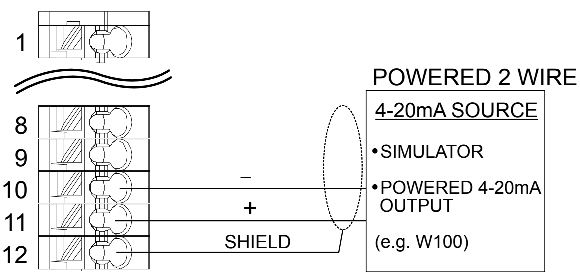


SENSOR LABEL

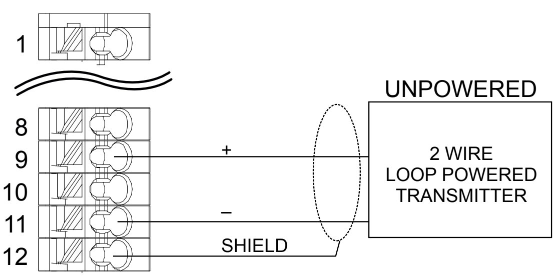
	CCOND	pH/ORP DIS	2 Wire Loop	2 Wire Pwrd	3 Wire	4 Wire
1	TEMP–	TEMP–				
8					COM(–)	24V(-)
9			+24V		+24V	+24V
10				XMTR–		XMTR–
11			XMTR–	XMTR+	XMTR+	XMTR+
12		SHIELD or use DI SHIELD (TB3 7-12)				



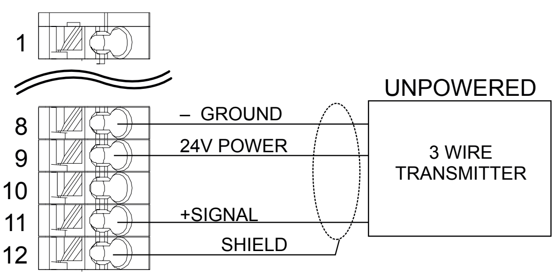
	CCOND	pH/ORP DIS	2 Wire Loop	2 Wire Pwrd	3 Wire	4 Wire
1	TEMP–	TEMP–				
8					COM(–)	24V(-)
9			+24V		+24V	+24V
10				XMTR–		XMTR–
11			XMTR–	XMTR+	XMTR+	XMTR+
12		SHIELD or use DI SHIELD (TB3 7-12)				



	CCOND	pH/ORP DIS	2 Wire Loop	2 Wire Pwrd	3 Wire	4 Wire
1	TEMP–	TEMP–				
8					COM(–)	24V(-)
9			+24V		+24V	+24V
10				XMTR–		XMTR–
11			XMTR–	XMTR+	XMTR+	XMTR+
12		SHIELD or use DI SHIELD (TB3 7-12)				

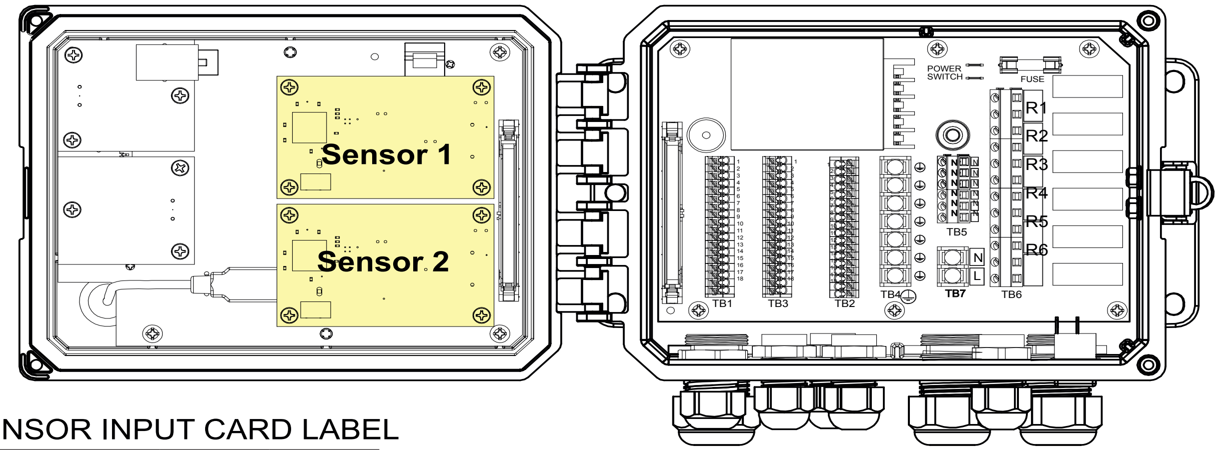


	CCOND	pH/ORP DIS	2 Wire Loop	2 Wire Pwrd	3 Wire	4 Wire
1	TEMP–	TEMP–				
8					COM(–)	24V(-)
9			+24V		+24V	+24V
10				XMTR–		XMTR–
11			XMTR–	XMTR+	XMTR+	XMTR+
12		SHIELD or use DI SHIELD (TB3 7-12)				



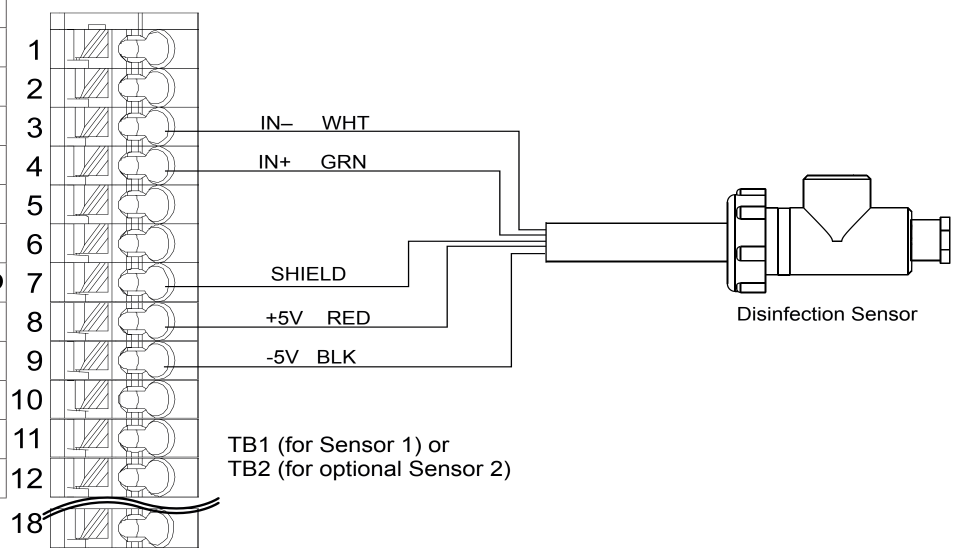
NOTE: To program the combination card analog input, you must go to Inputs menu, then enter the analog input (S13 or S23), scroll down to Transmitter, and select the type of transmitter from the list.

Figure 11a Combination Card 4-20mA Dual Sensor Input Wiring



SENSOR INPUT CARD LABEL

	ECOND	CCOND	pH/ORP DIS
1	TEMP–	TEMP–	TEMP–
2	TEMP+	TEMP+	TEMP+
3	R-SHLD		IN–
4		RCV	IN+
5	RCV–		
6	RCV+		
7	X-SHLD	SHIELD	SHIELD
8			+5V
9			–5V
10	XMT+	XMT	
11	XMT–		
12	⏚		



	CCOND	pH/ORP DIS	2 Wire Loop	2 Wire Pwrd	3 Wire	4 Wire
1	TEMP–	TEMP–				
2	TEMP+	TEMP+				
3	SHIELD	IN–				
4	RCV	IN+				
5		–5V				
6	XMT					
7		+5V				
8					COM(–)	24V(-)
9			+24V		+24V	+24V
10				XMTR–		XMTR–
11			XMTR–	XMTR+	XMTR+	XMTR+
12		SHIELD or use DI SHIELD (TB3 7-12)				

COMBINATION SENSOR/ANALOG CARD LABEL

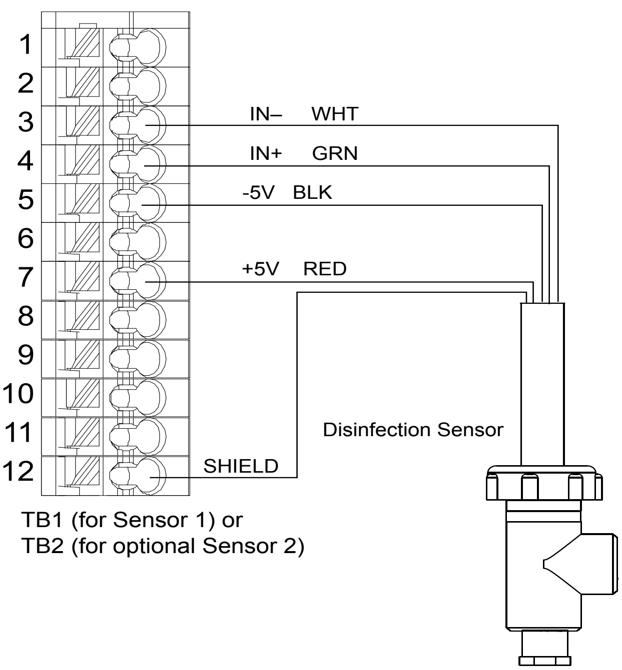
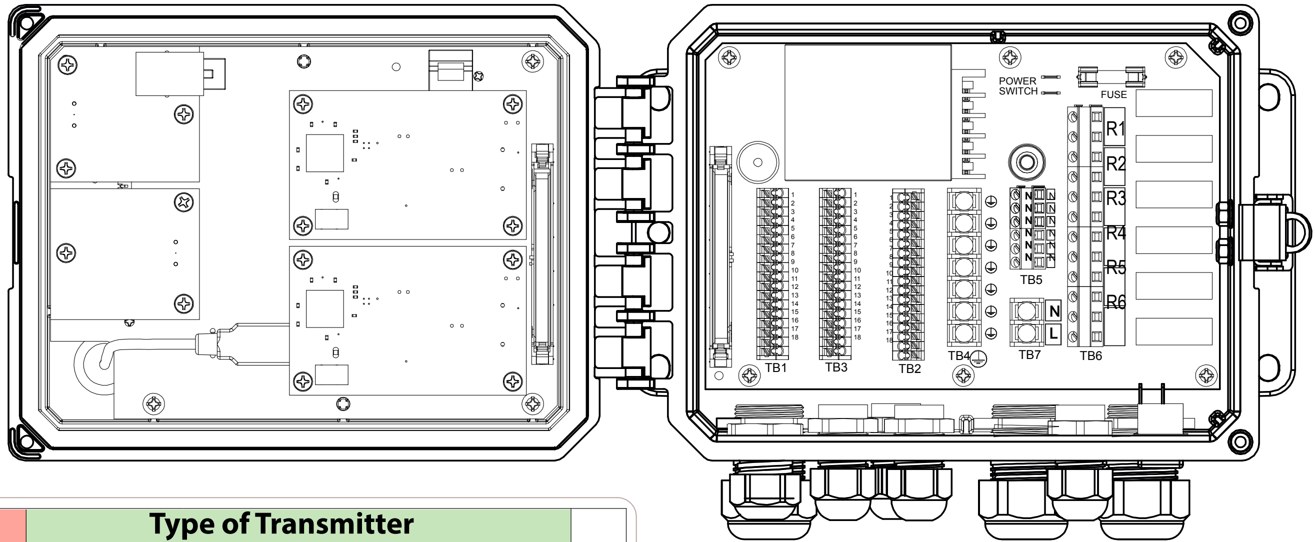
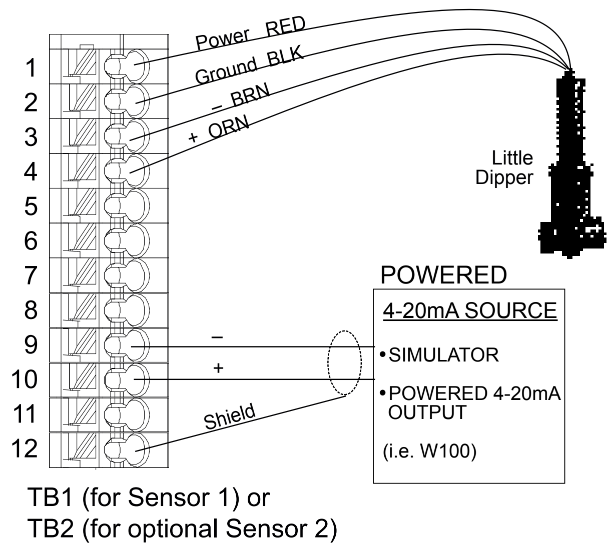


Figure 10 Disinfection Sensor Input Wiring



TB Pin#	Type of Transmitter				AI#
	2 Wire Loop	2 Wire Powered	3 Wire	4 Wire	
1	+24V		+24V	+24V	1
2				24V(–)	
3		XMTR–		XMTR–	
4	XMTR–	XMTR+	XMTR+	XMTR+	
5			COM(-)		
6	SHIELD	SHIELD	SHIELD	SHIELD	
7	+24V		+24V	+24V	2
8				24V(–)	
9		XMTR–		XMTR–	
10	XMTR–	XMTR+	XMTR+	XMTR+	
11			COM(-)		
12	SHIELD	SHIELD	SHIELD	SHIELD	



TB Pin#	Type of Transmitter				AI#
	2 Wire Loop	2 Wire Powered	3 Wire	4 Wire	
1	+24V		+24V	+24V	1
2				24V(–)	
3		XMTR–		XMTR–	
4	XMTR–	XMTR+	XMTR+	XMTR+	
5			COM(-)		
6	SHIELD	SHIELD	SHIELD	SHIELD	
7	+24V		+24V	+24V	2
8				24V(–)	
9		XMTR–		XMTR–	
10	XMTR–	XMTR+	XMTR+	XMTR+	
11			COM(-)		
12	SHIELD	SHIELD	SHIELD	SHIELD	

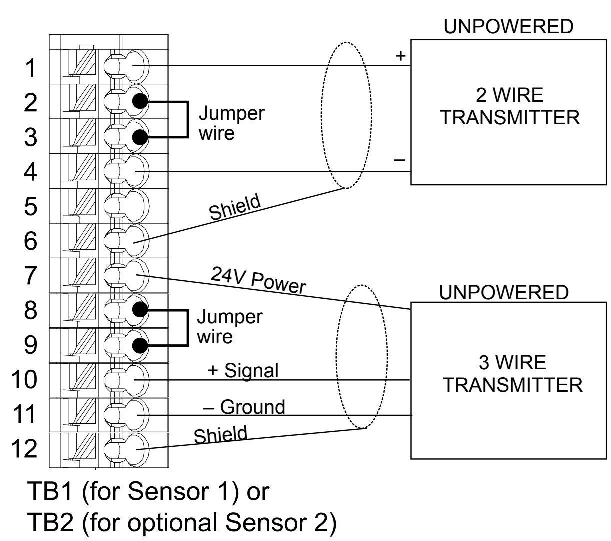


Figure 11 Dual 4-20mA Sensor Input Wiring

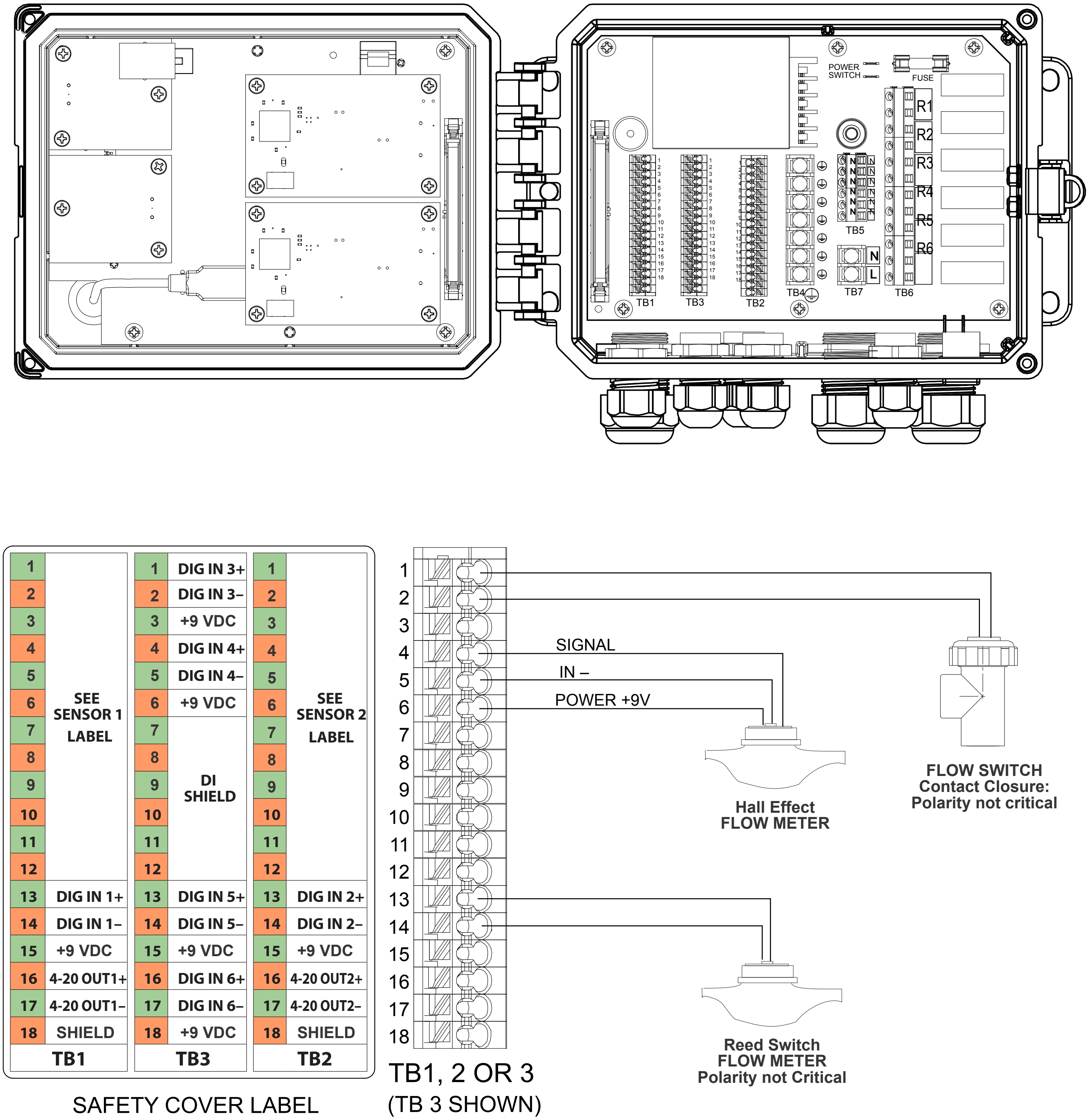


Figure 12 Digital Input Wiring

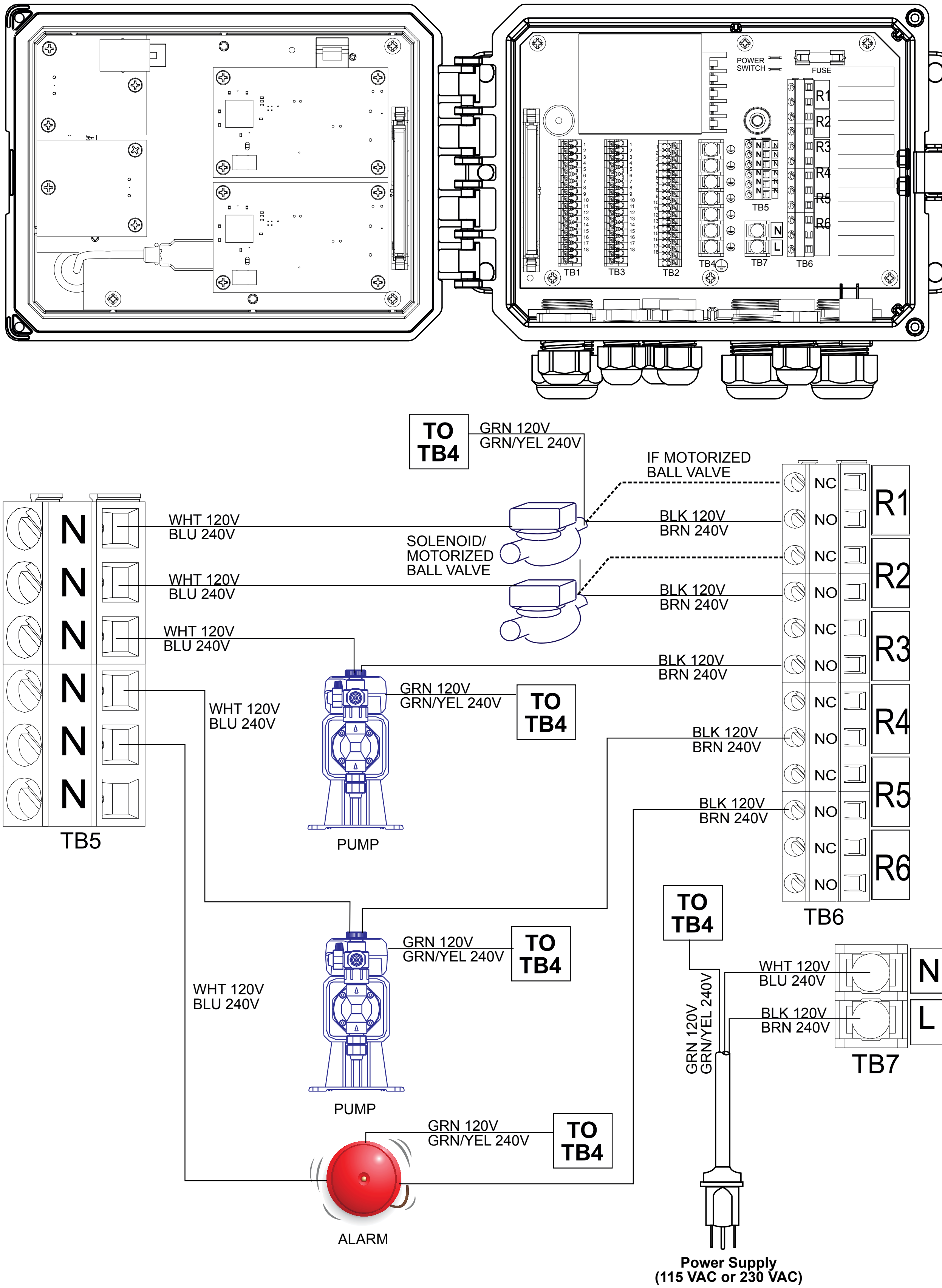


Figure 13 W600 AC Power & Relay Output Wiring

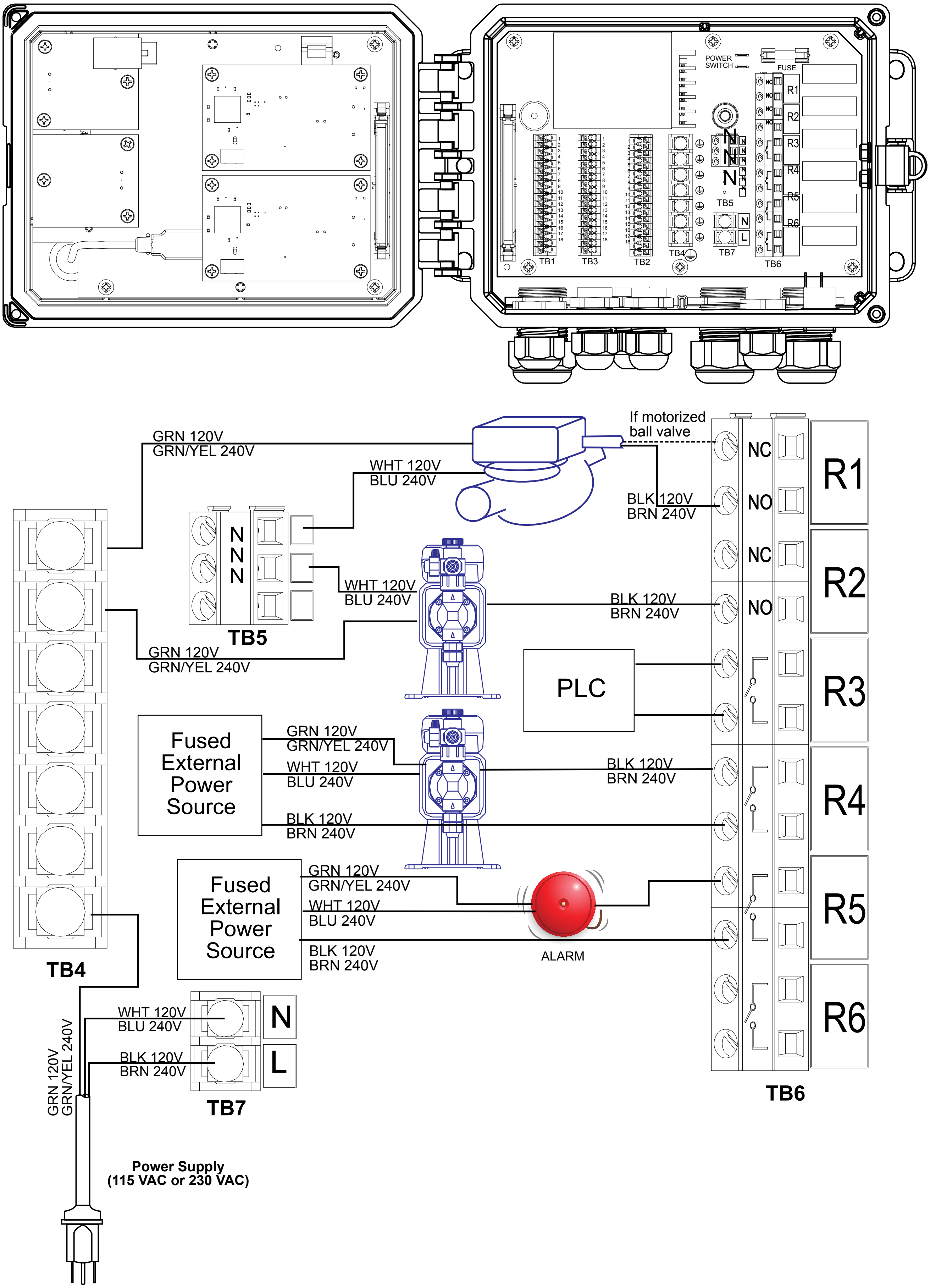


Figure 14 W610 AC Power & Relay Output Wiring

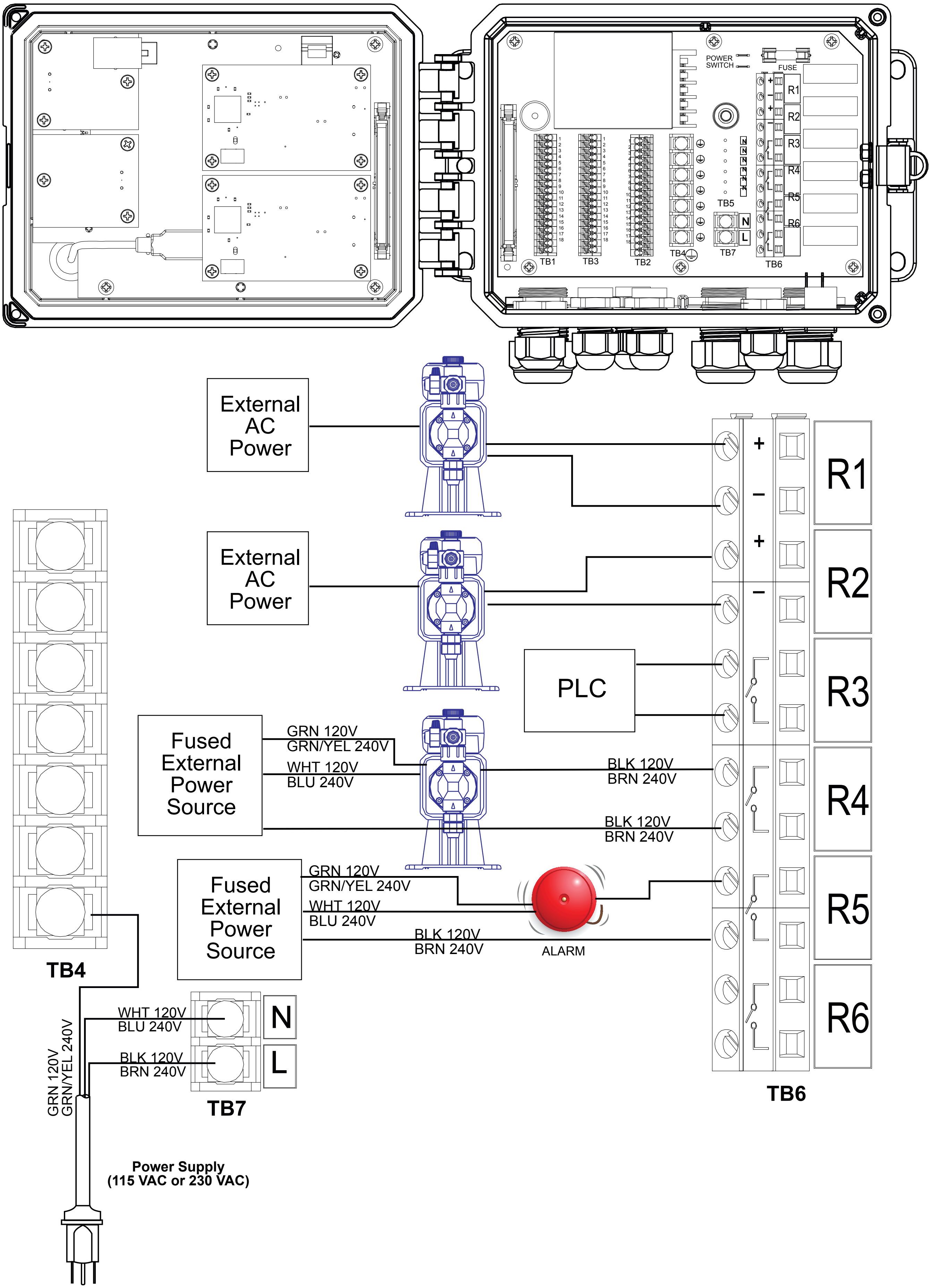


Figure 15 W620 AC Power & Relay Output Wiring

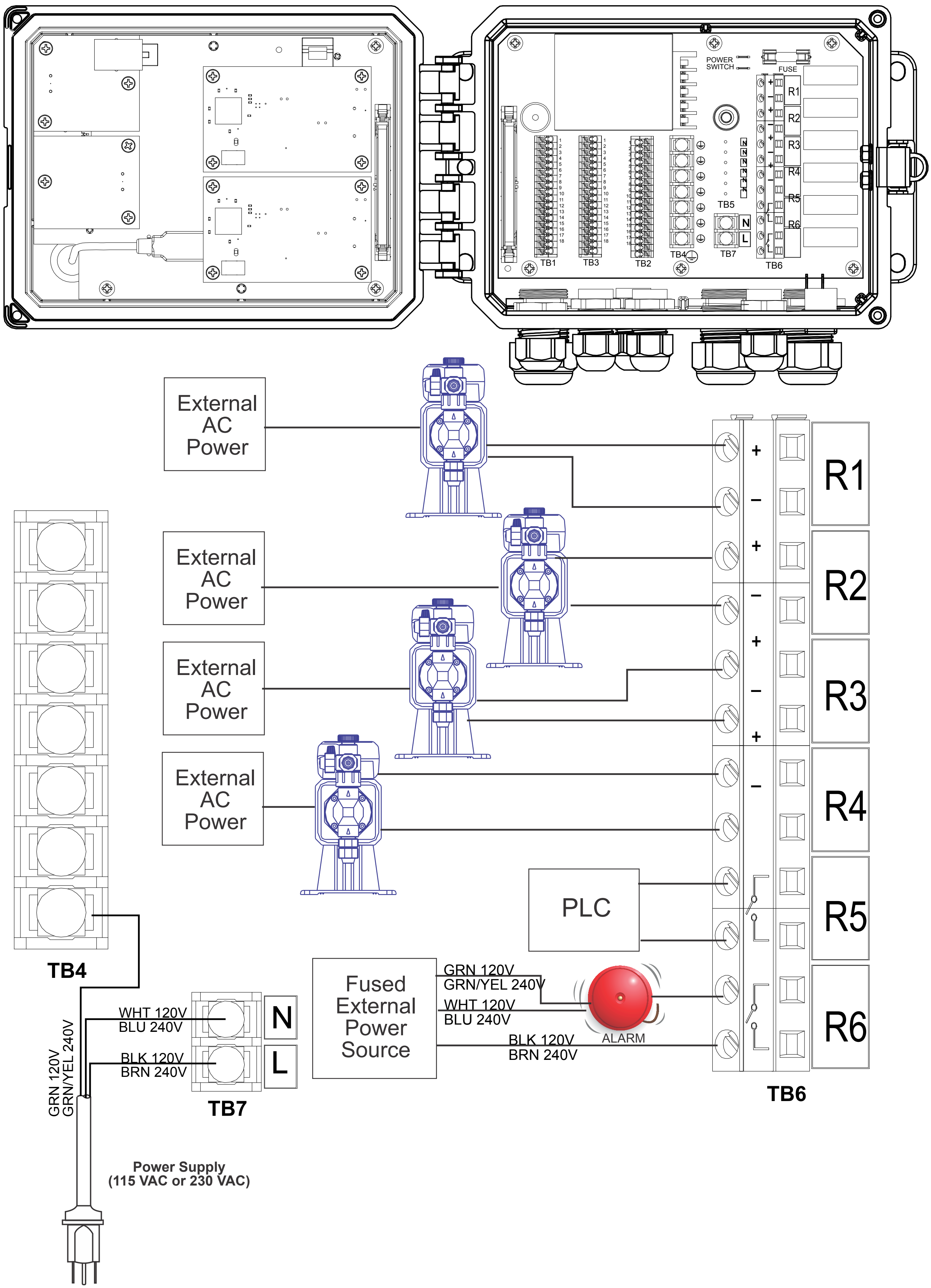


Figure 16 W640 AC Power & Relay Output Wiring

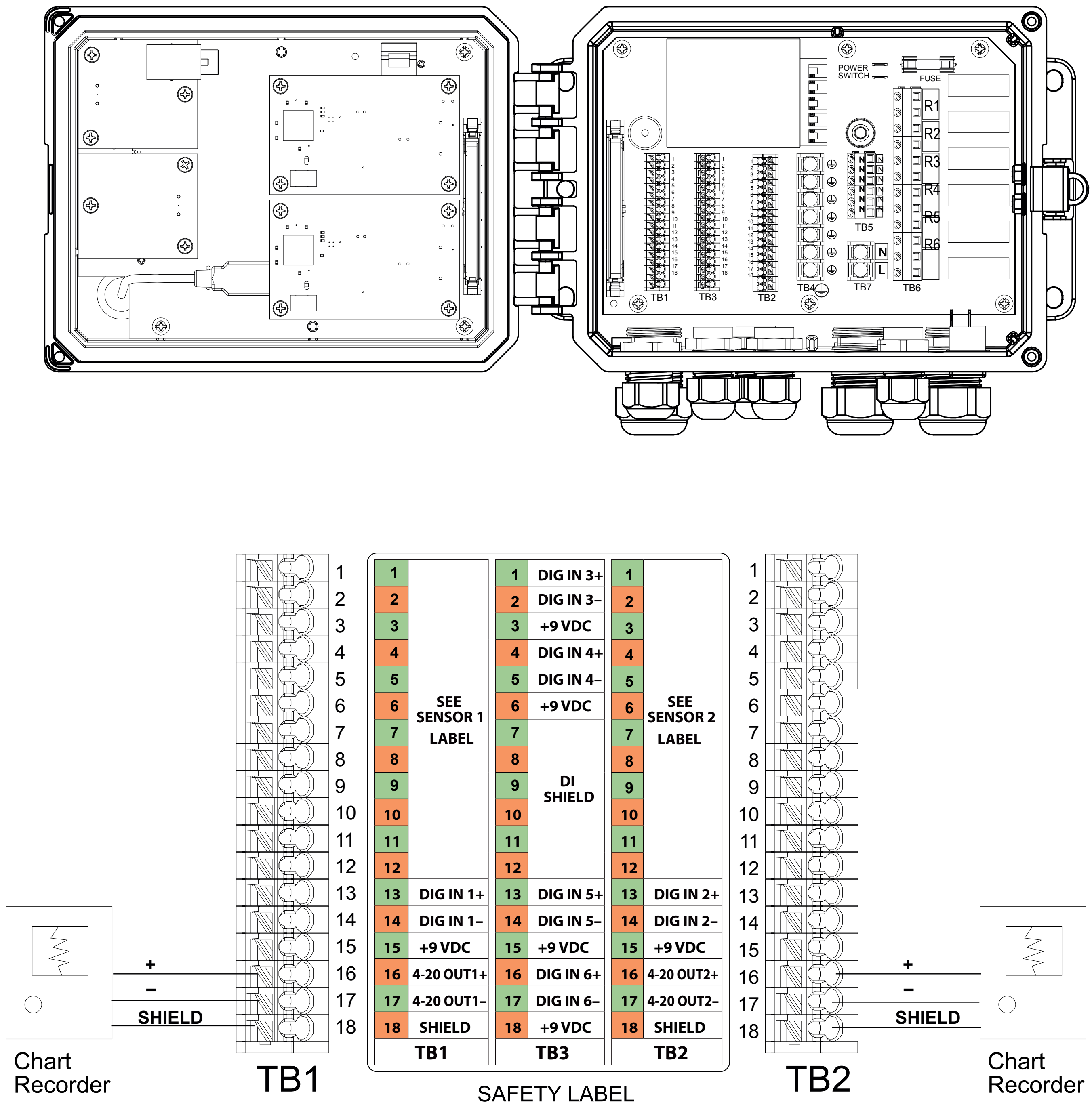


Figure 17 Analog Output Wiring

4.0 FUNCTION OVERVIEW

4.1 Front Panel

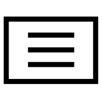
Figure 18 Front Panel

4.2 Touchscreen

A Home screen is displayed while the controller is on. This display shows a user-defined list of input readings or status of outputs. Touching any of the items on the Home Screen will bring up the item's Details Screen, where you can access calibration and setting menus. If more than four items have been selected to be displayed on the Home screen, the display will toggle between the first group of up to four and the next group. A "pause button" icon, when touched, stops the automatic toggling. Touching the down arrow icon allows for manual toggling. Touching the "play button" icon enables automatic toggling again. Touching the Menu icon brings up the Main Menu screen.

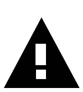
4.3 Icons

The following icons appear on the Home screen.

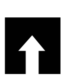


The Main Menu icon brings you to the list of menu options listed below.

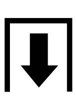
The following icons appear on the Main Menu screen. Touch the icon to get to the menu selections.



Alarm Menu



Inputs Menu



Outputs Menu

Configuration Menu

HOA Menu

Graph Menu

Home Page

Other icons may appear in the menu screens.

Calibration icon appears in sensor input menus and brings up the calibration menu

Cancel icon aborts a calibration or setting change

The Page Down icon scrolls down to a new page in a list of options.

The Page Up icon scrolls up to a new page in a list of options.

The Back/Return icon returns the display to the previous screen

The Make Character Higher icon is used when making an alphanumeric entry

The Make Character Lower icon is used when making an alphanumeric entry

The Move Cursor icon is used to scroll left to right within an alphanumeric entry

The Confirm icon accepts a choice, finishes entering data, or advances to the next calibration step

Settings Menu

The Character Delete icon deletes part of an alphanumeric entry

The Shift icon switches between upper and lower case alpha entry screens

The Next Screen icon moves to the next step in a calibration sequence. In a Graph it shifts the graph forward in time.

The Previous Screen icon moves back a step in a calibration sequence. In a Graph it shifts the graph backwards in time.

Overview of the use of icons

Changing Numeric Values

To change a number, use the Character Delete icon to the digit to be changed. If the new number will be negative, start with touching the minus sign, then use the numeric touchpad and decimal point to type the number (some entries must be integers and the decimal will be ignored and the setting rounded to the nearest integer). Once the value of the number is correct touch the Confirm icon to store the new value into memory, or touch the Cancel icon to leave the number at its previous value and go back.

Changing Names
To change the name used to identify an input or output, use the Move Cursor icon to the character to be changed and change it using either the Make Character Higher or Lower icons. Upper case and lower case letter, numbers, a blank space, period, plus and minus symbols are available. Move the cursor to the right and modify each character. Once the word is correct, use the Enter icon to store the new value into memory, or use the Cancel icon to leave the word at its previous value and go back.

Choosing from a List
Selecting the type of sensor, the units of measure of an input, or the control mode used for an output, the selection is picked from a list of available options. Touch the Page Up or Down icons if necessary to find the desired option, and then touch the option to highlight it. Touch the Confirm icon to store the new option into memory, or touch the Cancel icon to leave the selection at its previous value and go back.

Hand-Off-Auto Relay Mode
Touch the desired relay mode. In Hand mode the relay is forced on for a specified amount of time and when that time is up the relay returns to its previous mode, in Off mode the relay is always off until taken out of Off mode, and in Auto mode the relay is responding to control set points. Touch the Return icon to go back to the relay settings.

Interlock and Activate with Channels Menus
To select which digital inputs or relays will interlock this relay (Interlock Channels), or which digital inputs or relays will force this relay on (Activate with Channels), touch the input or relay number(s). The background of the selected item will turn dark. When finished selecting as many as needed, touch the Confirm icon to accept the changes or the Cancel icon to leave the selections at the previous settings and go back.

4.4 Startup

Initial Startup

After having mounted the enclosure and wired the unit, the controller is ready to be started. Plug in the controller and turn on the power switch to supply power to the unit. The display will briefly show the model number and then revert to the normal summary (Home) display. Refer to section 5 below for more details on each of the settings.

To return to the summary display, touch the Main Menu icon and then touch the Home icon.

Settings Menu (see section 5.4)

Choose language
Touch the Configuration Settings icon. Touch Global Settings. Touch the Scroll Down icon until the English word “Language” is displayed and then touch it. Touch the Scroll Down icon until your language is displayed and touch it. Touch the Confirm icon to change all menus to your language.

Set date (if necessary)
Touch the Scroll Up or Down icon until Date is displayed, and then touch it. Touch the Move Cursor icon to highlight the Day, and then use the numeric touchpad to change the date. Touch the Confirm icon to accept the change.

Set time (if necessary)
Touch the Scroll Up or Down icon until Time is displayed and then touch it. Touch the Move Cursor icon to highlight the digit to change, then use the numeric touchpad to change the time. Touch the Confirm icon to accept the change.

Set global units of measure
Touch the Scroll Up or Down icon until Global Units is displayed and then touch it. Touch the desired units. Touch the Confirm icon to accept the change.

Set temperature units of measure

Touch the Scroll Up or Down icon until Temp Units is displayed and then touch it. Touch the desired units. Touch the Confirm icon to accept the change.

Touch the Main Menu icon. Touch the Inputs icon.

Inputs (see section 5.2)

Program the settings for each input

The S11 sensor input will be displayed. Touch it to get to the Details screen. Touch the Settings icon. If the name of the sensor does not describe the typ[illegible] Scroll Down icon until Type is displayed. [illegible]ch the Scroll D[illegible] until the correct type of sensor [illegible] to highlight it. Touch the Confirm icon to accept the change. This will bring you back to the Settings screen. Finish the rest of the S1 settings. For disinfection sensors, choose the exact sensor in the Sensor menu. For contacting conductivity sensors, enter the cell constant. Select the units of measure. Enter the alarm set points and alarm deadband. Set the default temperature [illegible] temperature [illegible] if the tempera-ture signal becomes invalid.

When finished with S11, touch the Return icon until the list of inputs is displayed. Touch the Scroll Down icon and repeat the process for each input.

The S12 temperature input Element s[illegible] sensor type has been set. If not, select the correct temperature element and set the alarm set points and alarm deadband. Generic, ORP and disinfection sensors do not have temperature signals and are preset to Unassigned.

[illegible]ure, return to the S12 Details screen, touch the Calibrate icon, and touch the Enter icon to perform a calibration. If either input card is a Dual Analog Input card (4-20mA[illegible] of sensor that will be connected. Select [illegible] be conn[illegible] the device can be calibrated on its own and the RAFA calibration will only be in units [illegible] if [illegible] not be calibrated on its own and the RAFA will need to b[illegible] eer-[illegible]

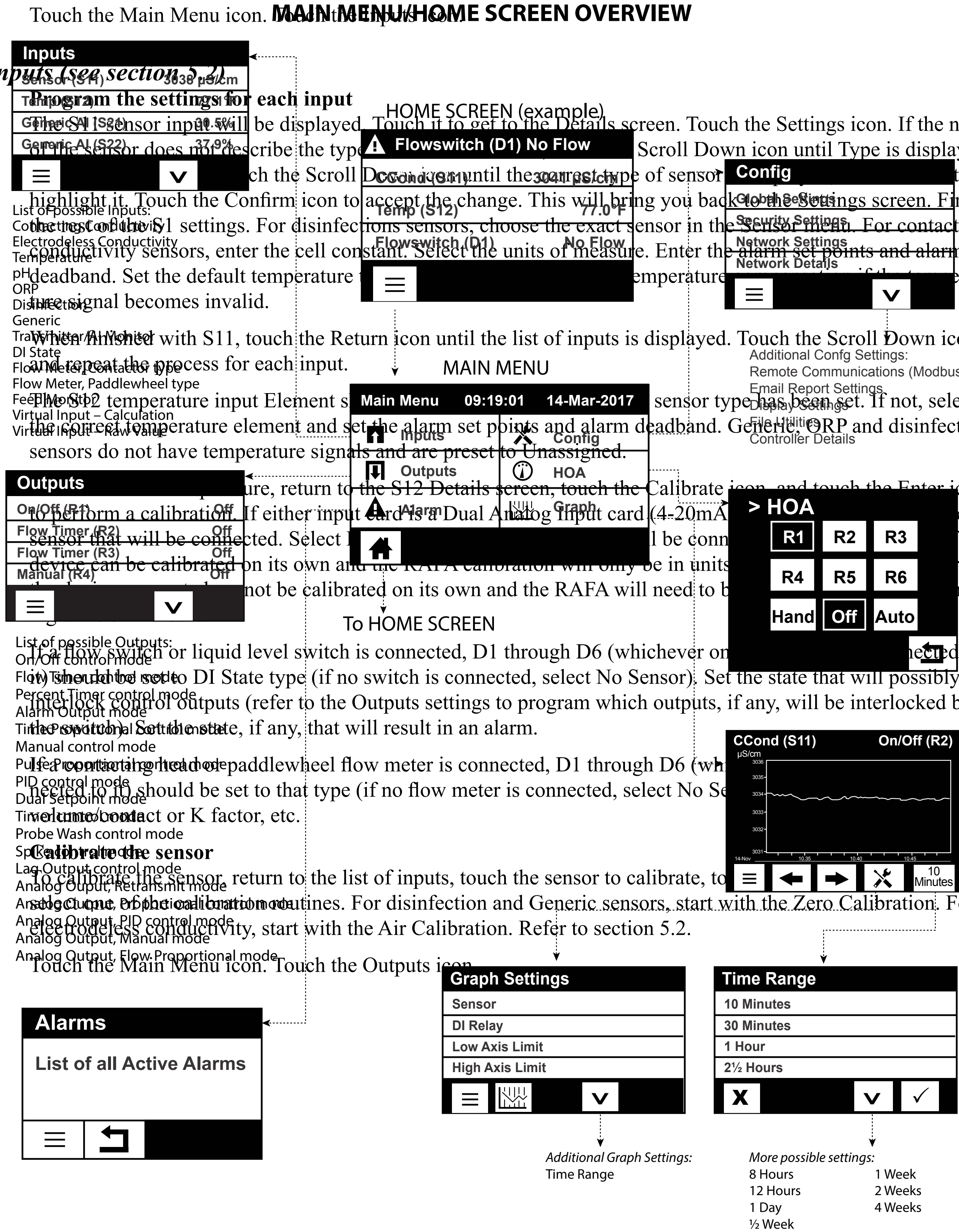
If a flow switch or liquid level switch is connected, D1 through D6 (whichever on[illegible]ected to it) should be set to DI State type (if no switch is connected, select No Sensor). Set the state that will possibly interlock control outputs (refer to the Outputs settings to program which outputs, if any, will be interlocked by the switch). Set the state, if any, that will result in an alarm.

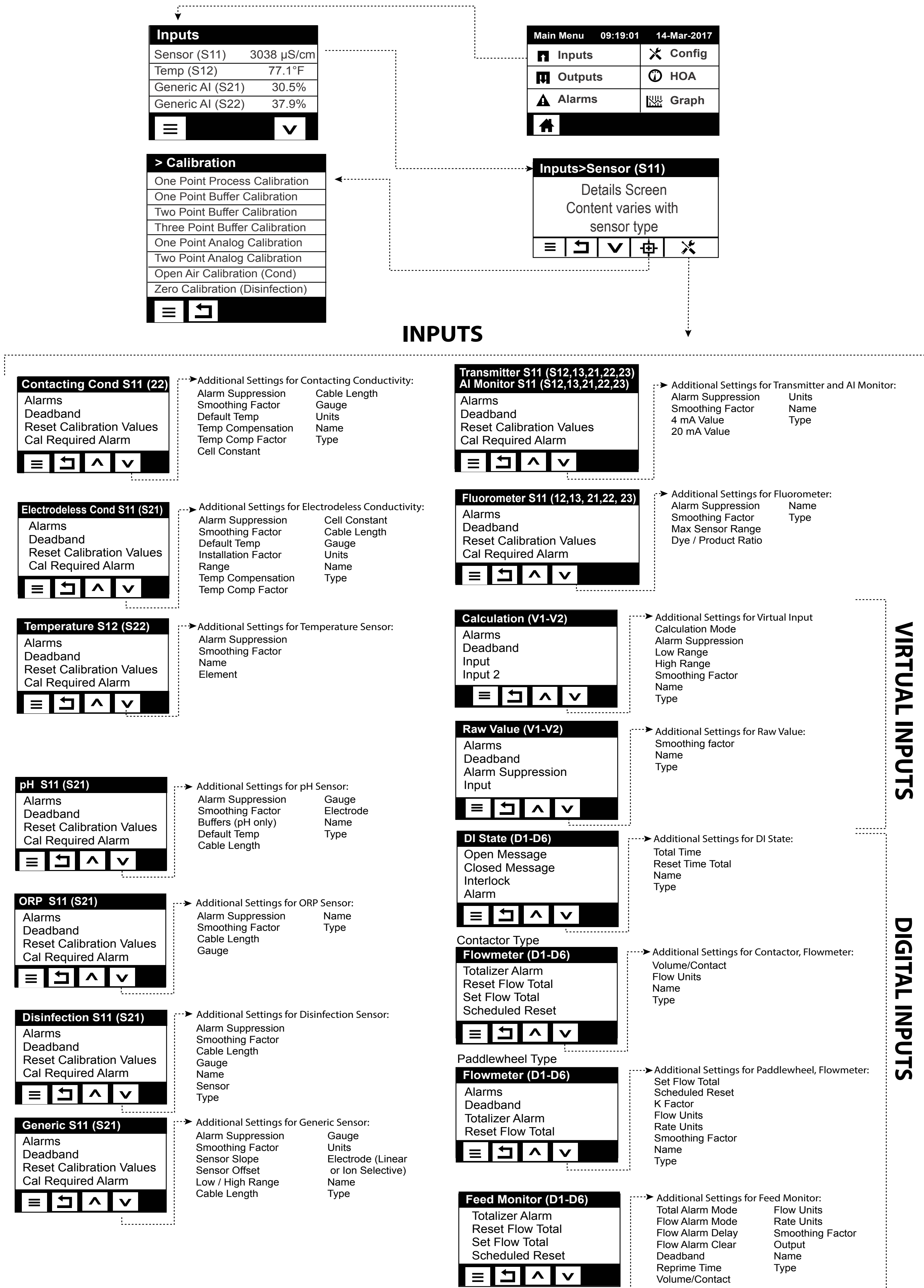
If a contacting head or paddlewheel flow meter is connected, D1 through D6 (wh[illegible] con-nected to it) should be set to that type (if no flow meter is connected, select No Se[illegible] ure, volume/contact or K factor, etc.

Calibrate the sensor

To calibrate the sensor, return to the list of inputs, touch the sensor to calibrate, to[illegible] select one of the calibration routines. For disinfection and Generic sensors, start with the Zero Calibration. For electrodeless conductivity, start with the Air Calibration. Refer to section 5.2.

Touch the Main Menu icon. Touch the Outputs icon.




Inputs
Sensor (S11) 3038 µS/cm
Temp (S12) 77.1°F
Generic AI (S21) 30.5%
Generic AI (S22) 37.9%
Main Menu 09:19:01 14-Mar-2017
Inputs
Config
Outputs
HOA
Alarms
Graph
> Calibration
One Point Process Calibration
One Point Buffer Calibration
Two Point Buffer Calibration
Three Point Buffer Calibration
One Point Analog Calibration
Two Point Analog Calibration
Open Air Calibration (Cond)
Zero Calibration (Disinfection)
Inputs>Sensor (S11)
Details Screen
Content varies with
sensor type
INPUTS
Contacting Cond S11 (22)
Alarms
Deadband
Reset Calibration Values
Cal Required Alarm
Additional Settings for Contacting Conductivity:
Alarm Suppression
Smoothing Factor
Default Temp
Temp Compensation
Temp Comp Factor
Cell Constant
Cable Length
Gauge
Units
Name
Type
Transmitter S11 (S12,13,21,22,23)
AI Monitor S11 (S12,13,21,22,23)
Alarms
Deadband
Reset Calibration Values
Cal Required Alarm
Additional Settings for Transmitter and AI Monitor:
Alarm Suppression
Smoothing Factor
4 mA Value
20 mA Value
Units
Name
Type
Electrodeless Cond S11 (S21)
Alarms
Deadband
Reset Calibration Values
Cal Required Alarm
Additional Settings for Electrodeless Conductivity:
Alarm Suppression
Smoothing Factor
Default Temp
Installation Factor
Range
Temp Compensation
Temp Comp Factor
Cell Constant
Cable Length
Gauge
Units
Name
Type
Fluorometer S11 (12,13, 21,22, 23)
Alarms
Deadband
Reset Calibration Values
Cal Required Alarm
Additional Settings for Fluorometer:
Alarm Suppression
Smoothing Factor
Max Sensor Range
Dye / Product Ratio
Name
Type
Temperature S12 (S22)
Alarms
Deadband
Reset Calibration Values
Cal Required Alarm
Additional Settings for Temperature Sensor:
Alarm Suppression
Smoothing Factor
Name
Element
Calculation (V1-V2)
Alarms
Deadband
Input
Input 2
Additional Settings for Virtual Input
Calculation Mode
Alarm Suppression
Low Range
High Range
Smoothing Factor
Name
Type
VIRTUAL INPUTS
Raw Value (V1-V2)
Alarms
Deadband
Alarm Suppression
Input
Additional Settings for Raw Value:
Smoothing factor
Name
Type
pH S11 (S21)
Alarms
Deadband
Reset Calibration Values
Cal Required Alarm
Additional Settings for pH Sensor:
Alarm Suppression
Smoothing Factor
Buffers (pH only)
Default Temp
Cable Length
Gauge
Electrode
Name
Type
DI State (D1-D6)
Open Message
Closed Message
Interlock
Alarm
Additional Settings for DI State:
Total Time
Reset Time Total
Name
Type
ORP S11 (S21)
Alarms
Deadband
Reset Calibration Values
Cal Required Alarm
Additional Settings for ORP Sensor:
Alarm Suppression
Smoothing Factor
Cable Length
Gauge
Name
Type
Contactor Type
Flowmeter (D1-D6)
Totalizer Alarm
Reset Flow Total
Set Flow Total
Scheduled Reset
Additional Settings for Contactor, Flowmeter:
Volume/Contact
Flow Units
Name
Type
DIGITAL INPUTS
Disinfection S11 (S21)
Alarms
Deadband
Reset Calibration Values
Cal Required Alarm
Additional Settings for Disinfection Sensor:
Alarm Suppression
Smoothing Factor
Cable Length
Gauge
Name
Sensor
Type
Paddlewheel Type
Flowmeter (D1-D6)
Alarms
Deadband
Totalizer Alarm
Reset Flow Total
Additional Settings for Paddlewheel, Flowmeter:
Set Flow Total
Scheduled Reset
K Factor
Flow Units
Rate Units
Smoothing Factor
Name
Type
Generic S11 (S21)
Alarms
Deadband
Reset Calibration Values
Cal Required Alarm
Additional Settings for Generic Sensor:
Alarm Suppression
Smoothing Factor
Sensor Slope
Sensor Offset
Low / High Range
Cable Length
Gauge
Units
Electrode (Linear
or Ion Selective)
Name
Type
Feed Monitor (D1-D6)
Totalizer Alarm
Reset Flow Total
Set Flow Total
Scheduled Reset
Additional Settings for Feed Monitor:
Total Alarm Mode
Flow Alarm Mode
Flow Alarm Delay
Flow Alarm Clear
Deadband
Reprime Time
Volume/Contact
Flow Units
Rate Units
Smoothing Factor
Output
Name
Type

OUTPUTS (RELAYS R1-R6)

Main Menu 09:19:01 14-Mar-2017

Inputs	Config
Outputs	HOA
Alarms	Graph

Outputs

On/Off (R1)	Off
Inhibitor (R2)	Off
Flow Timer (R3)	Off
Manual (R4)	Off

Outputs>On/Off (R1)

Details Screen
Content varies with
output type

On/Off (R1-R6)
HOA Setting
Set Point
Deadband
Duty Cycle Period

Additional Settings for On/OFF Mode:
Duty Cycle, On Delay Time, Off Delay Time, Output Time Limit, Reset Output Timeout, Interlock Channels, Activate with Channels, Minimum Relay Cycle, Hand Time Limit, Reset Time Total, Input, Direction, Name, Mode

Flow Timer (R1-R6)
HOA Setting
Feed Duration
Accumulated Volume
Output Time Limit

Additional Settings for Flow Timer Mode:
Reset Output Timeout, Interlock Channels, Activate with Channels, Minimum Relay Cycle, Hand Time Limit, Reset Time Total, Flow Input, Flow Input 2, Name, Mode

Only if HVAC mode is enabled
Bleed & Feed (R1-R6)
HOA Setting
Feed Time Limit
Output Time Limit
Reset Output Timeout

Additional Settings for Bleed & Feed Mode:
Interlock Channels, Activate with Channels, Minimum Relay Cycle, Hand Time Limit, Reset Time Total, Bleed, Name, Mode

Only if HVAC mode is enabled
Bleed then Feed (R1-R6)
HOA Setting
Feed Percentage
Feed Time Limit
Reset Timer

Additional Settings for Bleed then Feed Mode:
Output Time Limit, Reset Output Timeout, Interlock Channels, Activate with Channels, Minimum Relay Cycle, Hand Time Limit, Reset Time Total, Bleed, Name, Mode

Percent Timer (R1-R6)
HOA Setting
Sample Period
Feed Percentage
Output Time Limit

Additional Settings for Percent Timer Mode:
Reset Output Timeout, Interlock Channels, Activate with Channels, Minimum Relay Cycle, Hand Time Limit, Reset Time Total, Name, Mode

Only if HVAC mode is enabled
Biocide Timer (R1-R6)
HOA Setting
Event 1 (through 10)
Repetition
Week
Day
Start Time
Duration

Additional Settings for Biocide Timer Mode:
Bleed, Prebleed Time, Prebleed To, Cond Input, Bleed Lockout, Add Last Missed, Interlock Channels, Activate with Channels, Minimum Relay Cycle, Hand Time Limit, Reset Time Total, Name, Mode

Alarm (R1-R6)
HOA Setting
Alarm Mode
Select Alarms
Output

Additional Settings for Alarm Mode:
Interlock Channels, Activate with Channels, Minimum Relay Cycle, Hand Time Limit, Reset Time Total, Name, Mode

Time Prop (R1-R6)
HOA Setting
Set Point
Proportional Band
Sample Period

Additional Settings for Time Prop Mode:
Output Time Limit, Reset Output Timeout, Interlock Channels, Activate with Channels, Minimum Relay Cycle, Hand Time Limit, Reset Time Total, Input, Direction, Name, Mode

Only if HVAC mode is enabled
Int. Sampling (R1-R6)
HOA Setting
Set Point
Proportional Band
Deadband

Additional Settings for Intermittent Sampling Mode:
Sample Time, Hold Time, Maximum Blowdown, Wait Time, Output Time Limit, Reset Output Timeout, Interlock Channels, Activate with Channels, Min Relay Cycle, Hand Time Limit, Reset Time Total, Cond Input, Trap Sample, Name, Mode

Manual (R1-R16)
HOA Setting
On Delay Time
Off Delay Time
Output Time Limit

Additional Settings for Manual Mode:
Reset Output Timeout, Interlock Channels, Minimum Relay Cycle, Hand Time Limit, Reset Time Total, Name, Mode

Only if Relay Type is Pulse
Pulse Prop (R1-R6)
HOA Setting
Set Point
Proportional Band
Minimum/Maximum Output

Additional Settings for Pulse Prop Mode:
Maximum Rate, Interlock Channels, Activate with Channels, Minimum Relay Cycle, Hand Time Limit, Reset Time Total, Input, Direction, Name, Mode

Only if HVAC mode is disabled
Only if Relay Type is Pulse
PID Control (R1-R6)
HOA Setting
Set Point
Gain
Proportional Gain

Additional Settings for PID Control Mode:
Integral Time, Integral Gain, Derivative Time, Derivative Gain, Reset PID Integral, Minimum Output, Maximum Output, Maximum Rate, Input, Direction, Input Minimum, Input Maximum, Gain Form, Output Time Limit, Reset Output Timeout, Interlock Channels, Activate with Channels, Minimum Relay Cycle, Hand Time Limit, Reset Time Total, Name, Mode

Dual Setpoint (R1-R6)
HOA Setting
Set Point
Set Point 2
Deadband

Additional Settings for Dual Setpoint Mode:
Duty Cycle Period, Duty Cycle, On Delay Time, Off Delay Time, Output Time Limit, Reset Output Timeout, Interlock Channels, Activate with Channels, Minimum Relay Cycle, Hand Time Limit, Reset Time Total, Input, Direction, Name, Mode

Only if HVAC mode is disabled
Timer Control (R1-R6)
HOA Setting
Event 1 (through 10)
Repetition
Hourly
Week
Day
Events Per Day
Start Time
Duration

Additional Settings for Timer Control Mode:
Add Last Missed, Output Time Limit, Reset Output Timeout, Interlock Channels, Activate with Channels, Minimum Relay Cycle, Hand Time Limit, Reset Time Total, Name, Mode

Probe Wash (R1-R6)
HOA Setting
Event 1 (through 10)
Repetition
Hourly
Week
Day
Events Per Day
Start Time
Duration

Additional Settings for Probe Wash Mode:
Input, Input 2, Sensor Mode, Hold Time, Interlock Channels, Activate with Channels, Minimum Relay Cycle, Hand Time Limit, Reset Time Total, Name, Mode

Spike Control (R1-R6)
HOA Setting
Set point
Spike Set point
Deadband

Additional Settings for Spike Control Mode:
Duty Cycle Period, Duty Cycle, Event 1 (through 8), Repetition, Week, Day, Start Time, Duration, Input, Direction, Interlock Channels, Activate with Channels, Minimum Relay Cycle, Hand Time Limit, Reset Time Total, Name, Mode

Lag Control (R1-R6)
HOA Setting
Lead
Wear Leveling*
Wear Cycle Time*

Additional Settings for Lag Control Mode:
Activation Mode*, Set Point, Set Point 2, Deadband, Delay Time*, Output Time Limit, Reset Output Timeout, Interlock Channels, Activate with Channels, Min Relay Cycle, Hand Time Limit, Reset Time Total, Name, Mode

* See section 5.3.18

OUTPUTS (ANALOG A1-A2)

Outputs

On/Off (R1) Off
Inhibitor (R2) Off
Flow Timer (R3) Off
Manual (R4) Off

Main Menu 09:19:01 14-Mar-2017

Inputs | Config
Outputs | HOA
Alarms | Graph

Outputs>On/Off (R1)

Details Screen
Content varies with
output type

Retransmit (A1-A2)

HOA Setting
4 mA Value
20 mA Value
Hand Output

Additional settings for Retransmit Mode:
Error Output
Reset Time Total
Input
Name
Mode

Proportional Control (A1-A2)

HOA Setting
Set Point
Proportional Band
Min Output

Additional Settings for Proportional Control Mode:
Max Output
Output Time Limit
Reset Output Timeout
Interlock Channels
Activate with Channels
Hand Output
Hand Time Limit
Reset Time Total
Off Mode Output
Error Output
Input
Direction
Name
Mode

PID Control (A1)

HOA Setting
Set Point
Gain
Proportional Gain

Only if HVAC mode is disabled

Additional Settings for PID Control Mode:
Integral Time
Integral Gain
Derivative Time
Derivative Gain
Reset PID Integral
Min Output
Max Output
Max Rate
Output Time Limit
Reset Output Timeout
Interlock Channels
Activate with Channels
Hand Output
Hand Time Limit
Off Mode Output
Error Output
Reset Time Total
Input
Direction
Input Minimum
Input Maximum
Gain Form
Name
Mode

Manual Control (A1-A2)

HOA Setting
Interlock Channels
Activate with Channels
Minimum Relay Cycle

Additional Settings for Manual Control Mode:
Hand Time Limit
Reset Time Total
Name
Mode

Flow Prop (A1-A2)

HOA Setting
Target
Pump Capacity
Pump Setting

Additional Settings for Flow Prop Control Mode:
Specific Gravity
Output Time Limit
Reset Output Timeout
Interlock Channels
Activate with Channels
Hand Output
Hand Time Limit
Off Mode Output
Error Output
Reset Time Total
Flow Input
Name
Mode

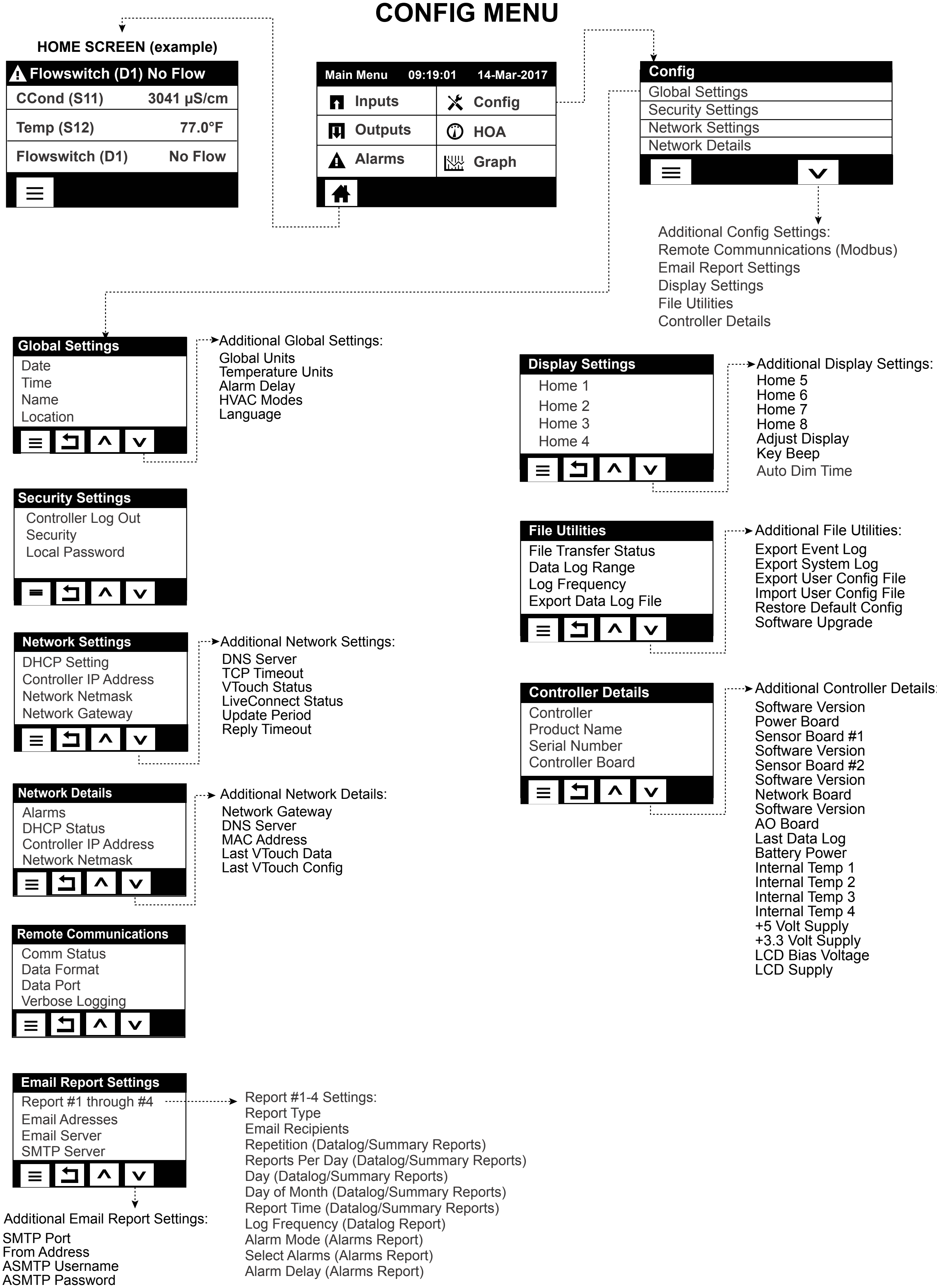
Lag Output (A1-A2)

HOA Setting
Lead
Reset Time Total
Output Time Limit

Additional settings for
Lag Output Mode:

Reset Output Timeout
Wear Leveling
Wear Cycle Time
Name
Mode

CONFIG MENU


HOME SCREEN (example)
Flowswitch (D1) No Flow
CCond (S11) 3041 µS/cm
Temp (S12) 77.0°F
Flowswitch (D1) No Flow
Main Menu 09:19:01 14-Mar-2017
Inputs
Config
Outputs
HOA
Alarms
Graph
Config
Global Settings
Security Settings
Network Settings
Network Details
Additional Config Settings:
Remote Communications (Modbus)
Email Report Settings
Display Settings
File Utilities
Controller Details
Global Settings
Date
Time
Name
Location
Additional Global Settings:
Global Units
Temperature Units
Alarm Delay
HVAC Modes
Language
Display Settings
Home 1
Home 2
Home 3
Home 4
Additional Display Settings:
Home 5
Home 6
Home 7
Home 8
Adjust Display
Key Beep
Auto Dim Time
Security Settings
Controller Log Out
Security
Local Password
File Utilities
File Transfer Status
Data Log Range
Log Frequency
Export Data Log File
Additional File Utilities:
Export Event Log
Export System Log
Export User Config File
Import User Config File
Restore Default Config
Software Upgrade
Network Settings
DHCP Setting
Controller IP Address
Network Netmask
Network Gateway
Additional Network Settings:
DNS Server
TCP Timeout
VTouch Status
LiveConnect Status
Update Period
Reply Timeout
Controller Details
Controller
Product Name
Serial Number
Controller Board
Additional Controller Details:
Software Version
Power Board
Sensor Board #1
Software Version
Sensor Board #2
Software Version
Network Board
Software Version
AO Board
Last Data Log
Battery Power
Internal Temp 1
Internal Temp 2
Internal Temp 3
Internal Temp 4
+5 Volt Supply
+3.3 Volt Supply
LCD Bias Voltage
LCD Supply
Network Details
Alarms
DHCP Status
Controller IP Address
Network Netmask
Additional Network Details:
Network Gateway
DNS Server
MAC Address
Last VTouch Data
Last VTouch Config
Remote Communications
Comm Status
Data Format
Data Port
Verbose Logging
Email Report Settings
Report #1 through #4
Email Adresses
Email Server
SMTP Server
Report #1-4 Settings:
Report Type
Email Recipients
Repetition (Datalog/Summary Reports)
Reports Per Day (Datalog/Summary Reports)
Day (Datalog/Summary Reports)
Day of Month (Datalog/Summary Reports)
Report Time (Datalog/Summary Reports)
Log Frequency (Datalog Report)
Alarm Mode (Alarms Report)
Select Alarms (Alarms Report)
Alarm Delay (Alarms Report)
Additional Email Report Settings:
SMTP Port
From Address
ASMTP Username
ASMTP Password

Outputs (see section 5.3)

Program the settings for each output

The R1 relay output will be displayed. Touch the relay field to get to the Details screen. Touch the Settings icon. If the name of the relay does not describe the control mode desired, touch the Scroll Down icon until Mode field is displayed. Touch the Mode field. Touch the Scroll Down icon until the correct control mode is displayed, then touch the Confirm icon to accept the change. This will bring you back to the Settings screen. Finish the rest of the R1 settings.

If you want the output to be interlocked by a flow switch or by another output being active, enter the Interlock Channels menu and select the input or output channel that will interlock this output.
The default is for the output to be in Off mode, where the output does not react to the settings. Once all settings for that output are complete, enter the HOA Setting menu and change it to Auto.
Repeat for each output.

Normal Startup

Startup is a simple process once your set points are in memory. Simply check your supply of chemicals, turn on the controller, calibrate it if necessary and it will start controlling.

4.5 Shut Down

To shut the controller down, simply turn off the power. Programming remains in memory. It is important that the pH/ORP electrode remains wet. If the shutdown is expected for any longer than a day, and it is possible for the electrode to dry out, remove the electrode from the tee and store it in pH 4 buffer or cooling tower water. Take care to avoid freezing temperatures when storing the pH/ORP electrodes to avoid breakage of the glass.

5.0 OPERATION using the touchscreen

These units control continuously while power is applied. Programming is accomplished either via the touchscreen or the optional Ethernet connection. See section 6.0 for Ethernet instructions.

To view the readings of each sensor, or whatever user-defined list of parameters that has been set, touch the Home icon if not already there. The menus for each of these parameters may be accessed directly by touching the parameter.

Keep in mind that even while browsing through menus, the unit is still controlling.

Touch the Main Menu icon from the home page to access all settings. The menu structure is grouped by alarms, inputs and outputs. Under the Configuration menu will be general settings such as the clock, the language, etc. that do not have an input or output associated with it. Each input has its own menu for calibration and unit selection as needed. Each output has its own setup menu including set points, timer values and operating modes as needed.

5.1 Alarms Menu

Touch the Alarms icon to view a list of active alarms. If there are more than six active alarms, the Page Down icon will be shown; touch this icon to bring up the next page of alarms.

Touch the Main Menu icon to go back to the previous screen.

5.2 Inputs Menu

Touch the Inputs icon to view a list of all sensor and digital inputs. The Page Down icon pages down the list of inputs, the Page Up icon pages up the list of inputs, the Main Menu icon brings back the previous screen.

Touch the input to access that input's details, calibration (if applicable) and settings.

Sensor Input Details

The details for any type of sensor input include the current value read, alarms, the raw (uncalibrated) signal, the sensor type, and the calibration gain and offset. If the sensor has automatic temperature compensation, then the sensor's temperature value and alarms, the temperature resistance value read, and the type of temperature element required are also displayed under a separate sensor input menu.

Calibration

Touch the Calibration icon to calibrate the sensor. Select the calibration to perform: One Point Process, One Point Buffer or Two Point Buffer Calibration. Not all calibration options are available for all types of sensor.

One Point Process Calibration

New Value
Enter the actual value of the process as determined by another meter or laboratory analysis and touch Confirm.

Cal Successful or Failed
If successful, touch Confirm to put the new calibration in memory.
If failed, you may retry the calibration or cancel. Refer to Section 8 to troubleshoot a calibration failure.

One Point Buffer Calibration, Disinfection/Generic Sensor Zero Cal, Conductivity Air Cal

Cal Disables Control
Touch Confirm to continue or Cancel to abort

Buffer Temperature (only appears if no temperature sensor is detected for sensor types that use automatic temperature compensation)
Enter the temperature of the buffer and touch Confirm.

Buffer Value (only appears for One Point Calibration except when automatic buffer recognition is used))
Enter the value of the buffer being used

Rinse Sensor
Remove the sensor from the process, rinse it off, and place it in the buffer solution (or oxidizer-free water for Zero Cal, or air for the conductivity open air cal). Touch Confirm when ready.

Stabilization
When the temperature (if applicable) and signal from the sensor is stable, the controller will automatically move to the next step. If they don't stabilize you may manually go to the next step by pressing Confirm.

Cal Successful or Failed
If successful, touch Confirm to put the new calibration in memory.
If failed, you may retry the calibration or cancel. Refer to Section 8 to troubleshoot a calibration failure.

Resume Control
Replace the sensor in the process and touch Confirm when ready to resume control.

Two Point Buffer Calibration

Cal Disables Control
Touch Confirm to continue or Cancel to abort

Buffer Temperature (only appears if no temperature sensor is detected for sensor types that use automatic temperature compensation)
Enter the temperature of the buffer and touch Confirm.

First Buffer Value (does not appear if automatic buffer recognition is used)
Enter the value of the buffer being used

Rinse Sensor
Remove the sensor from the process, rinse it off, and place it in the buffer solution. Touch Confirm when ready.

Stabilization
When the temperature (if applicable) and signal from the sensor is stable, the controller will automatically move to the next step. If they don't stabilize you may manually go to the next step by touching Confirm.

Second Buffer Temperature (only appears if no temperature sensor is detected for sensor types that use automatic temperature compensation)
Enter the temperature of the buffer and press Confirm.

Second Buffer Value (does not appear if automatic buffer recognition is used)
Enter the value of the buffer being used

Rinse Electrode
Remove the sensor from the process, rinse it off, and place it in the buffer solution. Touch Confirm when ready.

Stabilization
When the temperature (if applicable) and signal from the sensor is stable, the controller will automatically move to the next step. If they don't stabilize you may manually go to the next step by touching Confirm.

Cal Successful or Failed
If successful, touch Confirm to put the new calibration in memory. The calibration adjusts the offset and the gain (slope) and displays the new values. If failed, you may retry the calibration or cancel. Refer to Section 8 to troubleshoot a calibration failure.

Resume Control
Replace the sensor in the process and touch Confirm when ready to resume control.

Three Point Buffer Calibration (pH sensors only)

Cal Disables Control
Touch Confirm to continue or Cancel to abort

Buffer Temperature (only appears if no temperature sensor is detected)
Enter the temperature of the buffer and touch Confirm.

First Buffer Value (does not appear if automatic buffer recognition is used)
Enter the value of the buffer being used

Rinse Sensor
Remove the sensor from the process, rinse it off, and place it in the buffer solution. Touch Confirm when ready.

Stabilization
When the temperature (if applicable) and signal from the sensor is stable, the controller will automatically move to the next step. If they don't stabilize you may manually go to the next step by touching Confirm.

Second Buffer Temperature (only appears if no temperature sensor is detected)
Enter the temperature of the buffer and touch Confirm.

Second Buffer Value (does not appear if automatic buffer recognition is used)
Enter the value of the buffer being used

Rinse Electrode
Remove the sensor from the process, rinse it off, and place it in the buffer solution. Touch Confirm when ready.

Stabilization
When the temperature (if applicable) and signal from the sensor is stable, the controller will automatically move to the next step. If they don't stabilize you may manually go to the next step by touching Confirm.

Third Buffer Temperature (only appears if no temperature sensor is detected)
Enter the temperature of the buffer and touch Confirm.

Third Buffer Value (does not appear if automatic buffer recognition is used)
Enter the value of the buffer being used

Rinse Electrode
Remove the sensor from the process, rinse it off, and place it in the buffer solution. Touch Confirm when ready.

Stabilization
When the temperature (if applicable) and signal from the sensor is stable, the controller will automatically move to the next step.

Cal Successful or Failed
If successful, touch Confirm to put the new calibration in memory. The calibration adjusts the offset, gain (slope) and calibration midpoint and displays the new values. If failed, you may retry the calibration or cancel. Refer to Section 7 to troubleshoot a calibration failure.

Resume Control
Replace the sensor in the process and touch Confirm when ready to resume control.

One Point Analog Calibration

OK to disable control? Touch Confirm to continue or Cancel to abort.

Input Value
Enter the mA value that the transmitter will be sending. Touch Confirm to continue or Cancel to abort.

Please set input signal to specified value
Make sure that the transmitter is sending the desired mA signal. Touch Confirm to continue or Cancel to abort.
Automatic circuit calibration in progress

Cal Successful or Failed
If successful, touch Confirm to save calibration results. The calculated offset will be displayed.
If failed, you may retry the calibration or cancel. You may also restore calibration to the factory defaults. The calibration will fail if the measured mA is more than 2 mA away from the Input Value entered.

Please restore input signal to process value
Put the transmitter back into normal measurement mode if necessary and touch Confirm when ready to resume control.

Two Point Analog Calibration

OK to disable control? Touch Confirm to continue or Cancel to abort.

Input Value
Enter the mA value that the transmitter will be sending. Touch Confirm to continue or Cancel to abort.

Please set input signal to specified value
Make sure that the transmitter is sending the desired mA signal. Touch Confirm to continue or Cancel to abort.
Automatic circuit calibration in progress

Second Input Value
Enter the mA value that the transmitter will be sending. Touch Confirm to continue or Cancel to abort.

Please set input signal to specified value
Make sure that the transmitter is sending the desired mA signal. Touch Confirm to continue or Cancel to abort.
Automatic circuit calibration in progress

Cal Successful or Failed
If successful, touch Confirm to save calibration results. The calculated offset and gain will be displayed.
If failed, you may retry the calibration or cancel. You may also restore calibration to the factory defaults. The calibration will fail if the offset is more than 2 mA or the gain is not between 0.5 and 2.0.

Please restore input signal to process value
Put the transmitter back into normal measurement mode if necessary and touch Confirm when ready to resume control.

5.2.1 Contacting Conductivity

Settings

Touch the Settings icon to view or change the settings related to the sensor.

Alarms	Low-Low, Low, High and High-High Alarms limits may be set.
Deadband	This is the Alarm Deadband. For example, if the High Alarm is 3000, and the deadband is 10, the alarm will activate at 3001 and deactivate at 2990.
Reset Calibration Values	Enter this menu to reset the sensor calibration back to factory defaults.
Cal Required Alarm	To get an alarm message as a reminder to calibrate the sensor on a regular schedule, enter the number of days between calibrations. Set it to 0 if no reminders are necessary.
Alarm Suppression	If any of the relays or digital inputs are selected, any alarms related to this input will be suppressed if the selected relay or digital input is active. Typically this is used to prevent alarms if there is no sample flow past the flow switch digital input.
Smoothing Factor	Increase the smoothing factor percentage to dampen the response to changes. For example, with a 10% smoothing factor, the next reading shown will consist of an average of 10% of the previous value and 90% of the current value.
Default Temp	If the temperature signal is lost at any time, then the controller will use the Default Temp setting for temperature compensation.
Cable Length	The controller automatically compensates for errors in the reading caused by varying the length of the cable.
Gauge	The cable length compensation depends upon the gauge of wire used to extend the cable
Cell Constant	Do not change unless instructed by the factory.
Temp Compensation	Select between the standard NaCl temperature compensation method or a linear %/degree C method.
Temp Comp Factor	This menu only appears if Linear Temp Comp is selected. Change the %/degree C to match the chemistry being measured. Standard water is 2%.
Units	Select the units of measure for the conductivity.
Name	The name used to identify the sensor may be changed.
Type	Select the type of sensor to be connected.

5.2.2 Electrodeless Conductivity

Settings

Touch the Settings icon to view or change the settings related to the sensor.

Alarms	Low-Low, Low, High and High-High Alarms limits may be set.
Deadband	This is the Alarm Deadband. For example, if the High Alarm is 3000, and the deadband is 10, the alarm will activate at 3000 and deactivate at 2990.
Reset Calibration Values	Enter this menu to reset the sensor calibration back to factory defaults.
Cal Required Alarm	To get an alarm message as a reminder to calibrate the sensor on a regular schedule, enter the number of days between calibrations. Set it to 0 if no reminders are necessary.
Alarm Suppression	If any of the relays or digital inputs are selected, any alarms related to this input will be suppressed if the selected relay or digital input is active. Typically this is used to prevent alarms if there is no sample flow past the flow switch digital input.
Smoothing Factor	Increase the smoothing factor percentage to dampen the response to changes. For example, with a 10% smoothing factor, the next reading shown will consist of an average of 10% of the previous value and 90% of the current value.

Default Temp	If the temperature signal is lost at any time, then the controller will use the Default Temp setting for temperature compensation.
Installation Factor	Do not change unless instructed by the factory.
Cable Length	The controller automatically compensates for errors in the reading caused by varying the length of the cable.
Gauge	The cable length compensation depends upon the gauge of wire used to extend the cable
Cell Constant	Do not change unless instructed by the factory.
Range	Select the range of conductivity that best matches the conditions the sensor will see.
Temp Compensation	Select between the standard NaCl temperature compensation method or a linear %/ degree C method.
Temp Comp Factor	This menu only appears if Linear Temp Comp is selected. Change the %/degree C to match the chemistry being measured. Standard water is 2%.
Units	Select the units of measure for the conductivity.
Name	The name used to identify the sensor may be changed.
Type	Select the type of sensor to be connected.

5.2.3 Temperature

Settings

Touch the Settings icon to view or change the settings related to the sensor.

Alarms	Low-Low, Low, High and High-High Alarms limits may be set.
Deadband	This is the Alarm Deadband. For example, if the High Alarm is 100, and the dead-band is 1, the alarm will activate at 100 and deactivate at 99.
Reset Calibration Values	Enter this menu to reset the sensor calibration back to factory defaults.
Cal Required Alarm	To get an alarm message as a reminder to calibrate the sensor on a regular schedule, enter the number of days between calibrations. Set it to 0 if no reminders are necessary.
Alarm Suppression	If any of the relays or digital inputs are selected, any alarms related to this input will be suppressed if the selected relay or digital input is active. Typically this is used to prevent alarms if there is no sample flow past the flow switch digital input.
Smoothing Factor	Increase the smoothing factor percentage to dampen the response to changes. For example, with a 10% smoothing factor, the next reading shown will consist of an average of 10% of the previous value and 90% of the current value.
Name	The name used to identify the sensor may be changed.
Element	Select the specific type of temperature sensor to be connected.

5.2.4 pH

Settings

Touch the Settings icon to view or change the settings related to the sensor.

Alarms	Low-Low, Low, High and High-High Alarms limits may be set.
Deadband	This is the Alarm Deadband. For example, if the High Alarm is 9.50, and the dead-band is 0.05, the alarm will activate at 9.51 and deactivate at 9.45.
Alarm Suppression	If any of the relays or digital inputs are selected, any alarms related to this input will be suppressed if the selected relay or digital input is active. Typically this is used to prevent alarms if there is no sample flow past the flow switch digital input.
Smoothing Factor	Increase the smoothing factor percentage to dampen the response to changes. For example, with a 10% smoothing factor, the next reading shown will consist of an average of 10% of the previous value and 90% of the current value.
Reset Calibration Values	Enter this menu to reset the sensor calibration back to factory defaults.

Cal Required Alarm	To get an alarm message as a reminder to calibrate the sensor on a regular schedule, enter the number of days between calibrations. Set it to 0 if no reminders are necessary.
Buffers	Select if calibration buffers will be manually entered, or if they will be automatically detected, and if so, which set of buffers will be used. The choices are Manual Entry, JIS/NIST Standard, DIN Technical, or Traceable 4/7/10.
Default Temp	If the temperature signal is lost at any time, then the controller will use the Default Temp setting for temperature compensation.
Cable Length	The controller automatically compensates for errors in the reading caused by varying the length of the cable.
Gauge	The cable length compensation depends upon the gauge of wire used to extend the cable
Electrode	Select Glass for a standard pH electrode, or Antimony. Antimony pH electrodes have a default slope of 49 mV/pH and an offset of -320 mV at pH 7.
Name	The name used to identify the sensor may be changed.
Type	Select the type of sensor to be connected.

5.2.5 ORP

Settings

Touch the Settings icon to view or change the settings related to the sensor.

Alarms	Low-Low, Low, High and High-High Alarms limits may be set.
Deadband	This is the Alarm Deadband. For example, if the High Alarm is 800, and the deadband is 10, the alarm will activate at 801 and deactivate at 790.
Reset Calibration Values	Enter this menu to reset the sensor calibration back to factory defaults.
Cal Required Alarm	To get an alarm message as a reminder to calibrate the sensor on a regular schedule, enter the number of days between calibrations. Set it to 0 if no reminders are necessary.
Alarm Suppression	If any of the relays or digital inputs are selected, any alarms related to this input will be suppressed if the selected relay or digital input is active. Typically this is used to prevent alarms if there is no sample flow past the flow switch digital input.
Smoothing Factor	Increase the smoothing factor percentage to dampen the response to changes. For example, with a 10% smoothing factor, the next reading shown will consist of an average of 10% of the previous value and 90% of the current value.
Cable Length	The controller automatically compensates for errors in the reading caused by varying the length of the cable.
Gauge	The cable length compensation depends upon the gauge of wire used to extend the cable
Name	The name used to identify the sensor may be changed.
Type	Select the type of sensor to be connected.

5.2.6 Disinfection

Settings

Touch the Settings icon to view or change the settings related to the sensor.

Alarms	Low-Low, Low, High and High-High Alarms limits may be set.
Deadband	This is the Alarm Deadband. For example, if the High Alarm is 7.00, and the deadband is 0.1, the alarm will activate at 7.01 and deactivate at 6.90.
Reset Calibration Values	Enter this menu to reset the sensor calibration back to factory defaults.
Cal Required Alarm	To get an alarm message as a reminder to calibrate the sensor on a regular schedule, enter the number of days between calibrations. Set it to 0 if no reminders are necessary.

Alarm Suppression	If any of the relays or digital inputs are selected, any alarms related to this input will be suppressed if the selected relay or digital input is active. Typically this is used to prevent alarms if there is no sample flow past the flow switch digital input.
Smoothing Factor	Increase the smoothing factor percentage to dampen the response to changes. For example, with a 10% smoothing factor, the next reading shown will consist of an average of 10% of the previous value and 90% of the current value.
Cable Length	The controller automatically compensates for errors in the reading caused by varying the length of the cable.
Gauge	The cable length compensation depends upon the gauge of wire used to extend the cable
Name	The name used to identify the sensor may be changed.
Sensor	Select the specific type and range of disinfection sensor to be connected.
Type	Select the type of sensor to be connected.

5.2.7 Generic Sensor

Settings

Touch the Settings icon to view or change the settings related to the sensor.

Alarms	Low-Low, Low, High and High-High Alarms limits may be set.
Deadband	This is the Alarm Deadband. For example, if the High Alarm is 7.00, and the deadband is 0.1, the alarm will activate at 7.01 and deactivate at 6.90.
Reset Calibration Values	Enter this menu to reset the sensor calibration back to factory defaults.
Cal Required Alarm	To get an alarm message as a reminder to calibrate the sensor on a regular schedule, enter the number of days between calibrations. Set it to 0 if no reminders are necessary.
Alarm Suppression	If any of the relays or digital inputs are selected, any alarms related to this input will be suppressed if the selected relay or digital input is active. Typically this is used to prevent alarms if there is no sample flow past the flow switch digital input.
Sensor Slope	Enter the slope of sensor in mV/Units (if Electrode selection is Linear) or mV/Decade (if Electrode selection is Ion Selective).
Sensor Offset	Only appears if the Electrode selection is Linear. Enter the offset of the sensor in mV if 0 mV is not equal to 0 units. **For Ion Selective Electrodes, the Sensor Offset is not calculated until the first calibration is performed, and the sensor will read Zero until a calibration has been successfully completed!**
Low Range	Enter the low end of the range of the sensor
High Range	Enter the high end of the range of the sensor
Smoothing Factor	Increase the smoothing factor percentage to dampen the response to changes. For example, with a 10% smoothing factor, the next reading shown will consist of an average of 10% of the previous value and 90% of the current value.
Cable Length	The controller automatically compensates for errors in the reading caused by varying the length of the cable.
Gauge	The cable length compensation depends upon the gauge of wire used to extend the cable
Units	Type in the units of measure for the input, for example, ppm.
Electrode	Select the type of electrode to be connected. Select Linear if the sensor slope is a linear voltage per Units. Select Ion Selective if the electrode voltage output is logarithmic, defined as “mV/decade”.
Name	The name used to identify the sensor may be changed.
Type	Select the type of sensor to be connected.

5.2.8 Transmitter Input and AI Monitor Input

Select AI monitor if the device connected can be calibrated on its own and the RAFA calibration will only be in units of mA. Select Transmitter if the device connected cannot be calibrated on its own and the RAFA will be used to calibrate in engineering units of measure.

Settings

Touch the Settings icon to view or change the settings related to the sensor.

Alarms	Low-Low, Low, High and High-High Alarms limits may be set.
Deadband	This is the Alarm Deadband. For example, if the High Alarm is 7.00, and the deadband is 0.1, the alarm will activate at 7.01 and deactivate at 6.90.
Reset Calibration Values	Enter this menu to reset the sensor calibration back to factory defaults.
Cal Required Alarm	To get an alarm message as a reminder to calibrate the sensor on a regular schedule, enter the number of days between calibrations. Set it to 0 if no reminders are necessary.
Alarm Suppression	If any of the relays or digital inputs are selected, any alarms related to this input will be suppressed if the selected relay or digital input is active. Typically this is used to prevent alarms if there is no sample flow past the flow switch digital input.
Smoothing Factor	Increase the smoothing factor percentage to dampen the response to changes. For example, with a 10% smoothing factor, the next reading shown will consist of an average of 10% of the previous value and 90% of the current value.
4 mA Value	Enter the value that corresponds to a 4 mA output signal from the transmitter.
20 mA Value	Enter the value that corresponds to a 20 mA output signal from the transmitter.
Units	Select the units of measure for the transmitter.
Name	The name used to identify the transmitter may be changed.
Type	Select the type of sensor to be connected. The choice of AI Monitor and Transmitter is only available if a 4-20mA type sensor card is installed.

5.2.9 Fluorometer Input

Settings

Touch the Settings icon to view or change the settings related to the sensor.

Alarms	Low-Low, Low, High and High-High Alarms limits may be set.
Deadband	This is the Alarm Deadband. For example, if the High Alarm is 7.00, and the deadband is 0.1, the alarm will activate at 7.01 and deactivate at 6.90.
Reset Calibration Values	Enter this menu to reset the sensor calibration back to factory defaults.
Cal Required Alarm	To get an alarm message as a reminder to calibrate the sensor on a regular schedule, enter the number of days between calibrations. Set it to 0 if no reminders are necessary.
Alarm Suppression	If any of the relays or digital inputs are selected, any alarms related to this input will be suppressed if the selected relay or digital input is active. Typically this is used to prevent alarms if there is no sample flow past the flow switch digital input.
Smoothing Factor	Increase the smoothing factor percentage to dampen the response to changes. For example, with a 10% smoothing factor, the next reading shown will consist of an average of 10% of the previous value and 90% of the current value.
Max Sensor Range	Enter the value of the ppb of dye at which the sensor transmits 20 mA.
Dye/Product Ratio	Enter the value for the ratio of ppb of dye to ppm of inhibitor that is in the inhibitor product being fed.
Name	The name used to identify the transmitter may be changed.
Type	Select the type of sensor to be connected. The choice of Analog Input is only available if that type of sensor card is installed.

5.2.10 DI State

Input Details

The details for this type of input include the current state with a custom message for open versus closed, alarms, the status of the interlock, and the current type of input setting.

Settings

Touch the Settings icon to view or change the settings related to the sensor.

Open Message	The words used to describe the switch state may be customized.
Closed Message	The words used to describe the switch state may be customized.
Interlock	Choose whether the input should be in the interlocked state when the switch is either open or closed.
Alarm	Choose if an alarm should be generated when the switch is open, or closed, or if no alarm should ever be generated.
Total Time	Choose to totalize the amount of time that the switch has been open or closed. This will be displayed on the input details screen.
Reset Total Time	Enter this menu to reset the accumulated time to zero. Touch Confirm to accept, Cancel to leave the total at the previous value and go back.
Name	The name used to identify the switch may be changed.
Type	Select the type of sensor to be connected to the digital input channel.

5.2.11 Flow Meter, Contactor Type

Input Details

The details for this type of input include the total volume accumulated through the flow meter, alarms, and the current type of input setting.

Settings

Touch the Settings icon to view or change the settings related to the sensor.

Totalizer Alarm	A high limit on the total volume of water accumulated may be set.
Reset Flow Total	Enter this menu to reset the accumulated flow total to 0. Touch Confirm to accept, Cancel to leave the total at the previous value and go back.
Set Flow Total	This menu is used to set the total volume stored in the controller to match the register on the flow meter. Enter the desired value.
Scheduled Reset	Choose to automatically reset the flow total, and if so, Daily, Monthly or Annually.
Volume/Contact	Enter the volume of water that needs to go through the flow meter in order to generate a contact closure.
Flow Units	Select the units of measure for the water volume.
Name	The name used to identify the sensor may be changed.
Type	Select the type of sensor to be connected to the digital input channel.

5.2.12 Flow Meter, Paddlewheel Type

Input Details

The details for this type of input include the current flow rate, total volume accumulated through the flow meter, alarms, and the current type of input setting.

Settings

Touch the Settings icon to view or change the settings related to the sensor.

Alarms	Low and High Alarm limits may be set.
Deadband	This is the Alarm Deadband. For example, if the High Alarm is 100, and the deadband is 1, the alarm will activate at 100 and deactivate at 99.
Totalizer Alarm	A high limit on the total volume of water accumulated may be set.

Reset Flow Total	Enter this menu to reset the accumulated flow total to 0. Touch Confirm to accept, Cancel to leave the total at the previous value and go back.
Set Flow Total	This menu is used to set the total volume stored in the controller to match the register on the flow meter. Enter the desired value.
Scheduled Reset	Choose to automatically reset the flow total, and if so, Daily, Monthly or Annually.
K Factor	Enter the pulses generated by the paddlewheel per unit volume of water.
Flow Units	Select the units of measure for the water volume.
Rate Units	Select the units of measure for the flow rate time base.
Smoothing Factor	Increase the smoothing factor percentage to dampen the response to changes. For example, with a 10% smoothing factor, the next reading shown will consist of an average of 10% of the previous value and 90% of the current value.
Name	The name used to identify the sensor may be changed.
Type	Select the type of sensor to be connected to the digital input channel.

5.2.13 Feed Monitor

The Feed Monitor Digital Input type performs the following functions:

- Monitors a pulse signal from a pump (Iwaki PosiFlow, Tacmina Flow Checker, LMI Digital Pulse, etc)
- Totalizes the chemical feed and calculates the current flow rate
- Activates a Total Alarm if the feed exceeds a specified limit
- Activates a Flow verify alarm if the control output is ON and the feed monitor does not record any pulses within a specified period of time.

Each Feed Monitor input can be linked to any type of output channel (powered relay, dry contact relay, solid state relay, or analog 4-20 mA) to validate chemical feed from any type of pump.

Total Alarm

The RAFA monitors the total feed and activates a Total Alarm if the value exceeds the Totalizer Alarm set point. When used in conjunction with Scheduled Reset selections (Daily, Monthly, or Annually), this alarm can be used to alert users to situations where excess chemical product is used and/or to discontinue chemical feed if the amount exceeds the set point during the specified time period.

While a Total Alarm is active, the linked pump will be controlled based on the Total Alarm Mode setting:

Interlock	The output will be OFF while the alarm is active.
Maintain	The alarm condition has no effect on output control.

Flow Verify Alarm

The RAFA monitors the status or current percent output of the channel linked to the feed monitor to determine if a Flow Verify alarm should be activated.

The *Flow Alarm Delay* setting (MM:SS) contains the time to trigger the alarm if the output is activated and no pulses are registered. To avoid nuisance alarms at very low flow rates, if the linked output is a solid state relay (set with a pulse proportional or PID control mode) or an analog 4-20 mA output, the alarm will only be activated if no input pulses are monitored while the output is set to greater than a specified Dead Band (%).

The *Flow Alarm Clear* setting is the number of pulses that must be registered to verify that pump operation is restored and clear the Flow Verify alarm. During Flow Verify alarm conditions, the count of pulses registered will be reset to zero if no single pulses occur during the Flow Alarm Delay time period. In this manner, random single pulses spread over a long time period will not accumulate and result in a Flow Verify alarm being cleared before product feed is actually restored.

If desired, a user can configure the feed monitor to attempt to reprime the pump when a Flow Verify alarm first is activated.

The *Reprime Time* (MM:SS) specifies the amount of time that the output should be energized after the initiation of a Flow Verify alarm. If the linked output is a solid state relay (set to a pulse proportional or PID control mode) or an analog 4-20 mA output, the output will be set to the Max Output percent during the reprime event. If the Flow Verify alarm is cleared during the reprime event (because the specified number of pulses was registered), the reprime event will be immediately ended and normal control of the output channel will be restored.

While a Flow Verify alarm is active, the linked pump will be controlled based on the Flow Alarm Mode setting:

Disabled	*Flow Verify* alarms are not monitored, no change in output control.
Interlock	The output will be forced OFF while the alarm is active.(except during the reprime event)
Maintain	The alarm condition has no effect on output control. (except during the reprime event)

If a *Flow Verify* alarm is active and *Interlock* is selected, the output to the pump will be turned off after the specified Reprime Time and only operator actions can restore normal control operations. In most cases, action will be taken to manually reprime the pump, refill the chemical tank, etc. and the output will be put into Hand mode to confirm proper operation of the pump. When the Feed Monitor registers sufficient pulses, the Flow Verify alarm will clear and the pump output can be put back into Auto Mode.

If both *Total Alarm* and *Flow Verify* alarms are active simultaneously, an Interlock selection for either mode setting will take precedence for pump control. Automatic output control will continue despite the alarm conditions only if Maintain is selected for both mode settings.

Interlocking or Activating any Control Output with a Feed Monitor Input

Digital Input channels are available for selection as Interlock Channels or Activate With Channels by any output. If a Feed Monitor is selected in this manner, the Digital Input will trigger that action if any alarm (Flow Verify, Total Alarm, or Range Alarm) is currently active.

Input Details

The details for this type of input include the current flow rate of chemical feed, the total volume fed since the last reset, alarms, the status of the output linked to the input, the date and time of the last total reset, and the current type of input setting.

Settings

Touch the Settings icon to view or change the settings related to the sensor.

Totalizer Alarm	A high limit on the total accumulated volume of chemical fed may be set, to trigger a Total Alarm.
Reset Flow Total	Enter this menu to reset the accumulated flow total to 0. Touch Confirm to accept, Cancel to leave the total at the previous value and go back.
Set Flow Total	This menu is used to set the total accumulated volume stored in the controller to match a specified volume.
Scheduled Reset	Choose to automatically reset the flow total, and if so, Daily, Monthly or Annually
Total Alarm Mode	Choose to Interlock or Maintain the control of the linked pump while the Total Alarm is active.
Flow Alarm Mode	Choose to Interlock or Maintain the control of the linked pump while a Flow Verify alarm is active. Choose Disable to monitor flow rate and accumulate total without any flow alarms.
Flow Alarm Delay	Time (MM:SS) that will trigger a Flow Verify alarm if the output is activated and no pulses are registered.
Flow Alarm Clear	Enter the number of contacts that must be registered to clear a Flow Verify alarm.
Dead band	Enter the percent output above which the pump is considered On for monitoring of Flow Verify alarms. This setting is only available if the linked Output is a solid state (pulsing) relay or analog (4-20 mA) output.

Reprime Time	Time (MM:SS) that the output should be energized for the reprime event.
Volume/Contact	Enter the volume, in ml, of chemical delivered for each pulse of the feed monitoring device.
Flow Units	Select the units of measure for the accumulated feed total.
Rate Units	Select the units of measure for the feed flow rate time base.
Smoothing Factor	Increase the smoothing factor percentage to dampen the response to changes in the flowrate. For example, with a 10% smoothing factor, the next reading shown will consist of an average of 10% of the previous value and 90% of the current value.
Output	Select the relay or analog (4-20 mA) output channel controlling the pump which will be monitored by this feed monitor input.
Name	The name used to identify the sensor may be changed.
Type	Select the type of sensor to be connected to the digital input channel

5.2.14 Virtual Input – Calculation

A Virtual Input is not a physical sensor; it is a value that is calculated from two physical sensor inputs. The analog values that can be used for each type of calculation are selected from a List of all defined sensor inputs, analog inputs, flowmeter rates, the other virtual input, solid state relay %, and analog output %.
Calculation modes are:

- **Difference** (Input - Input 2)
- **Ratio** (Input / Input 2)
    - This selection could be used to calculate Cycles of Concentration in HVAC applications, for example
- **Total** (Input + Input 2)
- **% Difference** [(Input - Input 2) / Input]
    - This selection could be used to calculate % Rejection in RO applications, for example

Virtual Input Details
The details for any type of virtual input include the current value calculated, alarms, the status, and the input type.

Settings

Touch the Settings icon to view or change the settings related to the virtual input.

Alarms	Low-Low, Low, High and High-High Alarms limits may be set.
Deadband	This is the Alarm Deadband. For example, if the High Alarm is 7.00, and the deadband is 0.1, the alarm will activate at 7.01 and deactivate at 6.90.
Input	Select the physical input whose value will be used in the calculation shown above as the Input in the formula.
Input 2	Select the physical input whose value will be used in the calculation shown above as the Input 2 in the formula.
Calculation Mode	Select a calculation mode from the list.
Alarm Supression	If any of the relays or digital inputs are selected, any alarms related to this input will be suppressed if the selected relay or digital input is active. Typically, this is used to prevent alarms if there is no sample flow past the flow switch digital input.
Low Range	Set the low end of the normal range for the calculated value. A value below this will trigger a Range Alarm and deactivate any control output using the virtual input.
High Range	Set the high end of the normal range for the calculated value. A value above this will trigger a Range Alarm and deactivate any control output using the virtual input.
Smoothing Factor	Increase the smoothing factor percentage to dampen the response to changes. For example, with a 10% smoothing factor, the next reading shown will consist of an average of 10% of the previous value and 90% of the current value.
Name	The name used to identify the input may be changed.

Type	Select the type of input; either Calculation or Not Used.

5.2.15 Virtual Input – Raw Value

A Raw Value type Virtual Input is not a normal sensor signal. The value of the virtual input comes from the unmanipulated signal from a real sensor.

- non-temperature compensated µS/cm
- mV for pH, ORP, Disinfection
- mA for analog inputs
- ohms for temperature

Virtual Input Details

The details for a virtual input include the current raw value of the real input used, alarms, the status, and the input type.

Settings

Touch the Settings icon to view or change the settings related to the virtual input.

Alarms	Low-Low, Low, High and High-High Alarms limits may be set.
Deadband	This is the Alarm Deadband. For example, if the High Alarm is 7.00, and the deadband is 0.1, the alarm will activate at 7.01 and deactivate at 6.90.
Alarm Suppression	If any of the relays or digital inputs are selected, any alarms related to this input will be suppressed if the selected relay or digital input is active. Typically this is used to prevent alarms if there is no sample flow past the flow switch digital input.
Input	Select the physical input whose raw value will be used as this virtual input.
Smoothing Factor	Increase the smoothing factor percentage to dampen the response to changes. For example, with a 10% smoothing factor, the next reading shown will consist of an average of 10% of the previous value and 90% of the current value.
Name	The name used to identify the input may be changed.
Type	Select the type of input; either Calculation, Redundant, Raw Value, or Not Used

5.3 Outputs Menu

Touch the Outputs icon from the Main Menu to view a list of all relay and analog outputs. The Page Down icon pages down the list of outputs, the Page Up icon pages up the list of outputs, the Main Menu icon brings back the previous screen. Touch an output to access that output's details and settings.
NOTE: When the output control mode or the input assigned to that output is changed, the output reverts to OFF mode. Once you have changed all settings to match the new mode or sensor, you must put the output into AUTO mode to start control.

5.3.1 Relay, Any Control Mode

Settings

Touch the Settings icon to view or change the settings related to the relay. Settings that are available for any control mode include:

HOA Setting	Select Hand, Off or Auto mode by touching the desired mode.
Output Time Limit	Enter the maximum amount of time that the relay can be continuously activated. Once the time limit is reached, the relay will deactivate until the Reset Output Timeout menu is entered.

Reset Output Timeout	Enter this menu to clear an Output Timeout alarm and allow the relay to control the process again.
Interlock Channels	Select the relays and digital inputs that will interlock this relay, when those other relays are activated in Auto mode. Using Hand or Off to activate relays bypasses the Interlock logic.
Activate With Channels	Select the relays and digital inputs that will activate this relay, when those other relays are activated in Auto mode. Using Hand or Off to activate relays bypasses the Activate With logic.
Minimum Relay Cycle	Enter the number of seconds that will be minimum amount of time that the relay will be in the active or inactive state. Normally this will be set to 0, but if using a motorized ball valve that takes time to open and close, set this high enough that the valve has time to complete its movement.
Hand Time Limit	Enter the amount of time that the relay will activate for when it is in Hand mode.
Reset Time Total	Press the Confirm icon to reset the total accumulated on-time stored for the output back to 0.
Name	The name used to identify the relay may be changed.
Mode	Select the desired control mode for the output.

5.3.2 Relay, On/Off Control Mode

Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms related to this output, current cycle on time, relay type and the current control mode setting.

Settings

Touch the Settings icon to view or change the settings related to the relay.

Set point	Enter the sensor process value at which the relay will activate.
Deadband	Enter the sensor process value away from the set point at which the relay will deactivate.
Duty Cycle Period	Using a duty cycle helps to prevent overshooting the set point in applications where the response of the sensor to chemical additions is slow. Specify the amount of time for the cycle, and the percentage of that cycle time that the relay will be active. The relay will be off for the rest of the cycle, even if the set point has not been satisfied. Enter the length of the duty cycle in minutes:seconds in this menu. Set the time to 00:00 if use of a duty cycle is not required.
Duty Cycle	Enter the percentage of the cycle period that the relay will be active. Set the percentage to 100 if use of a duty cycle is not required.
On Delay Time	Enter the delay time for relay activation in hours:minutes:seconds. Set the time to 00:00:00 to immediately activate the relay.
Off Delay Time	Enter the delay time for relay deactivation in hours:minutes:seconds. Set the time to 00:00:00 to immediately deactivate the relay.
Input	Select the sensor to be used by this relay.
Direction	Select the control direction.

5.3.3 Relay, Flow Timer Control Mode

Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, remaining feed time, accumulated flow total, alarms related to this output, current cycle on time, relay type and the current control mode setting.

Settings

Touch the Settings icon to view or change the settings related to the relay.

Feed Duration	Enter the amount of time for the relay to activate for once the accumulated volume through the water meter has been reached.
Accumulated Volume	Enter the volume of water to pass through the water meter required to trigger the chemical feed.
Input	Select the input to be used to control this output.
Input #2	Select the second flowmeter input to be used to control this out-put if applicable. The sum of the two flow total volumes will be used to trigger the chemical feed.

5.3.4 Relay, Bleed and Feed Control Mode

ONLY AVAILABLE IF HVAC MODES ARE ENABLED IN CONFIG MENU – GLOBAL SETTINGS

Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms related to this output, current cycle on time, relay type and the current control mode setting.

Settings

Touch the Settings icon to view or change the settings related to the relay.

Feed Time Limit	Enter the maximum amount of feed time per bleed event
Bleed	Select the relay to be used for Bleed/Blowdown

5.3.5 Relay, Bleed then Feed Control Mode

ONLY AVAILABLE IF HVAC MODES ARE ENABLED IN CONFIG MENU – GLOBAL SETTINGS

Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, remaining feed time, the accumulated bleed time, alarms related to this output, current cycle on time, relay type and the current control mode setting.

Settings

Touch the Settings icon to view or change the settings related to the relay.

Feed Percentage	Enter the % of bleed relay activation time to use for the feed relay activation time
Feed Time Limit	Enter the maximum amount of feed time per bleed event
Reset Timer	Use this menu to cancel the current feed cycle
Bleed	Select the relay to be used for Bleed/Blowdown

5.3.6 Relay, Percent Timer Control Mode

Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, cycle time, accumulated on-time, alarms related to this output, current cycle on time, relay type and the current control mode setting.

Settings

Touch the Settings icon to view or change the settings related to the relay.

Sample Period	Enter the duration of the sample period.
Feed Percentage	Enter the % of the sample period time to use for the feed relay activation time

5.3.7 Relay, Biocide Timer Control Mode

ONLY AVAILABLE IF HVAC MODES ARE ENABLED IN CONFIG MENU – GLOBAL SETTINGS

Basic Biocide Operation

When a biocide event triggers, the algorithm will first prebleed (if a prebleed is programmed) for the set amount of prebleed time or down to the set prebleed conductivity. Then the biocide relay is turned on for the set duration. This is followed by a post-bio add lockout that blocks the bleed relay from turning on for a set amount of bleed lockout time.

Special Condition Handling

Prebleed

If both a time limit and a conductivity limit are set, the time limit takes precedence. The bleed relay will turn off once the time limit is reached or when the prebleed conductivity limit is reached (whichever occurs first). If the prebleed has a conductivity limit set, then the time limit can't be set to zero, as this would allow the prebleed to last forever if the conductivity limit is never reached.

Overlapping biocide events

If a second biocide event occurs while the first one is still active (in prebleed, biocide add or lockout), the second event will be ignored. An Event Skipped alarm will be set.

Interlock Conditions

Interlocks override the relay control, but do not change the operation of the timers or related bleed control.

A no-flow (or other interlock) condition does not delay a biocide add. The biocide add duration timer will continue even if the relay is locked out due to a no-flow or other interlock condition. This will prevent delayed biocide adds which can potentially cause higher than expected biocide concentrations in the system when two biocides adds occur close to the same time. Not allowing delayed biocide adds will also prevent incompatible biocides getting added at close to the same time.

"Activate With" Conditions

"Activate with channels" settings override the relay control, but do not change the operation of the timers or related bleed control. The biocide timer continues counting biocide add time when the biocide relay is forced on, and ends at the expected time (biocide event start time plus duration). If the "activate with" condition continues after the end of the biocide feed time, the relay remains activated.

Alarms

An Event Skipped alarm is set when a second biocide event occurs while one event is still running (either in prebleed, biocide add or post-biocide add lockout).

An Event Skipped alarm is also set when the biocide add relay never turns on during a biocide add because of an interlock condition.

The alarm is cleared when the relay is next activated for any reason (the next timer event or HAND mode or "activate with" force on condition).

Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms related to this output, current cycle on time, relay type and the current control mode setting. The current week number and day of the week is displayed (even if there is no multi-week repetition event programmed). Cycle Time shows the time counting down of the currently active part of the biocide cycle (pre-bleed, biocide feed, or post biocide feed lockout of the bleed).

Settings

Touch the Settings icon to view or change the settings related to the relay.

Event 1 (through 10)	Enter these menus to program timer events via the menus below:
Repetition	Select the time cycle to repeat the event: Daily, 1 Week, 2 Week, 4 Week, or None. An event means that the output is turned on at the same time of day, for the same amount of time, and except for the Daily cycle, on the same day of the week.
Week	Only appears if Repetition is longer than 1 Week. Select the week during which the event will occur.
Day	Only appears if Repetition is longer than Daily. Select the day of the week during which the event will occur.
Start Time	Enter the time of day to start the event.
Duration	Enter the amount of time that the relay will be on.

Bleed	Select the relay to be used for Bleed/Blowdown
Prebleed Time	If lowering the conductivity prior to feeding biocide is desired using a fixed time instead of a specific conductivity setting, enter the amount of time for the pre-bleed. Also may be used to apply a time limit on a conductivity based prebleed.
Prebleed To	If lowering the conductivity prior to feeding biocide is desired, enter the conductivity value. If no prebleed is required, or if a time-based prebleed is preferred, set the conductivity value to 0.
Cond Input	Select the sensor to be used to control the prebleed relay selected above.
Bleed Lockout	Enter the amount of time to lockout bleed after the biocide feed is complete.
Add Last Missed	Select Enabled if the controller should delay start the most recent Biocide cycle until immediately after an Interlock clears, or Disabled if all Biocide feed should be skipped if there is an Interlock condition at the time the add was due to start.

5.3.8 Relay, Alarm Output Mode

Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms related to this output, current cycle on time, relay type and the current control mode setting.

Settings

Touch the Settings icon to view or change the settings related to the relay.

Alarm Mode	Select the alarm conditions that will put the relay into the alarm state: All Alarms Selected Alarms
Select Alarms	Scroll through the list of all inputs and outputs, as well as System Alarms and Network (Ethernet) alarms. Touch the parameter to select alarms related to that parameter, then scroll through the list of alarms. Touch each alarm to check the box indicating the alarm is selected. Touch the Confirm icon when finished with that parameter to save the changes. Repeat for each input and output.
Output	Select if the relay will be active when in the alarm state (Normally Open) or if the relay will be active when not in the alarm state (Normally Closed).

5.3.9 Relay, Time Proportional Control Mode

Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, the current % on time calculated for the cycle, the current point in the cycle time, accumulated on-time, alarms related to this output, current cycle on time, relay type and the current control mode setting.

Settings

Touch the Settings icon to view or change the settings related to the relay.

Set point	Enter the sensor process value at which the relay will be off for the entire Sample Period.
Proportional Band	Enter the distance that the sensor process value is away from the set point at which the relay will be on for the entire Sample Period.
Sample Period	Enter the duration of the sample period.
Input	Select the sensor to be used by this relay.
Direction	Select the control direction.

5.3.10 Relay, Intermittent Sampling Control Mode

ONLY AVAILABLE IF HVAC MODES ARE ENABLED IN CONFIG MENU – GLOBAL SETTINGS

In an Intermittent Sampling with Proportional Blowdown control mode, the controller reads an analog input on a timed schedule, and the relay responds to maintain the conductivity value at the set point by activating for a programmable amount of time that varies with the deviation from the set point.

The relay goes through a sequence of activation/deactivation as described below. The intended purpose of this algorithm is boiler blowdown. A sample cannot be supplied to the sensor continuously in many boilers because a recirculating loop is not possible, and it would be a waste of hot water to constantly run a sample to a drain. A valve is opened intermittently to supply a sample to the sensor.

Where a non-ideal installation of the sensor can cause the sample to flash to steam, and give a false low reading, this can be corrected by taking the reading with the sample held in the pipe with the sampling valve closed, so the sample is at boiler pressure and therefore back in the liquid state. Enable Trap Sample if this is the case. Because the conductivity reading cannot be trusted while the valve is open, the blowdown is timed rather than in direct response to a sensor reading. Rather than relying upon a fixed time, where the blowdown could be much longer than necessary if the reading is just barely off the set point value, proportional blowdown adjusts the time appropriately.

If Trap Sample is Disabled, then the blowdown is not timed, and the Hold Time and Maximum Blowdown time are not used. The blowdown valve will stay open until the conductivity is below set point. In this case the Output Time Limit menu is available to stop the blowdown if the sensor is unresponsive.

Note that the software will not allow two relays using Intermittent Sampling to be assigned to the same sensor input; the previous relay set up will change to Off mode.

Output Details

The details for this type of output include the relay on/off state, relay status (HOA mode, Interlock status, Intermittent Sampling cycle step, etc.), time remaining for the active Intermittent Sampling cycle step, alarms related to this output, current cycle on time, relay type, the live reading of the conductivity, and the current control mode setting.

Settings

Touch the Settings icon to view or change the settings related to the relay.

Set point	Enter the conductivity value below which the controller will not start a blowdown cycle.
Proportional Band	(only shown if trap sample is enabled) Enter the conductivity value above the set point at which the maximum blowdown time will occur. For example, if the Set point is 2000 uS/cm, and the Proportional Band is 200 uS/cm, then if the conductivity is above 2200 uS/cm the blowdown valve will open for the Maximum Blowdown time described below. If the conductivity of the trapped sample is 2100 uS/cm, the blowdown valve will open for half the Maximum Blowdown time.
Deadband	(only shown if trap sample is disabled) Enter the sensor process value away from the set point at which the relay will deactivate.
Sample Time	Enter the length of time the blowdown valve will be open in order to capture a fresh sample of boiler water.
Hold Time	(only shown if trap sample is enabled) Enter the length of time the blowdown valve will be closed in order to ensure that the captured sample is at boiler pressure.
Maximum Blowdown	(only shown if trap sample is enabled) Enter the maximum length of time that the blowdown valve will be open, when the conductivity of the captured sample is above the set point plus the proportional band.
Wait Time	Enter the time to wait to sample the water again once the captured sample is below set point.
Trap Sample	Enable or disable trapping of the sample.
Cond Input	Select the sensor to be used by this relay.

5.3.11 Relay, Manual Mode

Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms related to this output, current cycle on time, relay type and the current control mode setting.

Settings

A Manual relay will activate if the HOA mode is Hand, or if it is Activated With another channel.

On Delay Time	Enter the delay time for relay activation in hours:minutes:seconds. Set the time to 00:00:00 to immediately activate the relay.
Off Delay Time	Enter the delay time for relay deactivation in hours:minutes:seconds. Set the time to 00:00:00 to immediately deactivate the relay.

5.3.12 Relay, Pulse Proportional Control Mode

ONLY AVAILABLE IF CONTROLLER INCLUDES PULSE OUTPUT HARDWARE

Output Details

The details for this type of output include the relay pulse rate, HOA mode or Interlock status, accumulated on-time, alarms related to this output, current cycle on time, relay type and the current control mode setting.

Settings

Touch the Settings icon to view or change the settings related to the relay.

Set point	Enter the sensor process value at which the output will pulse at the Minimum Output % set below.
Proportional Band	Enter the distance that the sensor process value is away from the set point beyond which the output will be pulsing at the Maximum Output % set below.
Minimum Output	Enter the lowest possible pulse rate as a percentage of the Maximum Stroke Rate set below (normally 0%).
Maximum Output	Enter the highest possible pulse rate as a percentage of the Maximum Stroke Rate set below.
Maximum Rate	Enter the maximum pulse rate that the metering pump is designed to accept (10 - 360 pulse/minute range).
Input	Select the sensor to be used by this relay.
Direction	Set the control direction.

5.3.13 Relay, PID Control Mode

ONLY AVAILABLE IF CONTROLLER INCLUDES PULSE OUTPUT HARDWARE & HVAC MODE IS DISABLED

The PID algorithm controls a solid state relay using standard Proportional-Integral-Derivative control logic. The algorithm provides feedback control based on an error value continuously calculated as the difference between a measured process variable and a desired set point. Tuning settings specify the response for proportional (the size of the error), integral (the time that the error has been present), and derivative (the rate of change for the error) parameters. With proper tuning, the PID control algorithm can hold the process value close the set point while minimizing overshoot and undershoot.

Normalized Error

The error value versus set point that is calculated by the controller is normalized and represented as percent of full scale. As a result, tuning parameters entered by the user are not dependent upon the scale of the process variable and the PID response with similar settings will be more consistent even when using different types of sensor inputs.

The scale used to normalize the error is dependent upon the type of sensor selected. By default, the full nominal range of the sensor is used. This range is editable by the user if tighter control is desired.

PID Equation Formats

The controller supports two different forms of the PID equation as specified by the Gain Form setting. The two forms require different units for entry of the PID tuning parameters.

Standard

The standard form is more commonly used in industry because its time-based settings for the integral and derivative coefficients are more meaningful. This form is selected by default.

Parameter	Description	Units
K_p	Gain	unitless
T_i	Integral Time	seconds or seconds/repeat
T_d	Derivative Time	seconds

$$Output\ (\%) = K_p \left[e(t) + \frac{1}{T_i} \int e(t)dt + T_d \frac{de(t)}{dt} \right]$$

Parameter	Description	Units
e(t)	Current Error	% of full scale
dt	Delta Time Between Readings	seconds
de(t)	Difference Between Current Error & Previous Error	% of full scale

Parallel

The parallel form allows the user to enter all parameters as Gains. In all cases, larger gain values result in faster output response.

Parameter	Description	Units
K_p	Proportional Gain	unitless
K_i	Integral Gain	1/seconds
K_d	Derivative Gain	seconds

$$Output\ (\%) = K_p\ e(t) + K_i \int e(t)dt + K_d \frac{de(t)}{dt}$$

Integral Value Management

To determine the integral component of the PID calculation, the controller software must maintain a running total of the accumulated area under the error curve (Current Integral). The sign of the value added to the accumulated Current Integral during each cycle may be positive or negative based on the current Direction setting as well as the relative values of the current process reading and the set point.

Override Control

The Current Integral accumulates when the output is set to Auto mode. If the controller is switched to Off mode, the value no longer accumulates, but it is not cleared. Therefore, PID control will resume where it left off if the controller is switched from Off back to Auto. Similarly, accumulation of the Control Integral will be suspended if the output is interlocked and resume after the lock-out is removed.

Bumpless Transfer

When the output is switched from Hand to Auto mode, the controller calculates a value for the Current Integral using the current error to generate the same output percent as the Hand Output setting. This calculation does not use the Derivative tuning setting to minimize errors from momentary fluctuations in the input signal. This feature ensures a smooth transition from manual to automatic control with minimal overshoot or undershoot as long as the user sets the Hand Output percentage close to the value that the process is expected to require for optimal control in Auto mode.

Wind-up Suppression

The Current Integral value that is accumulating while the output is set to Auto can become very large or very small if the process value remains on the same side of the set point for a prolonged period of time. However, the controller may not be able to continue to respond if its output is already set to the minimum or maximum limits (0-100% by default). This condition is referred to as Control Wind-Up and can result severe overshoot or undershoot after a prolonged upset has ended.

For example, if the process value remains far below the set point despite a control output being pinned at 100%, the Current Integral will continue to accumulate errors (wind-up). When the process value finally rises to above the set point, negative errors will begin to decrease the Current Integral value. However, the value may remain large enough to keep the output at 100% long after the set point is satisfied. The controller will overshoot the set point and the process value will continue to rise.

To optimize system recovery after wind-up situations, the controller suppresses updates to the Current Integral that would drive the output beyond its minimum or maximum limit. Ideally, the PID parameters will be tuned and the control elements (pump, valves, etc.) will be sized properly so that the output never reaches its minimum or maximum limit during normal control operations. But with this wind-up suppression feature, overshoot will be minimized should that situation occur.

Output Details

The details for this type of output include the pulse rate in %, HOA mode or Interlock status, input value, current integral, current and accumulated on-times, alarms related to this output, relay type, and the current control mode setting.

Set Point	Numeric entry of a process value used as a target for PID control. The default value, units and display format (number of decimal places) used during data entry are defined based on the Input channel setting selected.
Gain	When the Gain Form setting is Standard, this unitless value is multiplied by the total of the proportional, integral, and derivative terms to determine the calculated output percent.
Proportional Gain	When the Gain Form setting is Parallel, this unitless value is multiplied by the normalized error (current process value versus set point) to determine the proportional component of the calculated output percent.
Integral Time	When the Gain Form setting is Standard, this value is divided into the integral of the normalized error (area under the error curve), then multiplied by the Gain to determine the integral component of the calculated output percent.
Integral Gain	When the Gain Form setting is Parallel, this value is multiplied by the integral of the normalized error (area under the error curve) to determine the integral component of the calculated output percent.
Derivative Time	When the Gain Form setting is Standard, this value is multiplied by the change in error between the current reading and the previous reading, then multiplied by the Gain to determine the derivative component of the calculated output percent.
Derivative Gain	When the Gain Form setting is Parallel, this value is multiplied by the change in error between the current reading and the previous reading to determine the derivative component of the calculated output percent.
Reset PID Integral	The PID Integral Value is a running total of the accumulated area under the error curve (Current Integral). When this menu option is selected, this total is set to zero and the PID algorithm is reset to its initial state.
Minimum Output	Enter the lowest possible pulse rate as a percentage of the Maximum Stroke Rate set below (normally 0%).
Maximum Output	Enter the highest possible pulse rate as a percentage of the Maximum Stroke Rate set below.
Maximum Rate	Enter the maximum pulse rate that the metering pump is designed to accept (10 – 480 pulse/minute range).
Input	Select the sensor to be used by this relay
Direction	Set the control direction. This setting is used to determine the sign of the calculated error (current process value versus set point) and allows flexible control with only positive values for all PID tuning parameters.

Input Minimum	The low end of the sensor input range, used to normalize errors into percent of full scale units. These values are set to the nominal range of the selected input sensor by default.
Input Maximum	The high end of the sensor input range, used to normalize errors into percent of full scale units. These values are set to the nominal range of the selected input sensor by default.
Gain Form	Select the PID Equation Format used to enter tuning parameters.

5.3.14 Relay, Dual Set Point Mode

Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms related to this output, current cycle on time, relay type and the current control mode setting.

Settings

Touch the Settings icon to view or change the settings related to the relay.

Set point	Enter the first sensor process value at which the relay will activate.
Set point 2	Enter the second sensor process value at which the relay will activate.
Deadband	Enter the sensor process value away from the set point at which the relay will deactivate.
Duty Cycle Period	Using a duty cycle helps to prevent overshooting the set point in applications where the response of the sensor to chemical additions is slow. Specify the amount of time for the cycle, and the percentage of that cycle time that the relay will be active. The relay will be off for the rest of the cycle, even if the set point has not been satisfied. Enter the length of the duty cycle in minutes:seconds in this menu. Set the time to 00:00 if use of a duty cycle is not required.
Duty Cycle	Enter the percentage of the cycle period that the relay will be active. Set the percentage to 100 if use of a duty cycle is not required.
On Delay Time	Enter the delay time for relay activation in hours:minutes:seconds. Set the time to 00:00:00 to immediately activate the relay.
Off Delay Time	Enter the delay time for relay deactivation in hours:minutes:seconds. Set the time to 00:00:00 to immediately deactivate the relay.
Input	Select the sensor to be used by this relay.
Direction	Select the control direction. In Range will activate the relay when the input reading is between the two set points. Out of Range will activate the relay when the input reading is outside the two set points.

5.3.15 Relay, Timer Control Mode

ONLY AVAILABLE IF HVAC MODES ARE DISABLED IN CONFIG MENU – GLOBAL SETTINGS

Basic Timer Operation

When a timer event triggers the algorithm will activate the relay for the programmed time.

Special Condition Handling

<u>Overlapping timer events</u>

If a second timer event occurs while the first one is still active, the second event will be ignored. An Event Skipped alarm will be set.

<u>Interlock Conditions</u>

Interlocks override the relay control, but do not change the operation of the timer control.
A digital input or output interlock condition does not delay the relay activation. The relay activation duration timer will continue even if the relay is deactivated due to an interlock condition. This will prevent delayed events which can potentially cause problems in they do not occur at the correct time.

<u>“Activate With” Conditions</u>

“Activate with channels” settings override the relay control, but do not change the operation of the timer control. The relay activation duration timer continues counting when the timer relay is forced on, and ends at the expected time (event start time plus duration). If the “activate with” condition continues after the end of the event time,

the relay remains activated.
Alarms
An Event Skipped alarm is set when a second timer event occurs while one event is still running.
An Event Skipped alarm is also set when the timer relay never turns on during an event because of an interlock condition.
The alarm is cleared when the relay is next activated for any reason (the next timer event or HAND mode or "activate with" force on condition).

Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms related to this output, current cycle on time, relay type and the current control mode setting. The current week number and day of the week is displayed (even if there is no multi-week repetition event programmed). Cycle Time shows the time counting down of the currently active part of the timer cycle.

Settings

Touch the Settings icon to view or change the settings related to the relay.

Event 1 (through 10)	Enter these menus to program timer events via the menus below:
Repetition	Select the time cycle to repeat the event: Hourly, Daily, 1 Week, 2 Week, 4 Week, or None. An event means that the output is turned on at the same time of day, for the same amount of time, and except for the Daily cycle, on the same day of the week.
Week	Only appears if Repetition is longer than 1 Week. Select the week during which the event will occur.
Day	Only appears if Repetition is longer than Daily. Select the day of the week during which the event will occur.
Events Per Day	Only appears if Repetition is Hourly. Select the number of events per day. The events occur on the Start Time and then evenly spaced throughout the day.
Start Time	Enter the time of day to start the event.
Duration	Enter the amount of time that the relay will be on.
Add Last Missed	Select Enabled if the controller should delay start the most recent timer cycle until immediately after an Interlock clears, or Disabled if all events should be skipped if there is an Interlock condition at the time the add was due to start.

5.3.16 Relay, Probe Wash Control Mode

Basic Timer Operation
When a Probe Wash event triggers, the algorithm will activate the relay for the programmed time. The relay will activate a pump or valve to supply a cleaning solution to the sensor or sensors. The output of the selected sensors will either be held or disabled during the cleaning cycle, and for a programmable hold time after the cleaning cycle.
Special Condition Handling
Overlapping timer events
If a second timer event occurs while the first one is still active, the second event will be ignored. An Event Skipped alarm will be set.
Interlock Conditions
Interlocks override the relay control, but do not change the operation of the timer control.
A digital input or output interlock condition does not delay the relay activation. The relay activation duration timer will continue even if the relay is deactivated due to an interlock condition. This will prevent delayed events which can potentially cause problems in they do not occur at the correct time.
"Activate With" Conditions
"Activate with channels" settings override the relay control, but do not change the operation of the timer control.

The relay activation duration timer continues counting when the timer relay is forced on, and ends at the expected time (event start time plus duration). If the “activate with” condition continues after the end of the event time, the relay remains activated.

Alarms

An Event Skipped alarm is set when a second timer event occurs while one event is still running.

An Event Skipped alarm is also set when the timer relay never turns on during an event because of an interlock condition.

The alarm is cleared when the relay is next activated for any reason (the next timer event or HAND mode or “activate with” force on condition).

Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms related to this output, current cycle on time, relay type and the current control mode setting. The current week number and day of the week is displayed (even if there is no multi-week repetition event programmed). Cycle Time shows the time counting down of the currently active part of the timer cycle.

Settings

Touch the Settings icon to view or change the settings related to the relay.

Event 1 (through 10)	Enter these menus to program timer events via the menus below:
Repetition	Select the time cycle to repeat the event: Hourly, Daily, 1 Week, 2 Week, 4 Week, or None. An event means that the output is turned on at the same time of day, for the same amount of time, and except for the Daily cycle, on the same day of the week.
Week	Only appears if Repetition is longer than 1 Week. Select the week during which the event will occur.
Day	Only appears if Repetition is longer than Daily. Select the day of the week during which the event will occur.
Events Per Day	Only appears if Repetition is Hourly. Select the number of events per day. The events occur on the Start Time and then evenly spaced throughout the day.
Start Time	Enter the time of day to start the event.
Duration	Enter the amount of time that the relay will be on.
Input	Select the sensor that will be washed.
Input 2	Select the second sensor, if applicable, that will be washed.
Sensor Mode	Select the effect that the probe wash event will have on any control outputs that use the sensor(s) being washed. The options are to either Disable the sensor readings (turn the control output off) or Hold the sensor reading at the last valid sensor reading prior to the start of the probe wash event.
Hold Time	Enter the amount of time needed to hold the sensor reading after the event has finished, in order for the wash solution to be replaced by process solution.

5.3.17 Relay, Spike Control Mode

Basic Timer Operation

This algorithm is typically used to provide a baseline amount of chlorine for disinfection, and periodically shocking the system with a larger dose. During normal operation, the relay will be reacting to sensor to maintain a set point within a programmable Deadband, as described in On/Off Control Mode above. When a Spike event triggers, the algorithm will change from the normal set point to the Spike Set Point, and once it reaches that set point, maintains it for the programmed time. Once the time expires, control to the normal set point resumes.

Special Condition Handling

Overlapping timer events

If a second timer event occurs while the first one is still active, the second event will be ignored. An Event Skipped alarm will be set.

Interlock Conditions

Interlocks override the relay control, but do not change the operation of the timer control.

A digital input or output interlock condition does not delay the relay activation. The relay activation duration timer will continue even if the relay is deactivated due to an interlock condition. This will prevent delayed events which can potentially cause problems in they do not occur at the correct time.

"Activate With" Conditions

"Activate with channels" settings override the relay control, but do not change the operation of the timer control. The relay activation duration timer continues counting when the timer relay is forced on, and ends at the expected time (event start time plus duration). If the "activate with" condition continues after the end of the event time, the relay remains activated.

Alarms

An Event Skipped alarm is set when a second timer event occurs while one event is still running.

An Event Skipped alarm is also set when the timer relay never turns on during an event because of an interlock condition.

The alarm is cleared when the relay is next activated for any reason (the next timer event or HAND mode or "activate with" force on condition).

Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, current cycle on time, relay type and alarms. The current week number and day of the week is displayed (even if there is no multi-week repetition event programmed). Cycle Time shows the time counting down of the currently active part of the cycle.

Settings

Press the Settings key view or change the settings related to the relay.

Set point	Enter the sensor process value at which the relay will activate.
Spike Set point	Enter the sensor process value at which the relay will activate during the Spike Event time.
Deadband	Enter the sensor process value away from the set point at which the relay will deactivate. The same Deadband is used for the normal Set Point and the Spike Set Point.
Onset Time	The onset time determines when the duration timer starts. If set to zero, the duration time starts immediately. If set higher than that, the controller will not start the duration timer until the spike set point is achieved, or until the onset time is over, whichever comes first.
Duty Cycle Period	Using a duty cycle helps to prevent overshooting the set point in applications where the response of the sensor to chemical additions is slow. Specify the amount of time for the cycle, and the percentage of that cycle time that the relay will be active. The relay will be off for the rest of the cycle, even if the set point has not been satisfied. Enter the length of the Duty Cycle Period in minutes:seconds in this menu. Set the time to 00:00 if use of a duty cycle is not required.
Duty Cycle	Enter the percentage of the cycle period that the relay will be active. Set the percentage to 100 if use of a duty cycle is not required.
Event 1 (through 8)	Enter these menus to program spike events via the menus below:

Repetition	Select the time cycle to repeat the event: Daily, 1 Week, 2 Week, 4 Week, or None. An event means that the output is turned on at the same time of day, for the same amount of time, and except for the Daily cycle, on the same day of the week.
Week	Only appears if Repetition is longer than 1 Week. Select the week during which the event will occur.
Day	Only appears if Repetition is longer than Daily. Select the day of the week during which the event will occur.
Start Time	Enter the time of day to start the event.
Duration	Enter the amount of time that the relay will be on.
Input	Select the sensor to be used by this relay.
Direction	Select the control direction.

5.3.18 Relay Output, Flow Proportional Mode

ONLY AVAILABLE IF CONTROLLER INCLUDES PULSE OUTPUT HARDWARE

Overview

In Flow Proportional control mode, the controller monitors the rate of flow through an analog or digital flow meter, and continuously adjusts the proportional band to achieve a target PPM level.

The user enters the target PPM and the data necessary to calculate the proportional band (the water flow rate at which the maximum pulse rate will occur) required to maintain the target PPM with that flow rate of water.

$$\%\ output = \frac{\text{Target PPM x Water Flow Rate (liter/min or gal/min)}}{\text{Cycles x Pump Capacity (liter or gal/hr) x Pump Setting (\%) x Specific Gravity x 166.67}}$$

$$\%\ output = \frac{\text{Target PPM x Water Flow Rate } (m^3/min)}{\text{Cycles x Pump Capacity (liter/hr) x Pump Setting (\%) x Specific Gravity x 0.16667}}$$

Control Operation

If the output is continuously on for longer than the Output Time Limit, then output will deactivate.

Output Details

The details for this type of output include the output %, HOA mode or Interlock status, alarms related to this output, flow input value, current cycle on time, total accumulated on-time, raw pulse rate output, and the current control mode setting.

Settings

Touch the Settings icon to view or change the settings related to the relay.

Target	Enter the desired PPM set point for the product.
Pump Capacity	Enter the maximum flow rate for the metering pump
Pump Setting	Enter the stroke length setting for the metering pump, in percent
Specific Gravity	Enter the specific gravity of the product to be added.
Maximum Rate	Enter the maximum pulse rate that the metering pump is designed to accept (10 - 360 pulse/minute range).
Hand Output	Enter the output % desired when the output is in Hand mode
Flow Input	Select the flow meter to be used as an input for this control relay

5.3.19 Relay or Analog Output, Lag Control Mode

Overview

The Lead Lag control mode allows a group of outputs to be controlled by a single control algorithm using a variety of configurations. The control mode support backup pumps operation, alternate pump with wear leveling, and the activation of additional outputs after a time delay, or based on alternate set points, or based on digital state changes.

A Lead Lag group consists of a single Lead output and one or more Lag outputs. The Lead output can be set to any control mode. The new Lag control mode can be selected for any number of additional outputs (limited only by the number of outputs available within the controller). A setting for each Lag output allows selection of a Lead output that is used to create an ordered group of Lead Lag relays.

Example: R1 is an On/Off relay, R2 is set for Lag mode with a Lead output of R1. R3 is set as an additional Lag mode relay with a Lead output of R2, thus creating an ordered chain of three relays in the Lead Lag group (R1←R2←R3). After the group is defined, the Lead output (R1) operates with the standard On/Off Control functionality. The last Lag mode relay in the chain (R3) offers various settings that are used to define the desired control operations for the entire Lead Lag group. Selectable Lead Lag control options include backup, wear leveling, and/or activating additional outputs based on various criteria.

Backup Pump Control

By default, Lead Lag groups always provide backup operation if the Lead control mode determines that its output should be energized but it is disabled due to a Flow Verify alarm and/or because the Lead output HOA setting is Off or Hand (not in Auto mode).

Wear Leveling Modes

The order of Lead and Lag output activation can be changed based on configurable wear leveling modes. This option is intended to allow users to manage the usage of primary and secondary pumps within a system. One wear leveling mode selects a different output each time the group is activated. Additional modes vary the activation of the pumps within the group based on the time-on for each output, with the intent to either balance the usage of each pump or to energize the primary output most often and periodically exercise auxiliary pumps to insure proper operation when they are needed.

Output Activation Modes

Depending on the control mode selected for the Lead output, Lag output(s) can be configured for activation of additional outputs based on one or more of the following criteria:
On-time (for example, energize a second relay 10 minutes after the primary relay is turned on)
Control set points (for example, energize a second relay if the pH continues to rise)
Switch change (for example, energize a second pump to maintain a tank level when the low-low level switch opens

Control Operation

Backup Pump Control

The default control operation for the Lead Lag group is that if a condition exists that prevents one relay from being activated, it is skipped and the next output in the group is turned on instead. This situation may occur if the output is experiencing an active Flow Verify alarm or the output is not in Auto mode. Backup control using a Lag output does not require any additional settings and could be used to create an output for a backup pump to be activated only if the main pump loses prime and/or is taken out of service for maintenance.

Example: A Lead Lag group consisting of R1, R2 & R3 is configured (R1←R2←R3). All three pumps have PosiFlow monitors wired to inputs D1, D2 & D3, respectively. R1 uses On/Off mode to control caustic feed to maintain a pH set point above 7.0. R1 and R3 pumps are in Auto mode, R2 pump has been taken out of service for maintenance and is currently in HOA Off mode. The process pH falls below 7.0 and R1 is energized. Before the pH rises to satisfy the dead band, the D1 PosiFlow input monitors an error condition and activates a Flow Verify alarm for the R1 pump. The Lead Lag system de-energizes R1 and checks the status of R2. Because R2 is not is service, R3 is energized to maintain caustic feed.

Each digital input channel set up as a Feed Monitor type has a Flow Alarm Mode setting used to specify how the pump output is handled when Flow Verify alarms are identified. Based on this setting, the Lead Lag group responds as follows:

Disabled	The Flow Verify alarm is never activated and the Lead Lag group is not affected by the status of the PosiFlow input.
Interlock	When a Flow Verify alarm is activated, the related output is immediately turned off; if available, other outputs in the Lead Lag group are activated instead.
Maintain	When a Flow Verify alarm is activated, other outputs in the Lead Lag group are activated instead if they are available; if no other outputs are available, or if additional outputs are required due to Output Activation Mode settings, output(s) reporting a Flow Verify alarm may still be activated as a last resort.

Wear Leveling Modes

After the Lead Lag group is defined, additional parameters can be configured within the settings list of the last output in the group. These options optimize the behavior of the Lead Lag functionality. Several different wear leveling options can be selected to control the order in which outputs are activated.

Disabled

The order in which the Lead and Lag outputs turn on does not change automatically. They are always energized in the same order.

Duty Based

The order in which outputs are activated changes every time the Lead output is activated. How long each individual pump has been running is not considered.

Example: When the Lead output, set for On/Off control, drops below the setpoint, R1 is activated. R1 turns off after its deadband is satisfied. The next time the measurement goes below the setpoint, R2 is activated and R1 remains off. After all outputs in the group have been exercised for one feed cycle, the process begins again with the first output (R1).

Time Balanced

Time balanced mode alternates outputs in a manner that equalizes the runtime of all connected pumps. This mode takes into account how long each output in the Lead Lag group has been running (since a manual reset) and selects the output that has the lowest on-time during each cycle. If the output remains energized longer than the specified cycle time, the time-on for each output is recalculated and a different output may be activated to balance the usage of each.

Example: In a two-pump Lead Lag group, time balanced wear leveling is selected with a cycle time of 2 hours. When the Lead control mode (R1) determines the output should be activated, R2 turns on because it has the lowest accumulated on-time. After 2 hours, if the output remains activated, the on-times are re evaluated and R2 turns off and R1 turns on because it now has the least accumulated total on time. The cycle continues until the Lead control mode determines the feed is complete.

Time Unbalanced

This wear leveling mode improves fault-tolerance of the group by varying the wear on each pump by activating each pump for a different percentage of time. In this mode, a primary output is activated most of the time and secondary (auxiliary) output(s) are activated for a smaller percentage of the total output on-time. This strategy can be useful to ensure that a backup pump is exercised sufficiently so that it will be functional when needed, but does not wear at the same rate as the primary pump to minimize the chances of both pumps failing at the same time. When one Lag pump is defined within the Lead Lag group, the Lead pump runs 60% of the time and the Lag pump runs 40%. If more than two (2) pumps are defined for the group, fixed ratios are used to insure all pumps are exercised periodically and wear at different rates, as shown in the chart.

Percent On	Number of Relays				
Relay	**2**	**3**	**4**	**5**	**6**
1	60.0%	47.4%	41.5%	38.4%	36.5%
2	40.0%	31.6%	27.7%	25.6%	24.4%

3		21.1%	18.5%	17.1%	16.2%
4			12.3%	11.4%	10.8%
5				7.6%	7.2%
6					4.8%

Output Activation Modes

Depending on the current control mode selection for the Lead output, additional settings may be available within the settings list of the last output in the group to provide additional option(s) to optimize the behavior of the Lead Lag functionality. Several different activation modes can be selected to control the status of additional output(s) based on either elapsed time, alternate setpoints, and/or alternate switch inputs.

Disabled

No action is taken to activate more than one output within the Lead Lag group of outputs. This mode is used when a group of Lead Lag outputs exists only to provide backup in case of a Flow Verify failure on one of the pumps, or if a pump is taken out of service, and/or if only wear leveling is desired.

Time Based

Lag outputs are activated following the Lead output after a user-settable delay. The same delay value is used for all outputs. This menu selection is available only when the Lead output is using On/Off, Dual Setpoint, Spike or Manual control modes.

Example: If the Lead output is set to Manual, this control option could be used to force on the output based on a digital input signal (e.g., level switch). If the level switch remains open for more than the specified delay time, the second output in the Lead Lag group is energized. If another delay time elapses, a third output (if available) is also turned on.

In On/Off, Dual Setpoint, or Spike control modes, additional pump(s) are energized if the process value remains outside the setpoint range for more than the specified delay time.

Example: In a two-output Lead Lag group (R1←R2), the Lead (R1) output, set for Dual Setpoint control, is programmed to energize its output when the D.O. reading is outside the 4.0-4.5 ppb control range with a deadband of 0.1 ppb. Time based output activation is selected with a delay time of 15 minutes. When the D.O. value falls below 4.0 ppb, R1 is activated. After 15 minutes, if the D.O. has not risen to 4.1 ppb or higher, R2 will also be activated. When the process value reaches 4.1 ppb, both outputs are turned off.

Setpoint Based

Each Lag output has its own setpoint(s) and deadband when this option is selected. The setpoints for each output in the Lead Lag group are evaluated individually and outputs are added as needed based on the current process value. Setpoint based activation mode also incorporates time based activation and can also be configured to trigger an additional pump (if available) after a specified delay time. This menu selection is available only when the Lead output is using On/Off or Dual Setpoint control modes.

Example 1: The Lead output (R1) is set for On/Off control of pH with a setpoint of 8.50, a deadband of 0.20 and a "force lower" control direction. The first Lag output (R2) has a setpoint of 9.00 and a deadband of 0.20. The second Lag output (R3) has a setpoint of 9.50 and a deadband of 0.20. The delay time is disabled (set for 0:00 minutes). Wear leveling is disabled. When the pH goes above 8.50, R1 energizes. If the pH proceeds to exceed 9.00, R2 energizes. And if the pH rises above 9.50, R3 energizes. When the pH decreases to below 9.30, R3 goes off. When the pH falls to below 8.80, R2 goes off. And finally, when the pH decreases to below 8.30, R1 is turned off.

Example 2: The same three-pump configuration (R1←R2←R3) as in Example 1 except the delay time is set for 30 minutes. When the pH goes above 8.50, R1 energizes. If 30 minutes passes before the pH exceeds 9.00 or drops below 8.30, R1 remains on and R2 is energized. If the pH then rises above 9.00, the next output in the group, R3, is energized. If the pH continues to rise and exceeds 9.50, no additional action is possible. When the pH decreases to below 8.80, R3 goes off. When the pH falls to below 8.30, both R1 and R2 are turned off.

This control is very similar to the operation if three (3) separate On/Off control outputs are configured all with the pH as Input and using the setpoints listed above. However, the Lead Lag option improves on this control by incorporating backup pump controls and optional time based activation. If the pH rises above 8.50 when pump R1 has an active Flow Verify alarm or is in HOA Off mode, pump R2 immediately energizes. R3 energizes when the pH goes above 9.00. Although no third pump is available to activate if the pH continues to rise above 9.50, this control system is more fault tolerant than the currently available options.

Switch Based

When using switch based activation mode, each Lag output has an Activate With Channels setting that is used to specify one or more digital input or relay output channels that activates an additional output. Switch based activation mode incorporates time based activation and can also be configured to trigger an additional output (if available) after a specified delay time. This menu selection is available only when the Lead output is using Manual control mode.

Example 1: A lift station includes a tank with a high level switch (D1) and a high-high level switch (D2). Three pumps are configured as a Lead Lag group (R1←R2←R3). The Lead output (R1) is set for Manual control mode with an Activate With Channels selection of D1 (high level switch), R1 will be energized if D1 closes. The first Lag output (R2) has an Activate With Channels selection of D2 (high-high level switch). The last Lag output (R3) has no Activate With Channels selected. All pumps are in HOA Auto mode. The delay time is disabled (set for 0:00 minutes). Wear leveling is disabled. When the high level switch closes, the R1 pump is activated. If the high-high level switch closes, the R2 pump is also activated. When D2 opens, R2 is turned off. When D1 opens, R1 is turned off. In this configuration, the R3 pump serves only as a backup in case one of the pumps is down for maintenance (in HOA Off mode).

Example 2: The same lift station, two-level switches, three-pump configuration (R1←R2←R3) as in Example 1 except the delay time is set for 1 hour. When the high level switch closes, the R1 pump is activated. If the high-high level switch closes, the R2 pump is also activated. If the tank level remains above the high-high level switch for another 1 hour, the R3 pump is activated. When D2 opens, R3 is turned off. When D1 opens, both R2 and R1 are turned off. In this configuration, the R3 pump serves not only as a backup in case one of the pumps is down for maintenance, but also provides additional capacity should it be needed.

Advanced Functionality

The examples listed above detail the control behavior if wear leveling or output activation modes are enabled. The features are implemented independently. Wear Leveling modes are used to determine which output(s) are activated. Output Activation modes determine how many output(s) are activated at one time. More advanced output control strategies can be implemented when these features are used in combination.

Example: In a two-pump scenario, the Lead output (R1) is set for On/Off control of pH with a setpoint of 8.50, deadband of 0.20 and a "force lower" control direction. The Lag output (R2) has a setpoint of 9.00 and a deadband of 0.20. Time unbalanced (80/20) wear leveling is selected with a cycle time of 15 minutes. When the pH goes above 8.50, the on-times for each pump are evaluated. If R1 has been on less than 80% of the total time for the two pumps, it is energized. Otherwise, R2 has been on for less than 20% of the total time, so it is energized. If the pH remains above the deadband and does not exceed the second setpoint (8.30 < pH < 9.00), the pump selection is re-evaluated every 15 minutes and, if warranted, the pump in operation is switched. If the pH proceeds to exceed 9.00, both pumps are energized and wear leveling is no longer a consideration. When the pH fails to below 8.80, the pump on-times are again evaluated and the appropriate pump is turned off.

Note that while this control is quite powerful, it might cause confusion with users because the setpoints entered for a specific pump within the Lead Lag group may not coincide with the setpoints used to activate that particular pump during operation. The information shown on the Details pages for each pump should be sufficient to minimize this ambiguity.

Control Mode Conflicts

Some control modes are incompatible with Lag output functionality because of an interactive relationship between the output and one or more linked inputs:

- Intermittent Sampling – This control mode places a linked sensor into a Hold state during most of its operational cycle

- Probe Wash – This control mode places one or two linked sensors into a Hold state when a wash cycle is in progress and for a specified Hold period afterward

The link between the output and the sensor input(s) cannot be easily transferred to other outputs, so these types of control modes cannot be designated as Lead output for a Lead Lag group. Outputs configured with these types of control modes are not included on the selection list presented for Lead output. Also, the control mode of an output that is the Lead output for a Lead Lag group cannot be changed to one of these types. If selected, the controller will be unable to save the change and an error message will be added to system log.

Output Details

The details for this type of output include the relay on/off state, relay status (HOA mode, Interlock from sensor calibration, probe wash, or other condition), the current cycle and the total on-times, alarms related to this output, the output defined as the Lead of the group, the output that is the Last Lag output of the group, the number of outputs currently energized within the group, the elapsed time since the last change in the number of outputs energized, the elapsed time since the last wear leveling evaluation, the type of output, and the current control mode setting.

Settings 

Touch the Settings icon to view or change the settings related to the relay.

The Lag control mode output defined as the Last Lag within the Lead Lag group offers settings to define the parameters controlling operation of the entire group.

All Lag mode outputs that are not the Last Lag output in the Lead Lag group (those that are selected as a Lead output from another Lag mode output) offer a more limited list of settings.

Lag Settings (Menus with * are shown only in the Last Lag output settings)

HOA Setting	Select Hand, Off or Auto mode by touching the desired mode
Lead	Select the output that will be the lead output for this relay
Wear Leveling*	Select the wear leveling scheme to use. Refer to the detailed description above.
Wear Cycle Time*	This setting only appears if Time Balanced or Time Unbalanced Wear Leveling has been selected above. Enter the amount of elapsed time before time on totals for each output are reevaluated for wear leveling.
Activation Mode*	This entry is only appears if the control mode of the Lead output is On/Off, Dual Setpoint, Spike or Manual. Select one of the options that will determine if and when an additional output will be activated if the primary output is unable to reach the setpoint.
Set point	This setting only appears if the control mode of the Lead output is On/Off or Dual Setpoint and the Activation Mode above is Setpoint Based. Enter the process value for the input assigned to the Lead output that will trigger an additional output to activate.
Set point 2	This setting only appears if the control mode of the Lead output is Dual Setpoint and the Activation Mode above is Setpoint Based. Enter the process value for the input assigned to the Lead output that will trigger an additional output to activate.
Deadband	This setting only appears if the control mode of the Lead output is On/Off or Dual Setpointand the Activation Mode above is Setpoint Based. Enter the sensor process value away from the set point(s) at which the relay will deactivate.
Delay Time*	This setting only appears if the control mode of the Lead output is On/Off, Dual Setpoint, Spike or Manual. Enter the amount of time, if any, to delay the activation of the output.

Activate With Channels	This setting only appears if the control mode of the Lead output is Manual and the activation mode is Switch Based. Select one or more digital input and/or relay output channels that, if activated, will also activate the Lag output
Reset Time Total	Enter this menu to clear the accumulated time that the output has been activated . This value is used for Time Balanced or Time Unbalanced wear leveling.
Output Time Limit	Enter the maximum amount of time that the relay can be continuously activated. Once the time limit is reached, the relay will deactivate until the Reset Output Timeout menu is entered.
Reset Output Timeout	Enter this menu to clear an Output Timeout alarm and allow the relay to control the process again.
Name	The name used to identify the relay may be changed.
Mode	Select the desired control mode for the output.

Several standard settings that are available for most control modes are not available for Lag outputs. These features affect the entire Lead Lag group and can be specified only within the Lead output's settings. The settings for these fields are propagated down through the entire Lead Lag group when changed for the Lead output. Although the settings for these fields are identical for all outputs in the Lead Lag group, the handling by each Lag output may be independent or group-managed.

Below are the settings that are in the Lead Relay settings that will affect the Lead Lag group:

Interlock Channels	Select the relays and digital inputs that will interlock this relay and all others in the group.
Min Relay Cycle	Enter the number of seconds that will be minimum amount of time that each relay in the group will be in the active or inactive state. Normally this will be set to 0, but if using a motorized ball valve that takes time to open and close, set this high enough that the valve has time to complete its movement.
Hand Time Limit	Enter the amount of time that each relay in the group will activate for when it is in Hand mode.
Hand Output	This menu only appears for pulse relay or analog output Lead outputs. Enter the output % desired for each output in the group when the output is in Hand mode.
Off Mode Output	This menu only appears for analog output Lead outputs.Enter the output mA value desired for each output in the group when the output is in Off mode, or being Interlocked, or during a calibration of the sensor being used as an input. The acceptable range is 0 to 21 mA.
Error Output	This menu only appears for analog output Lead outputs.Enter the output mA desired for each output in the group when the sensor is not giving the controller a valid signal. The acceptable range is 0 to 21 mA.

The ***Activate With Channels*** setting, normally available for all outputs, is **not** propagated through the Lead Lag group. This field can be entered independently for each Lag Output when the control mode of the Lead output is Manual and the activation mode is Switch Based.

Most other settings for the various types of Lead control modes are managed independently from other outputs within a Lead Lag group. In most cases, no ***Activation Mode*** settings are available, so the Lead output determines the status for the entire group based on its settings and the current controller parameters. However, when an Activation Mode is enabled, the handling of some settings may require some additional explanation. For example,

- Duty Cycle - If a Lead output with a control mode of On/Off or Dual Setpoint has a Duty Cycle setting of less that 100%, this cycle will be managed for the Lead output only. The Duty Cycle will drive other Lag outputs for Backup or Wear Leveling purposes. However, if additional Lag Output(s) are energized due to Setpoint-Based or Time-Based Activation Mode settings, the additional outputs will operate independently of the

Duty Cycle setting. The Lead output will continue to cycle On and Off, however, the additional outputs will remain activated with 100% duty cycle until the setpoint deadband is satisfied.

- On Delay / Off Delay - If the Lead output with a control mode of On/Off, Dual Setpoint, or Manual has either an On or Off Delay Time setting specified, the delay will be managed for the Lead output only. If one or more Lag outputs provide Backup or Wear Leveling support, the Delay Times would also effect these outputs. However, if additional Lag Output(s) are energized due to Activation Mode settings, the additional outputs will operate independently of the On or Off Delay Time setting(s) and will energize and de-energize without delay when needed.

5.3.20 Analog Output, Retransmit Mode

Output Details

The details for this type of output include the output %, HOA mode or Interlock status, accumulated on-time, alarms related to this output, current cycle on time, relay type and the current control mode setting.

Settings

Touch the Settings icon to view or change the settings related to the relay.

4 mA Value	Enter the process value to correspond to a 4 mA output signal.
20 mA Value	Enter the process value to correspond to a 20 mA output signal.
Hand Output	Enter the output % desired when the output is in Hand mode.
Error Output	Enter the output % desired when the input signal is invalid (Error mode).
Input	Select the sensor input to retransmit.

5.3.21 Analog Output, Proportional Control Mode

Output Details

The details for this type of output include the output %, HOA mode or Interlock status, accumulated on-time, alarms related to this output, current cycle on time, relay type and the current control mode setting.

Settings

Touch the Settings icon to view or change the settings related to the relay.

Set point	Enter the sensor process value at which the output % will be the programmed minimum %.
Proportional Band	Enter the sensor process value away from the set point at which the output % will be the programmed maximum %.
Minimum Output	Enter the lowest output %. If the output should be off at the set point, this will be 0%.
Maximum Output	Enter the highest output %.
Hand Output	Enter the output % desired when the output is in Hand mode.
Off Mode Output	Enter the output mA value desired when the output is in Off mode, or being Interlocked, or during a calibration of the sensor being used as an input. The acceptable range is 0 to 21 mA.
Error Output	Enter the output mA desired when the sensor is not giving the controller a valid signal. The acceptable range is 0 to 21 mA.
Input	Select the sensor input to use for proportional control.
Direction	Select the control direction.

5.3.22 Analog Output, PID Control Mode

ONLY AVAILABLE IF CONTROLLER INCLUDES PULSE OUTPUT HARDWARE & HVAC MODE IS DISABLED

The PID algorithm controls an analog (4-20 mA) output using standard Proportional-Integral-Derivative control logic. The algorithm provides feedback control based on an error value continuously calculated as the difference between a measured process variable and a desired set point. Tuning settings specify the response for proportional (the size of the error), integral (the time that the error has been present), and derivative (the rate of change for the error) parameters. With proper tuning, the PID control algorithm can hold the process value close the set point while minimizing overshoot and undershoot.

Normalized Error

The error value versus set point that is calculated by the controller is normalized and represented as percent of full scale. As a result, tuning parameters entered by the user are not dependent upon the scale of the process variable and the PID response with similar settings will be more consistent even when using different types of sensor inputs.

The scale used to normalize the error is dependent upon the type of sensor selected. By default, the full nominal range of the sensor is used. This range is editable by the user if tighter control is desired.

PID Equation Formats

The controller supports two different forms of the PID equation as specified by the Gain Form setting. The two forms require different units for entry of the PID tuning parameters.

Standard

The standard form is more commonly used in industry because its time-based settings for the integral and derivative coefficients are more meaningful. This form is selected by default.

Parameter	Description	Units
K_p	Gain	unitless
T_i	Integral Time	seconds or seconds/repeat
T_d	Derivative Gain	seconds

$$Output\ (\%) = K_p \left[e(t) + \frac{1}{T_i} \int e(t)dt + T_d \frac{de(t)}{dt} \right]$$

Parameter	Description	Units
e(t)	Current Error	% of full scale
dt	Delta Time Between Readings	seconds
de(t)	Difference Between Current Error & Previous Error	% of full scale

Parallel

The parallel form allows the user to enter all parameters as Gains. In all cases, larger gain values result in faster output response. This form is used in the WebMaster controller and is used internally by the Control Module.

Parameter	Description	Units
K_p	Proportional Gain	unitless
K_i	Integral Gain	1/ seconds
K_d	Derivative Gain	seconds

$$Output\ (\%) = K_p\ e(t) + K_i \int e(t)dt + K_d \frac{de(t)}{dt}$$

Integral Value Management

To determine the integral component of the PID calculation, the controller software must maintain a running total of the accumulated area under the error curve (Current Integral). The sign of the value added to the accumulated Current Integral during each cycle may be positive or negative based on the current Direction setting as well as the relative values of the current process reading and the set point.

Override Control

The Current Integral accumulates when the output is set to Auto mode. If the controller is switched to Off mode, the value no longer accumulates, but it is not cleared. Therefore, PID control will resume where it left off if the controller is switched from Off back to Auto. Similarly, accumulation of the Control Integral will be suspended if the output is interlocked and resume after the lock-out is removed.

Bumpless Transfer

When the output is switched from Hand to Auto mode, the controller calculates a value for the Current Integral using the current error to generate the same output percent as the Hand Output setting. This calculation does not use the Derivative tuning setting to minimize errors from momentary fluctuations in the input signal. This feature ensures a smooth transition from manual to automatic control with minimal overshoot or undershoot as long as the user sets the Hand Output percentage close to the value that the process is expected to require for optimal control in Auto mode.

Wind-up Suppression

The Current Integral value that is accumulating while the output is set to Auto can become very large or very small if the process value remains on the same side of the set point for a prolonged period of time. However, the controller may not be able to continue to respond if its output is already set to the minimum or maximum limits (0-100% by default). This condition is referred to as Control Wind-Up and can result severe overshoot or undershoot after a prolonged upset has ended.

For example, if the process value remains far below the set point despite a control output being pinned at 100%, the Current Integral will continue to accumulate errors (wind-up). When the process value finally rises to above the set point, negative errors will begin to decrease the Current Integral value. However, the value may remain large enough to keep the output at 100% long after the set point is satisfied. The controller will overshoot the set point and the process value will continue to rise.

To optimize system recovery after wind-up situations, the controller suppresses updates to the Current Integral that would drive the output beyond its minimum or maximum limit. Ideally, the PID parameters will be tuned and the control elements (pump, valves, etc.) will be sized properly so that the output never reaches its minimum or maximum limit during normal control operations. But with this wind-up suppression feature, overshoot will be minimized should that situation occur.

Output Details

The details for this type of output include the analog output value in %, HOA mode or Interlock status, input value, current integral, current and accumulated on-times, alarms related to this output, and the current control mode setting.

Set Point	Numeric entry of a process value used as a target for PID control. The default value, units and display format (number of decimal places) used during data entry are defined based on the Input channel setting selected.
Gain	When the Gain Form setting is Standard, this unitless value is multiplied by the total of the proportional, integral, and derivative terms to determine the calculated output percent.
Proportional Gain	When the Gain Form setting is Parallel, this unitless value is multiplied by the normalized error (current process value versus set point) to determine the proportional component of the calculated output percent.
Integral Time	When the Gain Form setting is Standard, this value is divided into the integral of the normalized error (area under the error curve), then multiplied by the Gain to determine the integral component of the calculated output percent.
Integral Gain	When the Gain Form setting is Parallel, this value is multiplied by the integral of the normalized error (area under the error curve) to determine the integral component of the calculated output percent.
Derivative Time	When the Gain Form setting is Standard, this value is multiplied by the change in error between the current reading and the previous reading, then multiplied by the Gain to determine the derivative component of the calculated output percent.

Derivative Gain	When the Gain Form setting is Parallel, this value is multiplied by the change in error between the current reading and the previous reading to determine the derivative component of the calculated output percent.
Reset PID Integral	The PID Integral Value is a running total of the accumulated area under the error curve (Current Integral). When this menu option is selected, this total is set to zero and the PID algorithm is reset to its initial state.
Minimum Output	Enter the lowest possible output value (normally 0%).
Maximum Output	Enter the highest possible output value as a percentage.
Off Mode Output	Enter the output mA value desired when the output is in Off mode, or being Interlocked, or if the Output Time Limit has expired, or during a calibration of the sensor being used as an input. Also if there is a Probe Wash programmed for the sensor, and the Sensor Mode option is set to Disable the output during the Wash cycle (if the Sensor Mode option is set to Hold the output holds its last setting and the Integral is not updated during the Wash). The acceptable range is 0 to 21 mA.
Error Output	Enter the output mA desired when the sensor is not giving the controller a valid signal. The acceptable range is 0 to 21 mA.
Input	Select the sensor to be used by this output.
Direction	Set the control direction. This setting is used to determine the sign of the calculated error (current process value versus set point) and allows flexible control with only positive values for all PID tuning parameters.
Input Minimum	The low end of the sensor input range, used to normalize errors into percent of full scale units. These values are set to the nominal range of the selected input sensor by default.
Input Maximum	The high end of the sensor input range, used to normalize errors into percent of full scale units. These values are set to the nominal range of the selected input sensor by default.
Gain Form	Select the PID Equation Format used to enter tuning parameters.

5.3.23 Analog Output, Manual Mode

Output Details

The details for this type of output include the analog output %, HOA mode or Interlock status, accumulated on-time, alarms related to this output, current cycle on time, and the current control mode setting.

Settings

A Manual analog output will activate if the HOA mode is Hand, or if it is Activated With another channel. There are no additional programmable parameters

5.3.24 Analog Output, Flow Proportional Mode

Overview

In Flow Proportional control mode, the controller monitors the rate of flow through an analog or digital flow meter, and continuously adjusts the analog (4-20 mA) output proportional band to achieve a target PPM level.

The user enters the target PPM and the data necessary to calculate the proportional band (the water flow rate at which the maximum pulse rate will occur) required to maintain the target PPM with that flow rate of water.

$$\%\ output = \frac{\text{Target PPM x Water Flow Rate (liter/min or gal/min)}}{\text{Cycles x Pump Capacity (liter or gal/hr) x Pump Setting (\%) x Specific Gravity x 166.67}}$$

$$\%\ output = \frac{\text{Target PPM x Water Flow Rate } (m^3/min)}{\text{Cycles x Pump Capacity (liter/hr) x Pump Setting (\%) x Specific Gravity x 0.16667}}$$

Control Operation

If the output is continuously on for longer than the Output Time Limit, then output will deactivate.

Output Details

The details for this type of output include the output %, HOA mode or Interlock status, alarms related to this output, current cycle on time, total accumulated on-time, cycles of concentration, mA output, and the current control mode setting.

Settings

Touch the Settings icon to view or change the settings related to the relay.

Target	Enter the desired PPM set point for the product.
Pump Capacity	Enter the maximum flow rate for the metering pump.
Pump Setting	Enter the stroke length setting for the metering pump, in percent.
Specific Gravity	Enter the specific gravity of the product to be added.
Hand Output	Enter the output % desired when the output is in Hand mode.
Off Mode Output	Enter the output mA value desired when the output is in Off mode, or being Interlocked, or during a calibration of the sensor being used as an input. The acceptable range is 0 to 21 mA.
Error Output	Enter the output mA desired when the sensor is not giving the controller a valid signal. The acceptable range is 0 to 21 mA.
Flow Input	Select the flow meter to be used as an input for this control relay.

5.4 Configuration Menu

The configuration Settings Menu is used for settings and activities that are not tied to Inputs or Outputs.

5.4.1 Global Settings

Date	Enter the current year, month and day.
Time	Enter the current hour (military time), minute, and second.
Name	Enter the name to help identify the controller when it connects to VTouch.
Location	Enter the location to help identify the controller when it connects to VTouch.
Global Units	Select the units to be used for cable length and wire gauge settings, metric or Imperial.
Temperature Units	Select between Fahrenheit and Celsius.
Alarm Delay	Enter how much time to wait after powering up the controller before alarm conditions are considered valid.
HVAC Modes	Enable HVAC Modes for cooling tower and boiler applications where the relay control modes for Biocide timer, Bleed and Feed, Bleed then Feed, and Intermittent Sampling are required. Disable HVAC Modes if these control modes are not necessary and a more generic timer control mode will replace the Biocide timer.
Language	Select the language the software will use.

5.4.2 Security Settings

Controller Log Out	When Security is Enabled, and after the password has been entered, the controller requires immediate use of a password to calibrate or change settings. Once finished making changes, log out to prevent unauthorized changes by someone else. If not manually logged out, the controller will automatically log out after 10 minutes of inactivity.
Security	Select Enable to require a password in order to calibrate or change settings, or Disable to allow calibration and set point changes without a password. In order to enable security, the default password must be entered first, then touch Enabled, then touch the Confirm icon.

Local Password	Used to change the touchscreen password needed for full configuration capability if security has been enabled. The default local password is 5555. This can and should be changed using this menu if Security is enabled.

5.4.3 Network Settings

DHCP Setting	Select Enabled to get an IP address from the LAN or Disabled to use a fixed IP address.
Controller IP Address	Enter the default IP address to use if a network is not available or if DHCP is disabled.
Network Netmask	Enter the default netmask to use if a network is not available or if DHCP is disabled.
Network Gateway	Enter the default gateway address to use if a network is not available or if DHCP is disabled.
DNS Server	Enter the default DNS server IP address to use if DHCP is disabled.
TCP Timeout	Do not change from the default of 1 second unless directed to be technical service. The TCP Timeout should only be increased if the VTouch live connection is being Reset du to slow cellular connection speed.
VTouch Status	Select Enabled to activate a connection to VTouch, or Disabled to stop sending data and alarms to VTouch.
LiveConnect Status	Select Enabled to allow the ability to access the controller programming and log files remotely using VTouch, or Disabled to prevent remote connection to the controller using VTouch. The controller can still send data and alarms to VTouch, but the Live-Connect icon will not appear on the VTouch webpages.
Update Period	Enter the time between data updates being sent to VTouch.
Reply Timeout	Enter the maximum time allowed for VTouch to respond.

5.4.4 Network Details

The Network Details are for information only and display the network settings currently in use, and the recent history of the VTouch connection.

Alarms	Displays any active Network-related alarms
DHCP Status	Displays if the connection to the LAN using DHCP was successful or not.
Controller IP Address	Displays the IP address that the controller is currently using.
Network Netmask	Displays the netmask address that the controller is currently using.
Network Gateway	Displays the gateway address that the controller is currently using.
DNS Server	Displays the DNS server address that the controller is currently using.
MAC Address	Displays the MAC address of the Ethernet card.
Last VTouch Config	Displays the date and time of the last attempt to send configuration data to the VTouch server.
Last VTouch Data	Displays the date and time of the last attempt to send a data to the VTouch server.

5.4.5 Remote Communications (Modbus)

This menu will appear only if one of the optional Remote Communcations activation keys has been imported into the controller, either by the factory at the time of ordering, or later using a field activation file.

To add the Modbus feature in the field, purchase the activation key file and save it to an USB drive, as the only file stored on the root directory of the stick. Insert the stick into the USB port of the controller. Go to the Configuration Menu, then File Utilities, then Import User Config File. Press the Confirm icon to start the activation process.

The display will report whether the import was successful or not. The activation key file is only valid for the serial number of the controller for which it was purchased.

For a complete description of the Modbus feature and register map, refer to the separate Modbus instruction manual.

Comm Status	Select Modbus to enable the feature, or Disabled.

Data Format	Select to receive Modbus data in Standard (Float) format or Float Inverse format.
Data Port	The standard port for Modbus data is port 502. Enter the port used if it is non-standard.
Verbose Logging	If logging is Enabled, all Modbus requests will be logged in the Event Log (any errors, the function called, starting register, number of registers, value of the first register). This is useful when first setting up the HMI, but it will quickly fill the Event Log if it is not Disabled during normal operation. The Verbose Logging function will be automatically disabled after power to the controller is cycled.

5.4.6 Email Report Settings

NOTE: To set up the content of the Graph report, connect using a browser via Ethernet and go to the Graph webpage. See section 6.

Report #1 (through 4)	Enter this menu to activate and set up a report to email, via the menus below:
Report Type	Select the type of report to email: None, Alarm, Datalog, Graph, or Summary (the Home webpage showing a Summary of current conditions).
Email Recipients	Select up to 8 email addresses that reports may be sent to by touching the check box. The addresses are entered in the Email Addresses menu described above.
Repetition	Only appears if Report Type is Datalog, Graph or Summary. Select how frequently to repeat sending the report: None, Hourly, Daily, Weekly or Monthly.
Reports Per Day	Only appears if Report Type is Datalog, Graph or Summary. Only appears if the repetition is set to Hourly. Select the number of reports per day: 2, 3, 4, 6, 8, 12 or 24. The report is sent on the Report Time and then evenly spaced throughout the day.
Day	Only appears if Report Type is Datalog, Graph or Summary. Only appears if the repetition is set to Weekly. Choose the day of the week on which the report will be sent.
Day of Month	Only appears if Report Type is Datalog, Graph or Summary. Only appears if the repetition is set to Monthly. Choose the day of the month on which the report will be sent. If the current month has less days than the number entered, the report will be sent on the last day of the month.
Report Time	Only appears if Report Type is Datalog, Graph or Summary. Only appears if the repetition is set to Daily, Weekly or Monthly. Enter the time of day for the report to be sent.
Log Frequency	Only appears if the Report Type is Datalog. Select the amount of time between data points. The amount of time allowed varies with the repetition of the report.
Alarm Mode	Only appears if Report Type is Alarm. Choose to send emails on All Alarms or only Selected Alarms.
Select Alarms	Only appears if Rerport Type is Alarm. Only appears if the Alarm Mode is set to Selected Alarms. Select an Input or Output channel, System Alarm or Network Alarm, then touch the check box for individual alarms that will trigger an email to the list of recipients. Repeat for as many as desired.
Alarm Delay	Only appears if Report Type is Alarm. Enter how much time to wait after the alarm has been triggered before alarm conditions are considered valid and the email is sent.
Email Addresses	Enter up to 8 email addresses that reports may be sent to.
Email Server	Select the type of email server to be used: SMTP, or ASMTP.
SMTP Server	Enter the SMTP server address, either numeric or its name. Only appears if the email server type is SMTP or ASMTP.
SMTP Port	Enter the port to be used by SMTP server. Only appears if the email server type is SMTP or ASMTP. The default is port 25 for SMTP and port 587 for ASMTP.

From Address	Enter the controller's email address. Only appears if the email server type is SMTP or ASMTP.
ASMTP Username	Enter the username required for authentication. Only appears if the email server type is ASMTP.
ASMTP Password	Enter the password required for authentication. Only appears if the email server type is ASMTP.

5.4.7 Display Settings

Home 1	Select the input or output to display on the 1^{st} line of the display Home screen.
Home 2	Select the input or output to display on the 2^{nd} line of the display Home screen.
Home 3	Select the input or output to display on the 3^{rd} line of the display Home screen.
Home 4	Select the input or output to display on the 4th line of the display Home screen.
Home 5	Select the input or output to display on the 4^{th} line of the display Home screen.
Home 6	Select the input or output to display on the 5^{th} line of the display Home screen.
Home 7	Select the input or output to display on the 6^{th} line of the display Home screen.
Home 8	Select the input or output to display on the 7^{th} line of the display Home screen.
Adjust Display	Change the contrast and the brightness by touching the arrow keys. If the display becomes unreadable, it is possible to reset the defaults by powering down and pressing the bottom right corner of the touchscreen while powering back on.
Auto Dim Time	If this is set to a non-zero time, the display backlight will dim if the touchscreen is not touched for that amount of time. Touching the screen will turn the back to normal brightness.
Key Beep	Select enable to hear a beep when an icon is pressed, or disable for silence

5.4.8 File Utilities

File Transfer Status	Displays the status of the last attempt to export a file
Data Log Range	Select how far back in time for data to be downloaded: Since Previous download, past 6 hours, all the way up to the past 3 months.
Log Frequency	Select the amount of time between data points. The amount of time allowed varies with the Data Log Range. If the Data Log Range is selected as Since Previous download, the choices for frequency of data points will be limited by how far back in time the last download occurred.
Export Data Log File	Save the Data Log file, as defined by the Data Log Range and Log Frequency settings above, to a USB stick.
Export Event Log	Save the Event Log file to a USB stick. This records set point changes, user calibrations, alarms, relay state changes, file exports, etc.
Export System Log	Save the System Log file to a USB stick. This records hardware changes, software upgrades, automatic calibrations, power loss, system-level issues, etc.
Export User Config File	The User Configuration file contains all settings for the controller. Enter this menu to save the controller's settings to an USB stick for using later to restore settings to this controller, or to program additional controllers with the same settings as this one. It takes several minutes to create the file and transfer it to the stick.
Import User Config File	The User Configuration file contains all settings for the controller. Insert an USB stick containing the desired Configuration file. Enter this menu to import the file from the stick onto the controller.
Restore Default Config	Enter this menu to restore all of the settings to the factory default values. Any changes to settings that were previously made will be lost!

Software Upgrade	Insert a USB stick that has the upgrade file stored in the root directory into the USB connector under the watertight cap on the outside of the front panel (see figure 18). Touch the Confirm icon, and then touch the Confirm icon to start the upgrade.

NOTE: To maintain the IP65 rating, always remove the stick and replace the cap securely over the USB connector when not in use.

5.4.9 Controller Details

Controller	Displays the name for the group of default settings used as built
Product Name	Displays the model of the controller as built
Serial Number	Displays the serial number of the controller
Controller Board	Displays the revision number of the front panel circuit board
Software Version	Displays the software version on the controller board
Power Board	Displays the revision number of the power/relay board
Sensor Board #1	Displays the revision number of the sensor board in the Sensor 1 slot
Software Version	Displays the software version on the sensor board in the Sensor 1 slot
Sensor Board #2	Displays the revision number of the sensor board in the Sensor 2 slot
Software Version	Displays the software version on the sensor board in the Sensor 2 slot
Network Board	Displays the revision number of the network board
Software Version	Displays the software version on the network board
Display Board	Displays the revision number of the display board
AO Board	Displays the revision number of the analog output board
Last Data Log	Displays the date and time of the last data log download
Battery Power	Displays the VDC output of the battery that is used to hold the date and time. The acceptable range is 2.4-3.2 VDC.
Processor Temp	Displays the temperature of the main processor. The acceptable range is -10 to 65 C.
I/O Card 1 Temp	Displays the temperature of the sensor input processor installed in I/O slot 1. The acceptable range is -10 to 65 C.
I/O Card 2 Temp	Displays the temperature of the sensor input processor installed in I/O slot 2. The acceptable range is -10 to 65 C.
Network Temp	Displays the temperature of the network card processor. The acceptable range is -10 to 65 C.
+5 Volt Supply	The normal range is 4.75 to 5.25 VDC. The 5 V supply is used for powering all the I/O.
+3.3 Volt Supply	The normal range is 3.135 to 3.465 VDC. The 3V supply is used to run the system.
LCD Bias Voltage	The normal range is -25 to -20 VDC. This is the touchscreen voltage after contrast adjustment.
LCD Supply	The normal range is -25 to -20 VDC. This is the touchscreen voltage before contrast adjustment.

5.5 HOA Menu

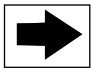
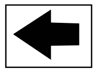
The HOA (Hand-Off-Automatic) Menu is used to quickly and easily test all relay outputs, and to stop or enable automatic control.

Touch the relay number in order to change the HOA state of that relay. The relay number will be shaded dark, and its current HOA state will be shaded dark. Then touch the desired state. The change happens immediately unless that relay has a Minimum Relay Cycle programmed that is above 0 seconds.

5.6 Graph Menu

The Graph Menu is used to display a graph containing one sensor or analog input value plus one digital input or relay state. Touch the Graph icon and t[illegible] display “Generating Graph Please Stand By” for a few seconds then show the graph. The default is to [illegible] sensor input S11 and the state of relay output R1 over the past 10 minutes.

Touching any point on either line on the graphs displays a vertical line plus the details for that data point: date and time, value of the sensor, and an arrow showing if the state or the digital input/relay was high or low at that time.

Touching the  or the  icons will redraw the graph forward or backwards in time, in increments of one time range. It can only go back in time to the point where the data log file used to generate the graph starts. Changing the time frame while in the graph view, after moving back in time, shows data from that past time. Exiting the graph menu and returning to the graph menu moves back to the current time.

Settings

Sensor	Enter this menu to select the sensor, analog input, flowmeter type digital input (total flow and/or flow rate if applicable), or analog output value to show on the graph
DI/Relay	Enter this menu to select digital input, or analog output value to show on the graph
Low Axis Limit	The graph auto-scales based on the sensor value if both Low and High Axis Limit are set to 0. To manually adjust the Y axis scale, enter the low limit here.
High Axis Limit	The graph auto-scales based on the sensor value if both Low and High Axis Limit are set to 0. To manually adjust the Y axis scale, enter the high limit here.
Time Range	Select the time range for the X axis of the graph. The time range may also be accessed from the graph view by touching the time range icon in the lower right corner.

The resolution of the screen only allows for 84 data points per graph, so not all data points in each time range can be shown. For finer resolution, download the data log CSV file from the Config – File Utilities menu and graph the data in Excel or equivalent spreadsheet application.

Time Range	Time between data points	Datalog file used
10 minutes	10 seconds	Daily
30 minutes	30 seconds	Daily
1 hour	1 minute	Daily
2½ hours	2 minutes	Weekly
8 hours	6 minutes	Weekly
½ day	10 minutes	Weekly
1 day	20 minutes	Weekly
½ week	1 hour	Monthly
1 week	2 hours	Monthly
2 weeks	4 hours	Monthly
4 week	8 hours	Monthly

6.0 OPERATION using Ethernet

All of the same settings that are available using the touchscreen are also available using a browser that is connected to the controller’s Ethernet IP address. The controller may be connected to a Local Area Network (LAN), directly to the Ethernet port of a computer, or to the VTouch account management system server.

6.1 Connecting to a LAN

Connect the controller’s network card to the LAN using a CAT5 cable with RJ45 connector.

6.1.1 Using DHCP

Using the touchscreen, from the Main menu, touch Config, then touch Network Settings, then touch DHCP Setting. Touch Enabled, then the Confirm icon.

After a power cycle of the controller, return to Config, then Network Details to view the Controller IP Address that has been assigned to the controller by the network.

6.1.2 Using a fixed IP Address

Using the touchscreen, from the Main menu, touch Config, then touch Network Settings, then touch DHCP Setting. Touch Disabled, then the Confirm icon. Cycle power to the controller. If DHCP is already Disabled then you can skip this step.

Using the touchscreen, from the Main menu, touch Config, then touch Network Settings, then touch Controller IP Address. Enter the IP address provided by the administrator of the LAN then touch the Confirm icon. Repeat for the Network Netmask and Network Gateway settings. Cycle power to the controller.

6.2 Connecting Directly to a Computer

Connect the controller's network card to the computer using a CAT5 cable with RJ45 connector.

Follow the instructions above to give the controller a fixed IP address that is compatible with the network settings of the computer.

Open a browser and type the numeric Controller IP address in the web page address field. The login screen should quickly appear. The default user name is admin and the default password is 5555. The default View-Only user name is user and default password is 1111. These can and should be changed in the Config menu, under Security Settings.

6.3 Navigating the web pages

From any computer that is directly connected to the controller, or is on the same network as the controller, open a browser and type the numeric Controller IP address in the web page address field. The login screen should quickly appear. The default user name is admin and the default password is 5555. The default View-Only user name is user and default password is 1111. These can and should be changed in the Config menu, under Security Settings.

The Home page will appear. This will display the date and time, any active alarms, and the current readings or status of all of the Inputs and Outputs. On the left side of the page you will see links to the Main Menu selections: Alarms, Inputs, Outputs and Config. Hover the mouse pointer over each menu to see the submenus, and click on the submenu to access all of the details and settings associated with it.

6.4 Graphs Webpage

The graphs page can display up to 8 parameters at a time. All possible parameters available based upon the controller programming are listed in one column. Click the right arrow to add the highlighted parameter to the Selected column, or the left arrow to move a selected parameter back out. Use the up and down arrows to move the highlighted selected parameter up and down the list to set the order of the graphs on the page.

Select the Time Range for the X-Axis of the graph from the pulldown list, from 1 Hour to 4 Weeks.

Click the Refresh Graph button to display the changes.

If you are setting up a Graph Report email, click Save For Report to set the current page settings as the ones to be used for the report. You will want to make sure that the selected Time Range is at least as long as the Report Frequency set in the Email Report menu.

You can then change the settings on the graphs webpage without changing the report settings, by clicking the refresh button without clicking the Save For Report button. The graph page will be greyed out until the refresh button has been clicked.

In order to see what the report settings are, click the Load Report Settings button.

The graph email will contain an html attachment showing the graphs. The Export Graph button can be used to save the graphs as an image that can be copied to a document. The same button is also available directly from the Graphs web-page.

The graphs will display the parameter's data in 360 data points, equally spread over the time range, in a blue line. For analog inputs and outputs, the minimum value, maximum value, and average value over that same time range are also displayed and graphed in a yellow line. The Y-axis will auto-scale to fit the data.

To change the Y-axis scale to a custom range, click anywhere on the axis, enter the desired minimum and maximum values, click Save, and then click the refresh graph button. To return to auto-ranging, click the Y-axis, click Set Defaults, and refresh.

7.0 MAINTENANCE

The controller itself requires very little maintenance. Wipe with a damp cloth. Do not spray down the controller unless the enclosure door is closed and latched.

7.1 Electrode Cleaning

NOTE: The controller must be recalibrated after cleaning the electrode.

Frequency
The electrode should be cleaned periodically. The frequency required will vary by installation. In a new installation, it is recommended that the electrode be cleaned after two weeks of service. To determine how often the electrode must be cleaned, follow the procedure below.

1. Read and record the conductivity.
2. Remove, clean and replace the conductivity electrode.
3. Read conductivity and compare with the reading in step 1 above.

If the variance in readings is greater than 5%, increase the frequency of electrode cleaning. If there is less than 5% change in the reading, the electrode was not dirty and can be cleaned less often.

Cleaning Procedure
The electrode can normally be cleaned using a cloth or paper towel and a mild detergent. If coated with scale, clean with a dilute (5%) solution of hydrochloric acid solution. Occasionally an electrode may become coated with various substances that require a more vigorous cleaning procedure. Usually the coating will be visible, but not always. To clean a coated electrode, use fine grit abrasive, such as emery paper. Lay the paper on a flat surface and move the electrode in a back and forth motion. The electrode should be cleaned parallel to the carbon electrodes, not perpendicular.

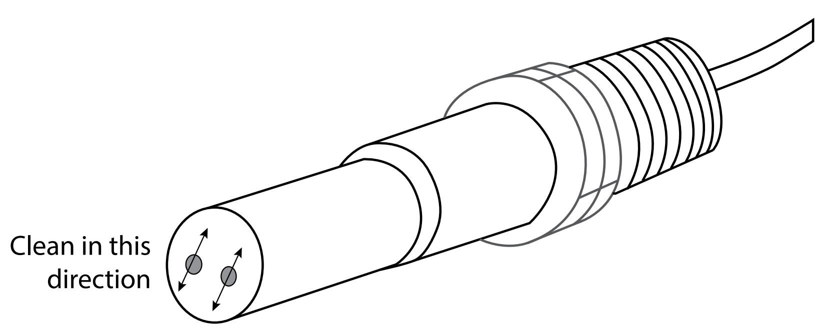


Figure 19 Cleaning the Electrode

7.2 Replacing the Fuse Protecting Powered Relays

⚠ **CAUTION:** Disconnect power to the controller before opening front panel!

Locate the fuse on the circuit board at the back of the controller enclosure under the plastic safety cover. Gently remove the old fuse from its retaining clip and discard. Press the new fuse into the clip, secure the front panel of the controller and return power to the unit.

Warning: Use of non-approved fuses can affect product safety approvals. Specifications are shown below. To insure product safety certifications are maintained, it is recommended that a Walchem fuse be used.

Fuse 5 x 20 mm, 6A, 250V	**Walchem P/N** 102834

8.0 TROUBLESHOOTING

⚠ **CAUTION**: Disconnect power to the controller before opening front panel!

Troubleshooting and repair of a malfunctioning controller should only be attempted by qualified personnel using caution to ensure safety and limit unnecessary further damage. Contact the factory.

8.1 Calibration Failure

Calibrations will fail if the adjustments to the reading are outside of the normal range for a properly functioning system. Refer to the instruction manual for the specific sensor being used for further information.

8.1.1 Contacting Conductivity Sensors

The calibration will fail if the adjustment to the gain is outside of 0.5 to 2.0.

Possible Cause	Corrective Action
Dirty electrode	Clean electrode
Improper wiring of sensor to controller	Correct wiring
Wrong cell constant entered	Program the controller cell constant setting at the value that matches the electrode being used
Incorrect temperature reading or setting	Ensure that the temperature is accurate
Incorrect cable length or wire gauge setting	Set to the correct values
Faulty electrode	Replace electrode

8.1.2 Electrodeless Conductivity Sensors

The calibration will fail if the adjustment to the gain is outside of 0.2 to 10, or the offset is outside of -10,000 to 10,000.

Possible Cause	Corrective Action
Dirty sensor	Clean sensor
Improper wiring of sensor to controller	Correct wiring
Sensor placed too close to container walls	Relocate sensor
Sensor placed in the direct path of electrical current flow	Relocate sensor
Incorrect temperature reading or setting	Ensure that the temperature is accurate
Incorrect cable length or wire gauge setting	Set to the correct values
Faulty sensor	Replace sensor

8.1.3 pH Sensors

The calibration will fail if the adjustment to the gain is outside of 0.2 to 1.2, or if the calculated offset is outside of -140 to 140.

Possible Cause	Corrective Action
Dirty electrode	Clean electrode
Improper wiring of sensor to controller	Correct wiring
Incorrect temperature reading or setting	Ensure that the temperature is accurate
Incorrect cable length or wire gauge setting	Set to the correct values
Faulty electrode	Replace electrode
Faulty preamplifier	Replace preamplifier

8.1.4 ORP Sensors

The calibration will fail if the adjustment to the gain is outside of 0.5 to 1.5, or if the calculated offset is outside of -300 to 300.

Possible Cause	Corrective Action
Dirty electrode	Clean electrode
Improper wiring of sensor to controller	Correct wiring
Faulty electrode	Replace electrode
Faulty preamplifier	Replace preamplifier

8.1.5 Disinfection Sensors

The calibration will fail if the adjustment to the gain is outside of 0.2 to 10.0, or if the calculated offset is outside of -40 to 40.

Possible Cause	Corrective Action
Insufficient conditioning	Wait for the appropriate amount of time before attempting a calibration.
Insufficient sample flow	Increase flow rate to between 30 and 100 liter per hour.
Air bubbles on membrane	Dislodge bubbles. Adjust flow rate higher if necessary.
Air bubbles in electrolyte	Refill membrane cap with electrolyte.
Dirty membrane	Clean membrane
Loose membrane cap	Tighten membrane cap.
Faulty membrane	Replace membrane cap.
High Pressure	Reduce pressure to below 1 atmosphere and refill cap with electrolyte
No electrolyte fill solution in membrane cap	Fill membrane cap with electrolyte. Replace membrane cap if it will not hold solution.
Improper wiring of sensor to controller	Correct wiring
Faulty sensor	Replace sensor
Faulty analysis equipment or reagents	Consult test equipment instructions
Sample contaminated with interfering molecule (refer to Sensitivity specification in sensor instructions)	Remove source of contamination

8.1.6 Analog Inputs

The calibration will fail if the adjustment to the gain is outside of 0.5 to 2.0, or if the calculated offset is outside of -2 to 2 mA.

Possible Cause	Corrective Action

Improper wiring of sensor to controller	Correct wiring
Faulty sensor	Replace sensor

8.1.7 Temperature Sensors

The calibration will fail if the calculated offset is outside of -10 to 10.

Possible Cause	Corrective Action
Improper wiring of sensor to controller	Correct wiring
Temperature input is set to the incorrect element	Reprogram to match the connected temperature element
Faulty sensor	Replace sensor

8.2 Alarm Messages

HIGH or HIGH-HIGH ALARM
Occurs if the sensor reading rises above the high alarm set points. If your unit is programmed for an alarm relay output, the alarm relay will activate. The controller will continue to check the sensor reading, and any outputs using the sensor will remain active.

Possible Cause	Corrective Action
The process went further out of control than normal.	May have to increase chemical flow rate.
The chemical supply has run out.	Replenish the chemical supply.
The pump or valve or supply line is faulty.	Repair or replace the control device.
Wrong chemical is being controlled.	Replace with correct chemical.
The sensor is not responding to changes.	Repair or replace sensor. Evaluate mixing or recirculation.
The pump is siphoning, valve leaking.	Repair or replace the control device or re-route tubing.
Control output has been left in “HAND” mode.	Switch back to “AUTO”.
It may be a normal part of the process.	None required.

LOW or LOW-LOW ALARM
Occurs if the sensor reading drops below the low alarm set points. If your unit is programmed for an alarm relay output, the alarm relay will activate. The controller will continue to check the sensor reading, and any outputs using the sensor will remain active.

Possible Cause	Corrective Action
The process went further out of control than normal.	May have to increase chemical flow rate.
The chemical supply has run out.	Replenish the chemical supply.
The pump or valve or supply line is faulty.	Repair or replace the control device.
Wrong chemical is being controlled.	Replace with correct chemical.
The sensor is not responding to changes.	Repair or replace sensor. Evaluate mixing or recirculation.
The pump is siphoning, valve leaking.	Repair or replace the control device or re-route tubing.
Control output has been left in “HAND” mode.	Switch back to “AUTO”.
It may be a normal part of the process.	None required.

DI STATE CUSTOM MESSAGE
A digital input that is a DI State type can be set such that either the open or closed state generates an alarm. The alarm message may be customized. The most common use for this will be a Flow Switch.

Possible Cause	Corrective Action
No flow	Check piping for closed valves, blockage, etc. Check recirculation pump.
Faulty flow switch/cable	Check with ohmmeter.
Faulty controller	Check by shorting digital input in controller.

TOTAL ALARM
Occurs if the flow meter or feed monitor totalizer alarm limit is exceeded.

Possible Cause	Corrective Action
Normal operation	Reset the total to clear alarm, or wait for the automatic total reset to occur.
AC coupled onto flow meter cable	Route cable at least 6 inches (150 mm) away from any AC voltage
Noise coupled onto flow meter cable	Shield cable

RANGE ALARM (for flow meter or feed monitor type digital inputs) Occurs if the flow meter or feed monitor accumulated total is too large. The maximum total is 1 trillion times the increment of the device. For example, if the increment is one gallon per pulse the maximum total is 1 trillion gallons.	
Possible Cause	**Corrective Action**
Normal operation	Reset the total to clear alarm, or wait for the automatic total reset to occur.

FLOW VERIFY Occurs if the feed monitor digital input does not register any contacts while the control output for that pump has been active for longer than the Flow Alarm Delay time.	
Possible Cause	**Corrective Action**
Metering pump has lost prime	Re-prime metering pump
Faulty metering pump	Repair or replace metering pump
Incorrect feed monitoring device wiring	Correct wiring. Make sure that digital input that the feed monitoring device is connected to has been assigned to the correct relay
Faulty feed monitoring sensor	Replace feed monitoring sensor
Blown fuse	Verify the pump is getting power. Replace fuse
Faulty output relay	Replace relay board
Faulty digital input	Verify that feed monitoring device is making contact closures using an ohmmeter. If OK, and connected properly, replace the controller circuit board.

OUTPUT TIMEOUT This error condition will stop control. It is caused by the output (either relay or analog) being activated for longer than the programmed Time Limit.	
Possible Cause	**Corrective Action**
The process went further out of control than normal.	Increase time limit or reset timer.
The chemical supply has run out.	Replenish the chemical supply.
The pump or valve or supply line is faulty.	Repair or replace the control device.
Wrong chemical is being controlled.	Replace with correct chemical.
The sensor is not responding to changes.	Replace sensor. Evaluate mixing or recirculation.

RANGE ALARM (for sensor inputs) It indicates that the signal from the sensor is out of the normal range. This error condition will stop control of any output using the sensor. This prevents controlling based upon a false sensor reading. If the temperature sensor goes into range alarm, then the controller will go into manual temperature compensation using the Default Temperature setting.	
Possible Cause	**Corrective Action**
Sensor wires shorted	Disconnect short
Faulty sensor	Replace sensor
Faulty controller	Replace or repair controller

EVENT SKIPPED ALARM An event skipped alarm is set when a second biocide or timer event occurs while one event is still running (either in prebleed, biocide-add or post-biocide add lockout in the case of the biocide timer mode). An event skipped alarm is also set when the timer relay never turns on during an event because of an interlock condition. The alarm is cleared when the relay is next activated for any reason (the next timer event or HAND mode or “activate with” force on condition).	
Possible Cause	**Corrective Action**
Incorrect programming	Reprogram to eliminate overlapping events
Long duration interlock condition	Normal operation
Long duration prebleed	Decrease prebleed time Increase bleed flow rate Reprogram to eliminate overlapping events

SENSOR FAULT This error indicates that the signal from the sensor is no longer valid at all. This error condition will stop control of any output using the sensor.	
Possible Cause	**Correction Action**
Sensor wires shorted	Disconnect short
Faulty sensor	Replace sensor

Faulty controller	Replace or repair controller
INPUT FAILURE **This alarm indicates that the sensor input circuit is no longer working, or that one of the inputs used to calculate a virtual input is in a Sensor Fault condition. This error condition will stop control of any output using the input.**	
Possible Cause	**Correction Action**
Faulty controller	Replace or repair controller
If using virtual inputs, sensor fault of one of the inputs	See Sensor Fault troubleshooting above
BATTERY POWER LOW **This alarm indicates that the battery which holds the date and time in memory is below 2.4 VDC.**	
Possible Cause	**Correction Action**
Faulty battery	Replace battery
SYSTEM TEMP LOW **This alarm indicates that the temperature inside the controller is below -10 °C.**	
Possible Cause	**Correction Action**
Low ambient temperatures	Provide heat for the controller
SYSTEM TEMP HIGH **This alarm indicates that the temperature of the controller or sensor processor IC is above 75 °C, or that the temperature of the Ethernet card processor IC is above 85 °C.**	
Possible Cause	**Correction Action**
High ambient temperatures	Provide cooling for the controller
High power draw	Do not use the controller's 24VDC to power more than 1.5W total
DISPLAY ERROR **This alarm occurs if the user interface gets lost**	
Possible Cause	**Correction Action**
Pressing icons very quickly	Exit out of the screen and continue programming
NETWORK CARD FAILURE **This alarm occurs if the Ethernet circuit board fails**	
Possible Cause	**Correction Action**
Ethernet card locked up	Try a power cycle to reset it
Ethernet card not seated correctly	Unplug the network card and plug it back in
Faulty Ethernet card	Replace Ethernet card
WEB SERVER FAILURE **This alarm occurs if the web server on the Ethernet circuit board fails**	
Possible Cause	**Correction Action**
Web server locked up	Try a power cycle to reset it
Faulty Ethernet card	Replace Ethernet card
VTouch DATA COMM ERROR **This alarm occurs if the controller attempts to send data to VTouch and VTouch fails to acknowledge receipt of the data**	
Possible Cause	**Correction Action**
No connection to LAN	Connect Ethernet cable to LAN
Wrong IP, subnet and/or gateway address	Program valid settings for LAN in the controller or use DHCP if supported by the LAN
LAN is blocking outside access	Program LAN's router to open access
Network card failure	See above
SENSOR CAL REQUIRED **This alarm occurs if the sensor's Cal Reminder Alarm has been set to more than 0 days and if the sensor has not been calibrated within that number of days**	
Possible Cause	**Correction Action**
Time to calibrate	Calibrate the sensor
Reminder set in error	Set the Cal Reminder Alarm to 0

CALCULATION ERROR This alarm occurs if a virtual input calculation cannot be completed, for example if it has to divide by zero.	
Possible Cause	**Correction Action**
Zero value for the input used as the denominator	Calibrate or evaluate that input

DI FLOW VERIFY This alarm occurs if the control output is on but the associate flow verification device is not registering flow	
Possible Cause	**Correction Action**
Metering pump has lost prime	Re-prime metering pump
Faulty metering pump	Repair or replace pump
Faulty verification device wiring	Correct wiring
Wrong digital input assigned to the output	Correct programming error
Faulty verification device	Repair or replace device
Faulty wiring of output to pump	Correct wiring
Faulty output board	Repair or replace board
Faulty digital input	Replace board

CONTROLLER, POWER, DISPLAY, OR SENSOR BOARD ERROR This alarm occurs if the board listed is not recognized	
Possible Cause	**Correction Action**
Poor ribbon cable connection	Remove and reseat ribbon cable, cycle power
Poor option card connection	Remove and reseat the board, cycle power
Faulty board	Return the controller for repair

CONTROLLER, POWER, SENSOR, DISPLAY, NETWORK OR ANALOG OUTPUT BOARD VARIANT This alarm occurs if the type of board that is detected is not a valid type	
Possible Cause	**Correction Action**
Poor ribbon cable connection	Reseat ribbon cable
Faulty ribbon cable	Replace ribbon cable
Faulty Board	Replace the board listed in the error message

SENSOR SOFTWARE VERSION This alarm occurs if a sensor input card with software v2.11 or lower is installed onto a controller board running software v2.13 or higher	
Possible Cause	**Correction Action**
Software is not compatible between boards	Perform a Software Upgrade

NETWORK SOFTWARE VERSION This alarm occurs if an Ethernet card is installed onto a controller board running a higher software version than the Ethernet card	
Possible Cause	**Correction Action**
Software is not compatible between boards	Perform a Software Upgrade

INVALID SENSOR TYPE This alarm occurs if the programmed sensor type is not possible for the installed sensor board	
Possible Cause	**Correction Action**
The sensor board has been removed and replaced with a different type	Reinstall the correct board or reprogram the input to a valid type for the board installed

INVALID CONTROL MODE This alarm occurs if the programmed control mode is not possible for the installed power relay board	
Possible Cause	**Correction Action**
The power relay board has been removed and replaced with an incorrect model	Reinstall the correct board or reprogram the output to a valid type for the board installed

VTouch LIVE CONNECT ERROR This alarm occurs if the controller is unable to establish an encrypted connection to the VTouch server. If there is also a VTouch Data Comm Error, fix that first.	
Possible Cause	**Correction Action**
No UDP support on Port 9012 or TCP support on Port 44965	Open ports/protocols on router

DISABLED (SENSOR, DIGITAL OR VIRTUAL INPUT; RELAY OR ANALOG OUTPUT) This alarm occurs if software for that input or output did not start correctly	
Possible Cause	**Correction Action**
The software is not functioning	If the error message clears on its own, no action is required. If the error message persists, cycle power. If the error message still persists, return the controller for repair.
RELAY OR ANALOG OUTPUT CONTROL FAILURE **This alarm occurs if software for that output did not run correctly**	
Possible Cause	**Correction Action**
The software is not functioning	If the error message clears on its own, no action is required. If the error message persists, cycle power. If the error message still persists, return the controller for repair.
FRAM FILE SYSTEM ERROR **This alarm occurs if the FRAM is not detected at power up**	
Possible Cause	**Correction Action**
The FRAM was or is not functioning	If the error message clears on its own, no action is required. If the error message persists, cycle power. If the error message still persists, replace the controller board.

8.3 Procedure for Evaluation of Conductivity Electrode

Try cleaning the electrode first (refer to Sect. 7.1). To check the electrode, check the electrode connections to the terminal strip (refer to Figure 7). Make sure that the correct colors go to the correct terminals, and that the connections are tight. Restore power and see if the conductivity is back to normal. If not, replace the electrode.

8.4 Procedure for evaluation of the pH/ORP electrode

The most common cause of a calibration failure is an electrode problem. First try cleaning the electrode, then retry the calibration. If this fails again, replace the electrode and retry the calibration.

The next most common problem is wet or poor connections. Check the connection of the electrode to the cable for moisture. Check the connections between the cable and the terminal strip. Make sure that they are tight, that the terminal is not clamped to the plastic jacket, and that the wires are routed to the correct terminal. If there is a junction box installed between the electrode and the controller, check the wiring there as well.

You should be able to measure the +5VDC ±5% and -5VDC ±5% vs IN- at the terminal strip. If not, the controller is faulty. You should be able to measure the IN+ vs IN- (DC scale) and get the appropriate values for the buffer solutions used. If not, the preamplifier or its wiring is faulty.

The last possibility is to try replacing the preamplifier.

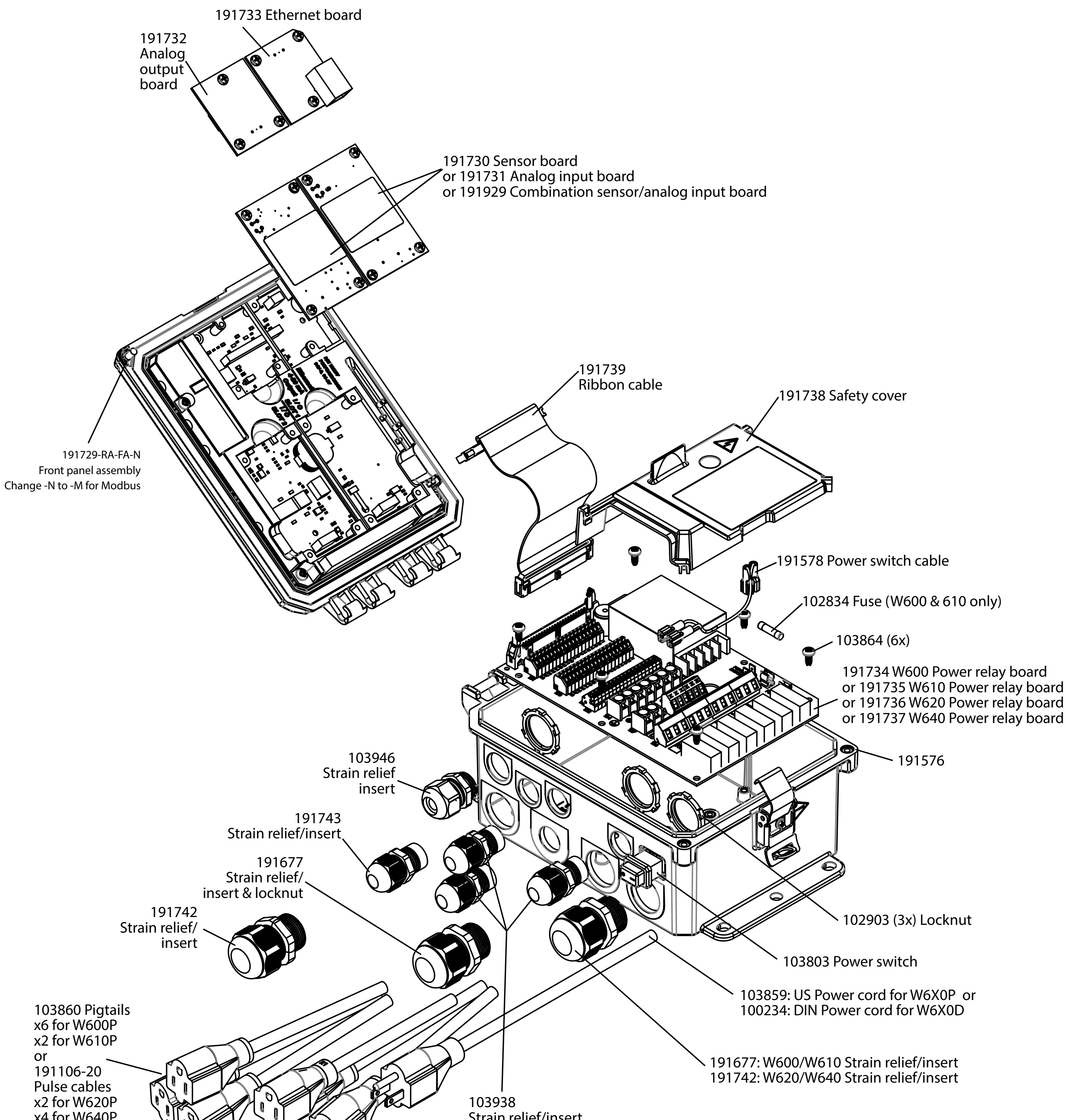
8.5 Diagnostic Lights

Some of the circuit boards inside the controller have diagnostic lights.

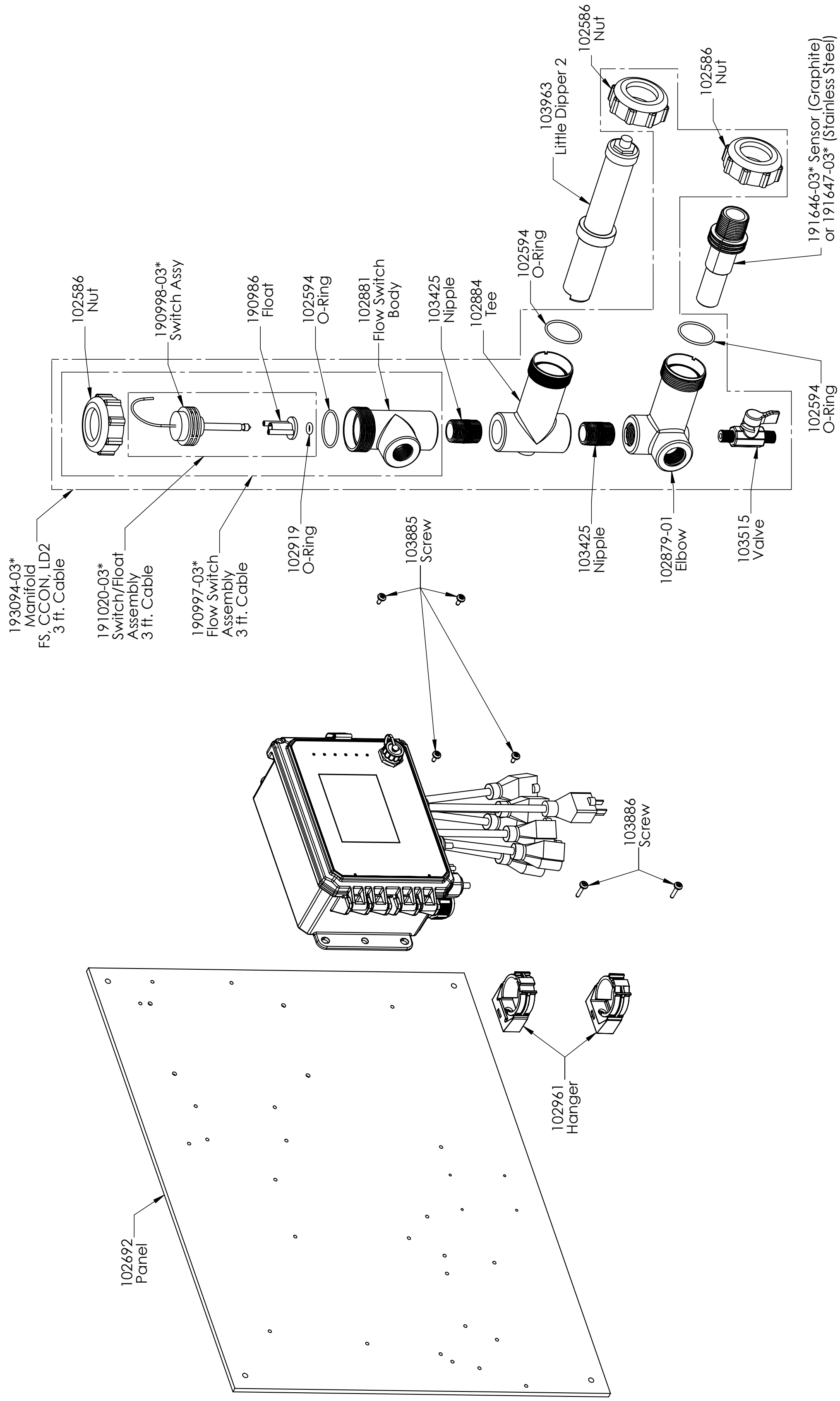
POWER/RELAY BOARD AMBER NEON (ONLY FOR MODELS WITH POWERED RELAYS) Indicates status of the fuse protecting the relays. Normal operation is ON. If not on:	
Possible Cause	**Correction Action**
Fuse has blown or is missing	Replace fuse
Controller model has only dry contact or pulse proportional relays	Normal
CONTROLLER BOARD D7 LED **Indicates status of the software application. Normal operation is that 5 seconds after power-up, it does one long blink on, two short blinks, on long blink off. If it is not doing this:**	
Possible Cause	**Correction Action**
Controller software is not running	Try a power cycle to reset it
Faulty controller board	Replace controller board
CONTROLLER BOARD D8 LED **Indicates the status of the 5 VDC power supply. Normal operation is ON. If not on:**	
Possible Cause	**Correction Action**

Faulty ribbon cable	Replace ribbon cable
Faulty power supply	Replace power/relay board
CONTROLLER BOARD D9 LED **Indicates the status of the 3.3 VDC power supply. Normal operation is ON. If not on:**	
Possible Cause	**Correction Action**
Faulty ribbon cable	Replace ribbon cable
Faulty power supply	Replace power/relay board
SENSOR BOARD LED **Indicates the status of the sensor board. Blinks slowly for several seconds during power-up. Normal operation is OFF. If not behaving this way:**	
Possible Cause	**Correction Action**
Sensor card locked up	Try a power cycle to reset it
Sensor card not seated correctly	Unplug the card and plug it back in
Faulty sensor card	Replace sensor card

9.0 Spare Parts Identification



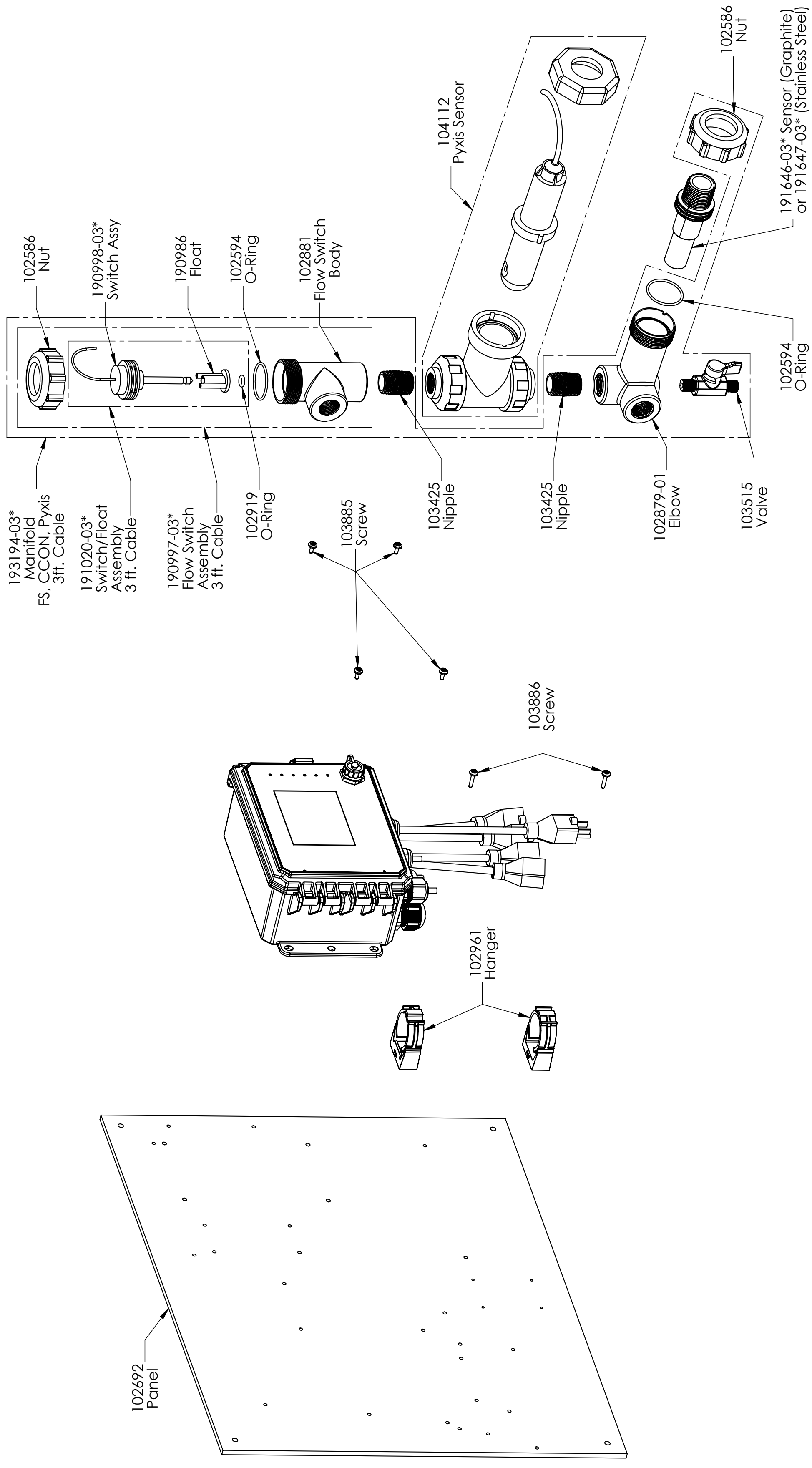
Controller Parts



WCT600 Sensor option BD and FD

BD: Graphite contacting conductivity + Flow Switch manifold on panel + Little Dipper

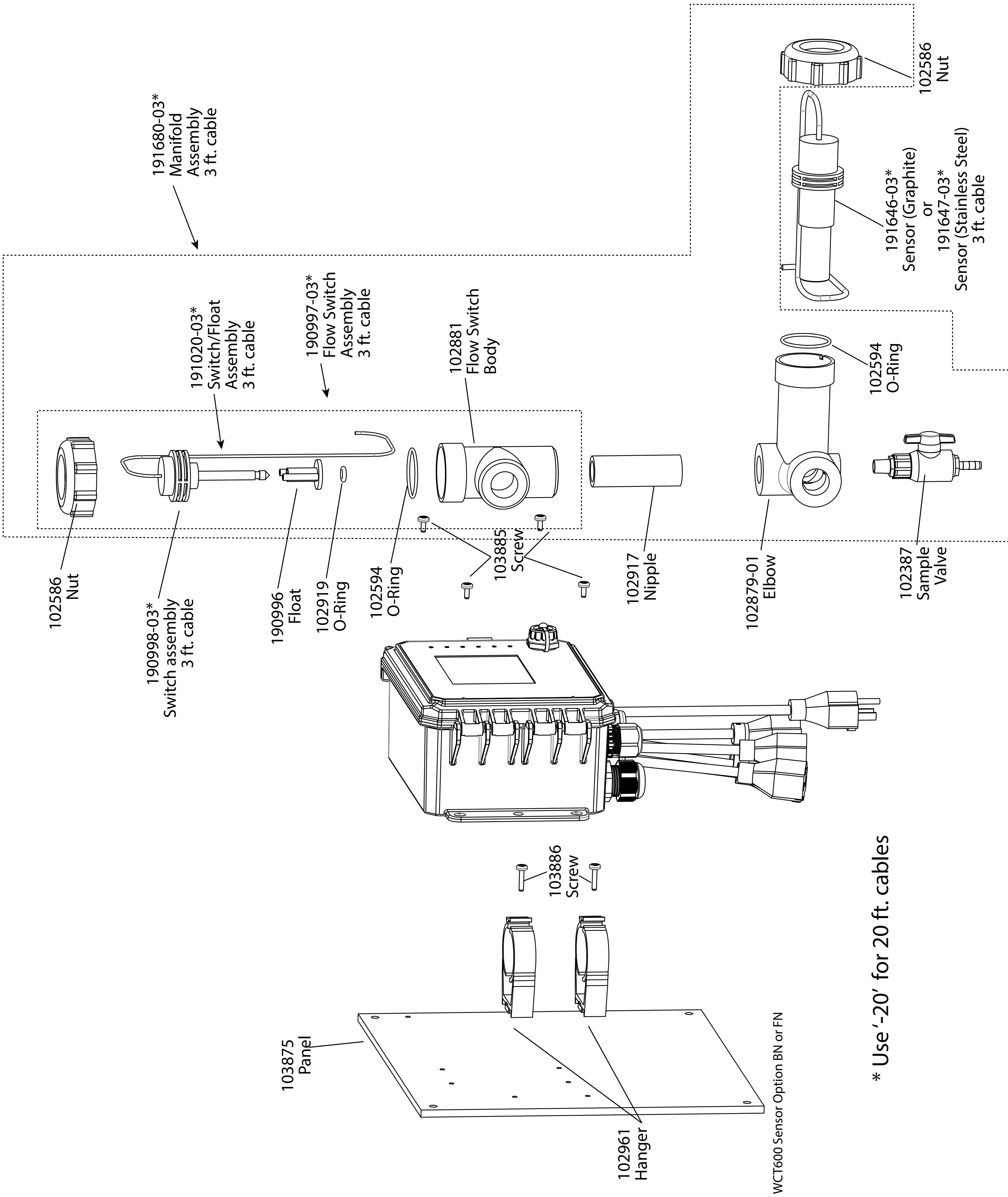
FD: 316SS contacting conductivity + Flow Switch manifold on panel + Little Dipper



WCT600 Sensor option BQ and FQ

BQ: Graphite contacting conductivity + Flow Switch manifold on panel + Pyxis

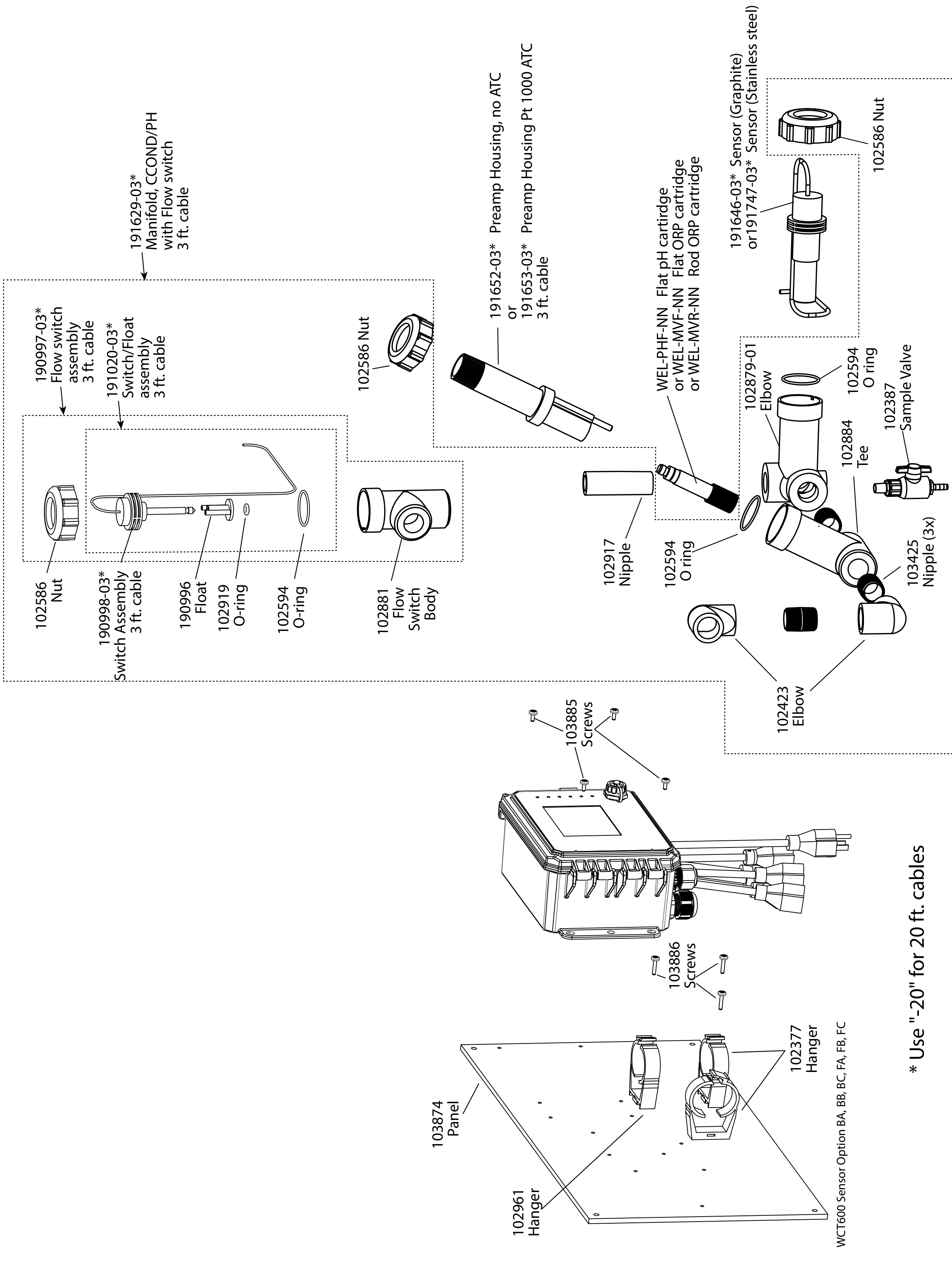
FQ: 316SS contacting conductivity + Flow Switch manifold on panel + Pyxis



WCT600 Sensor option BN or FN

BN: Graphite contacting conductivity + Flow Switch manifold on panel

FN: 316SS contacting conductivity + Flow Switch manifold on panel



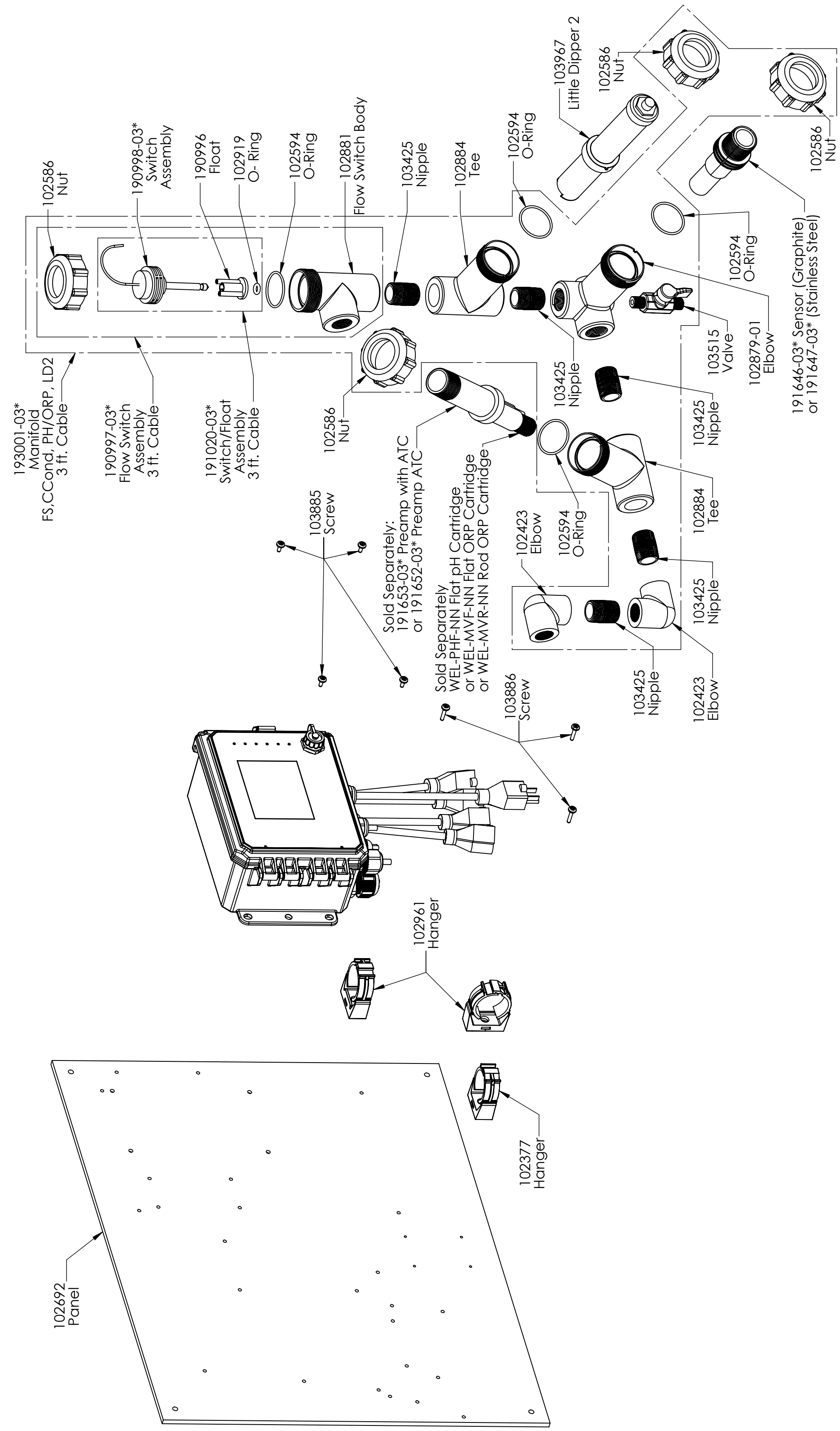
WCT600 Sensor option BA, BB, BC, FA, FB, FC

BA: Graphite contacting conductivity + Flow Switch manifold on panel + WEL-PHF no ATC

BB: + WEL-MVR no ATC — BC: +WEL-MVF no ATC

FA: 316SS contacting conductivity + Flow Switch manifold on panel + WEL-PHF no ATC

FB: + WEL-MVR no ATC — FC: + WEL-MVF no ATC



WCT600 Sensor option BH, BI, BJ, FH, FI, FJ

BH: Graphite contacting conductivity + Flow Switch manifold on panel + WEL-PHF no ATC + Little Dipper

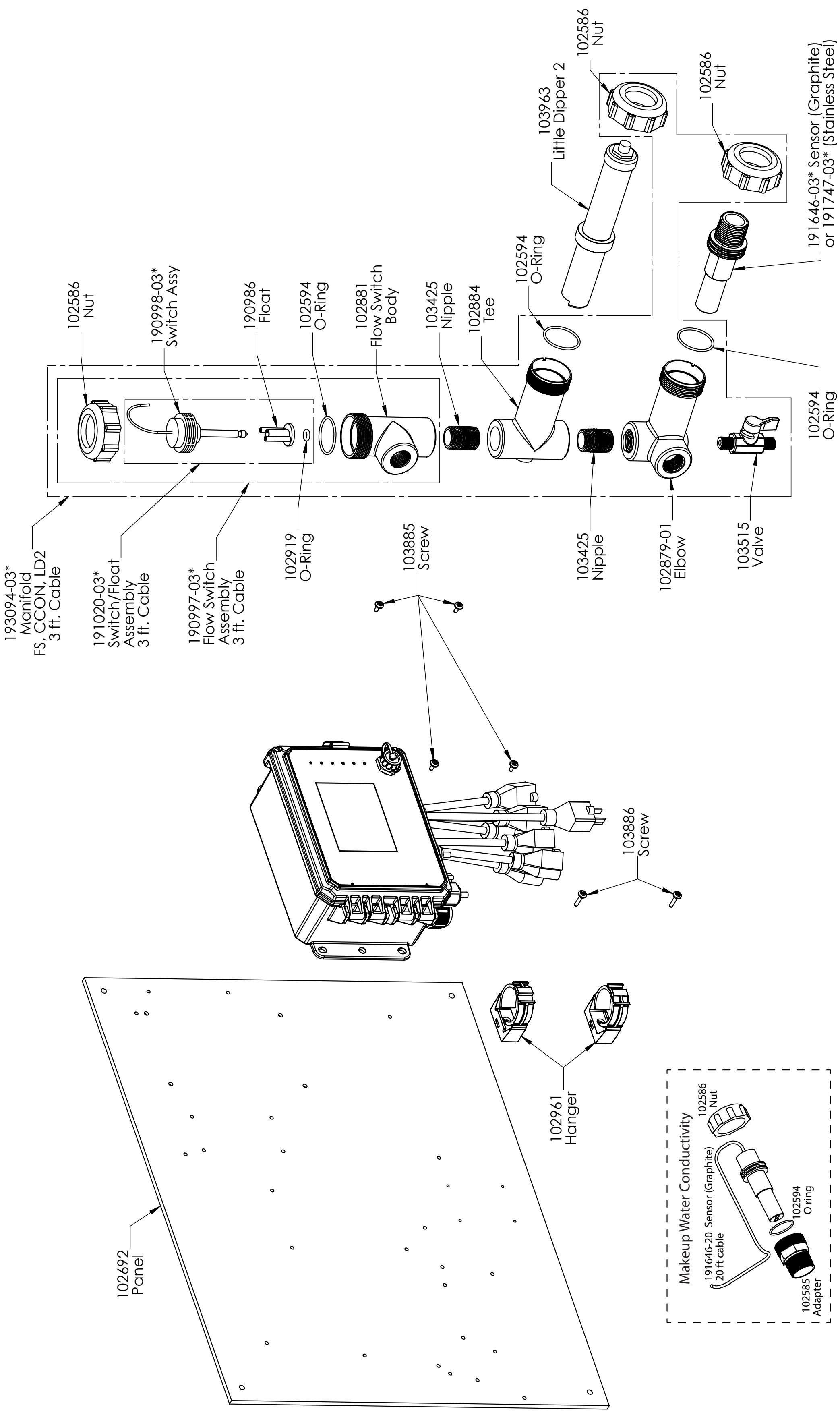
BI: + WEL-MVR no ATC + Little Dipper

BJ: + WEL-MVF no ATC + Little Dipper

FH: 316SS contacting conductivity + Flow Switch manifold on panel + WEL-PHF no ATC + Little Dipper

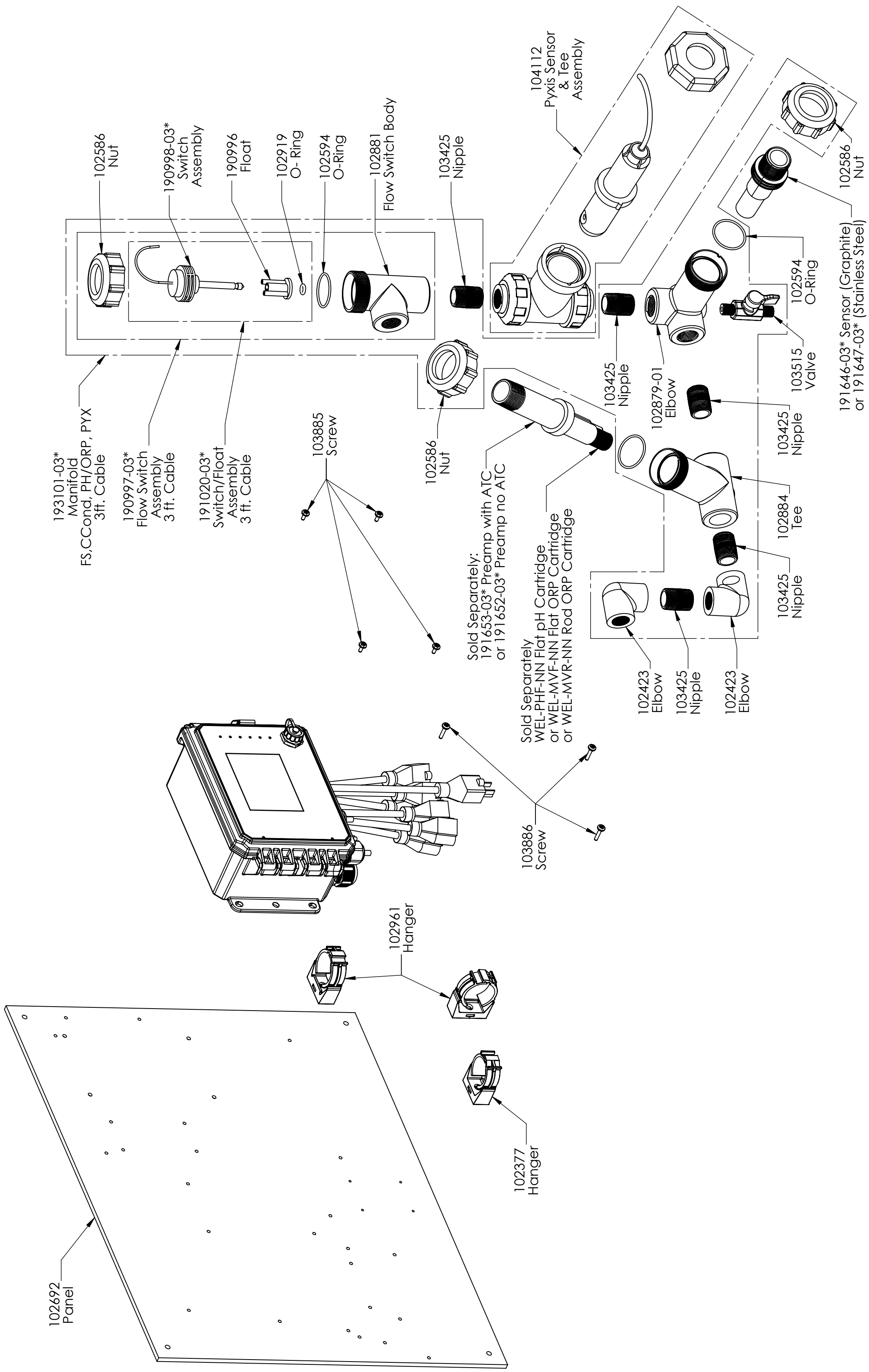
FI: + WEL-MVR no ATC + Little Dipper

FJ: + WEL-MVF no ATC + Little Dipper



WCT600 Sensor option BK

Graphite contacting conductivity + LD + Flow Switch manifold on panel with Makeup graphite conductivity with threaded adapter

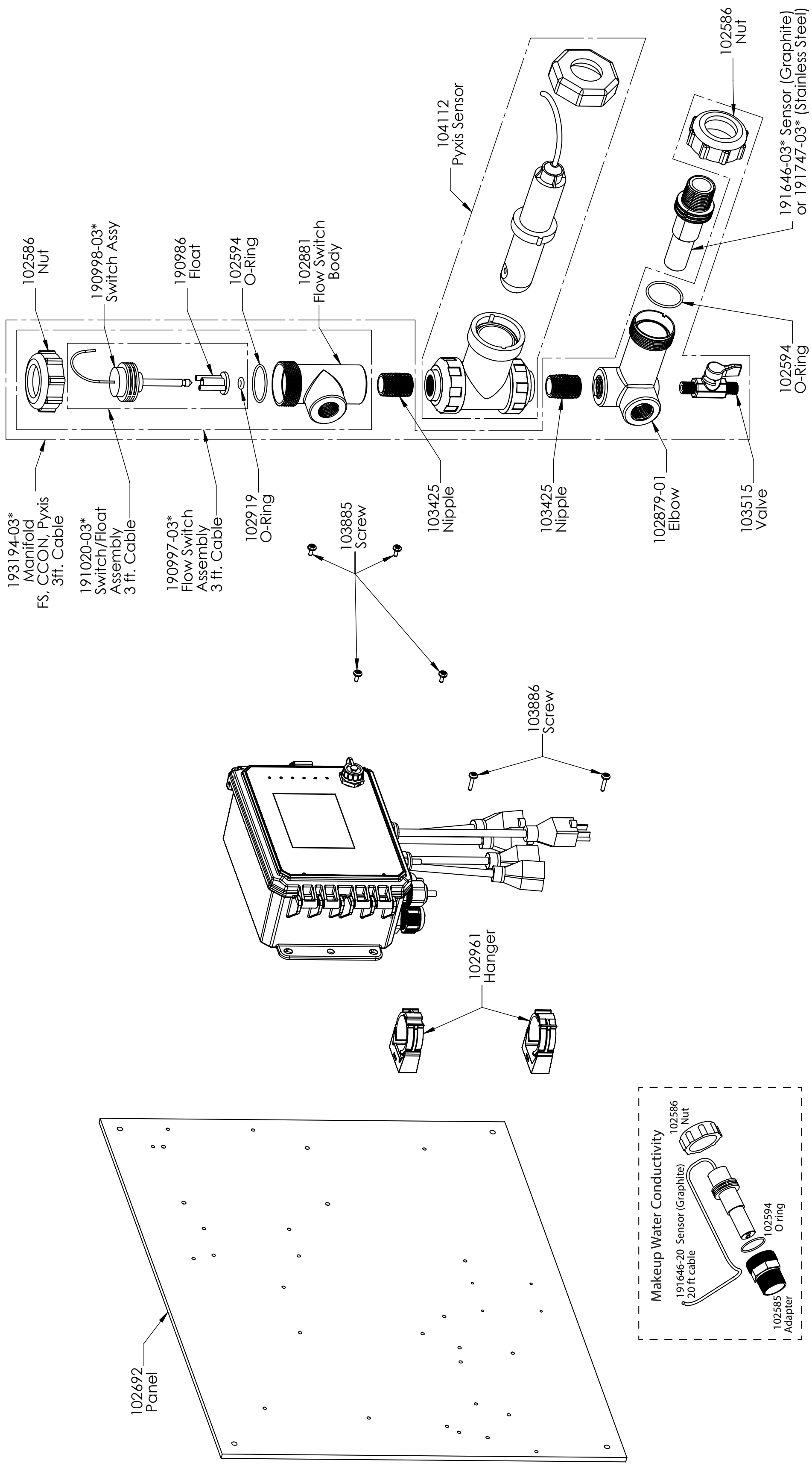


WCT600 Sensor option BR, BS, BT, FR, FS, FT

BR: Graphite contacting conductivity + Flow Switch manifold on panel + WEL-PHF no ATC + Pyxis

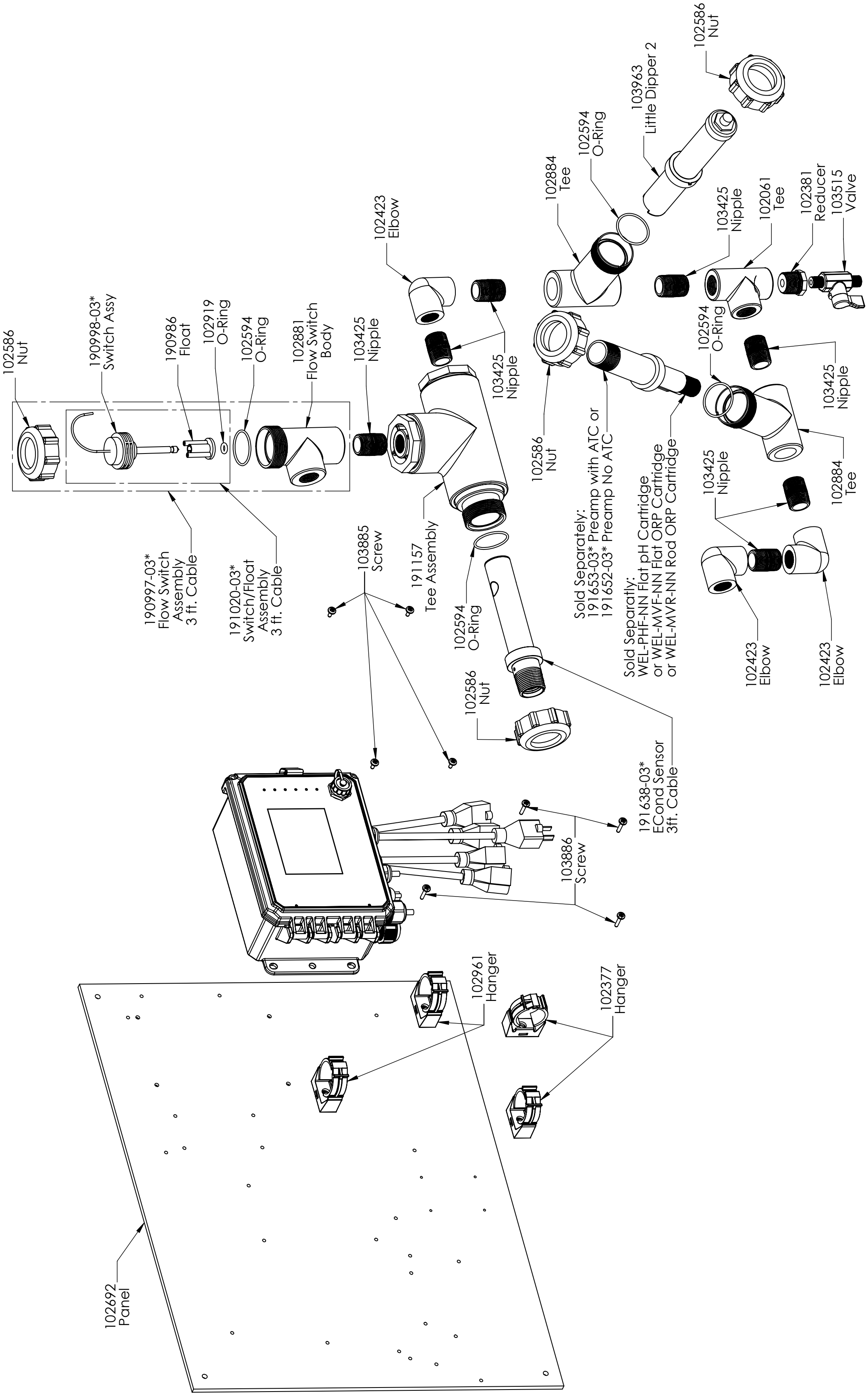
BS: + WEL-MVR no ATC + Pyxis

BT: + WEL-MVF no ATC + Pyxis



WCT600 Sensor option BU

Graphite contacting conductivity + Pyxis + Flow Switch manifold on panel with Makeup graphite conductivity with threaded adapter

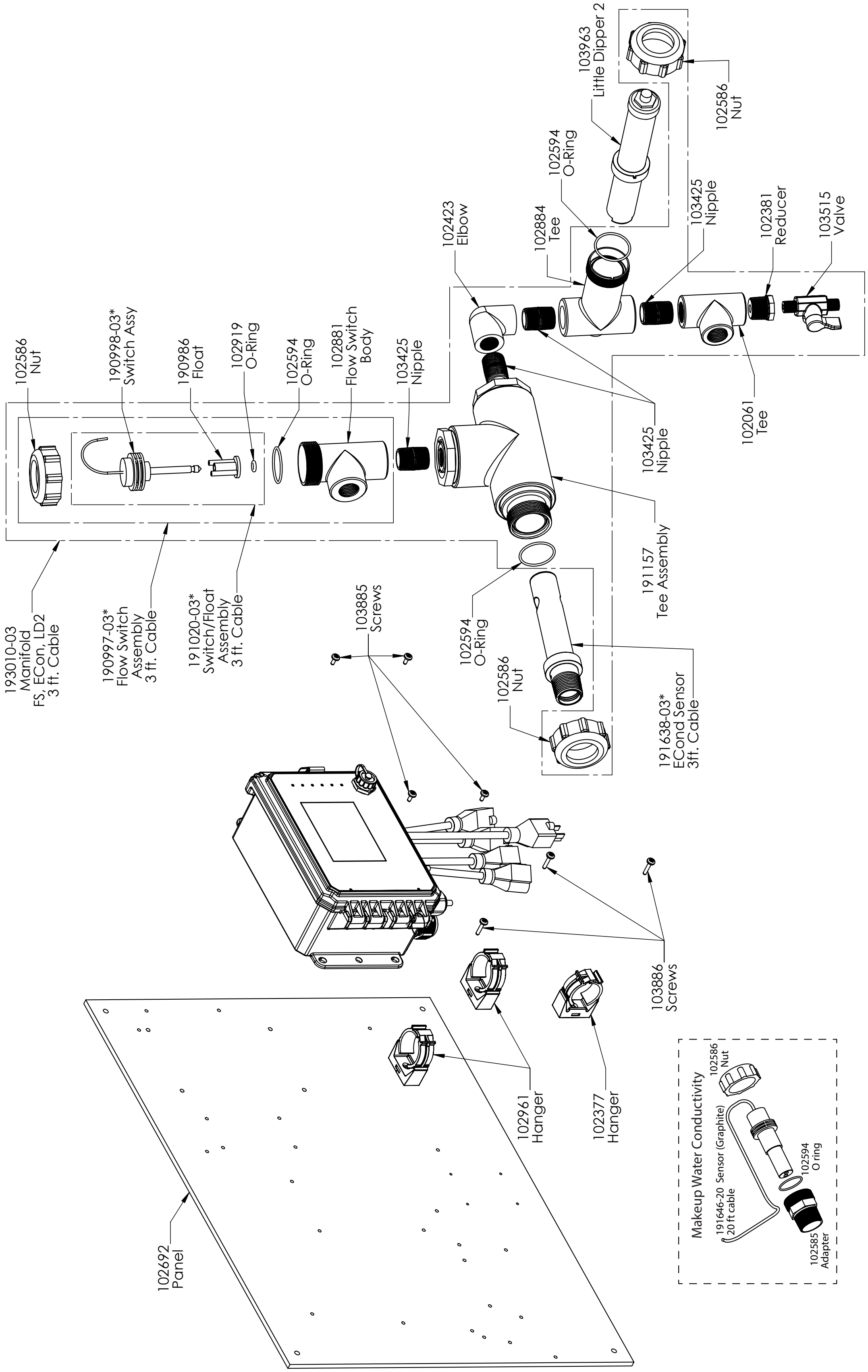


WCT600 Sensor option HH, HI, HJ

HH: Electrodeless conductivity + Flow Switch manifold on panel + WEL-PHF no ATC + LD

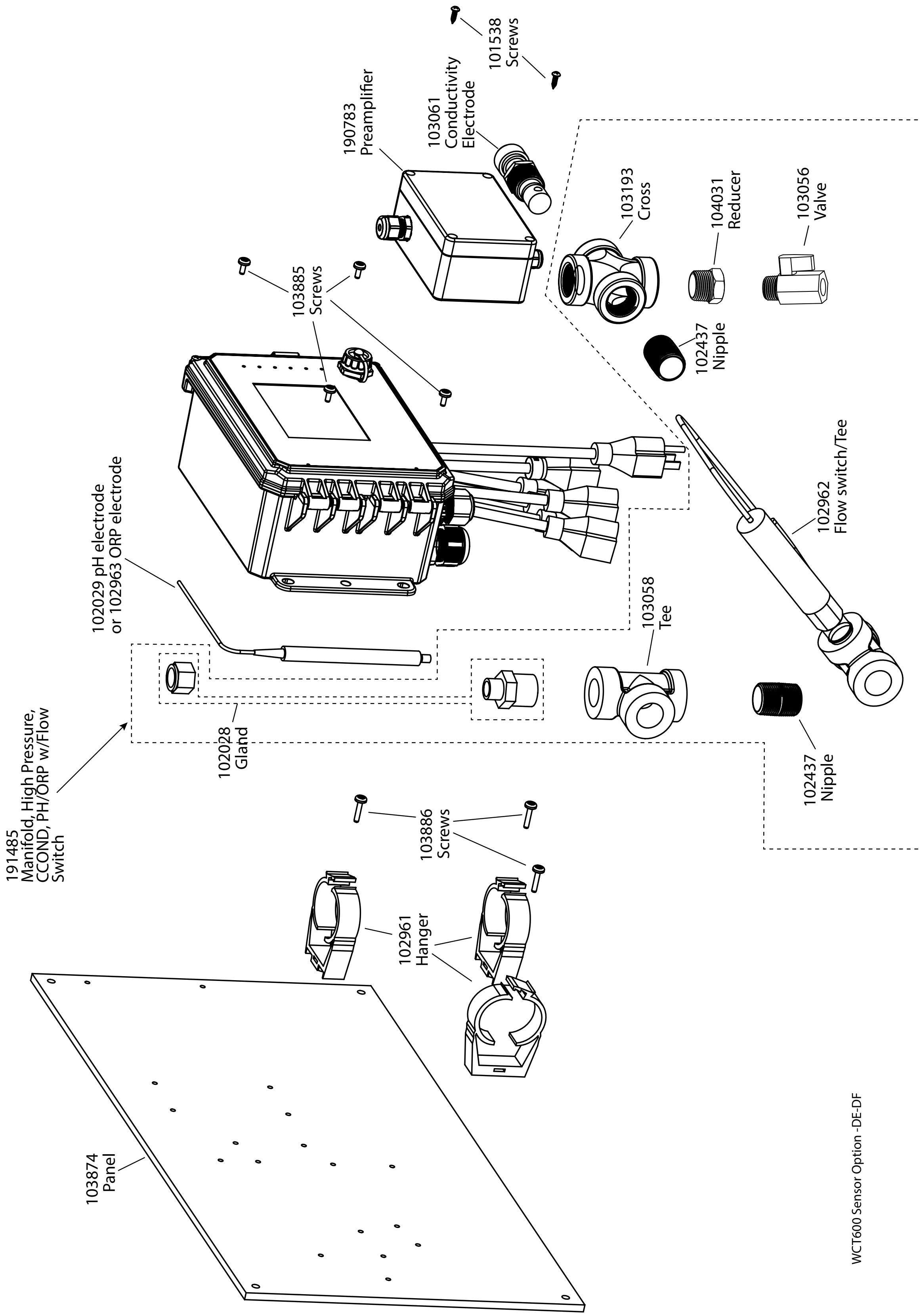
HI: + WEL-MVR no ATC + LD

HJ: + WEL-MVF no ATC + LD



WCT600 Sensor option HK

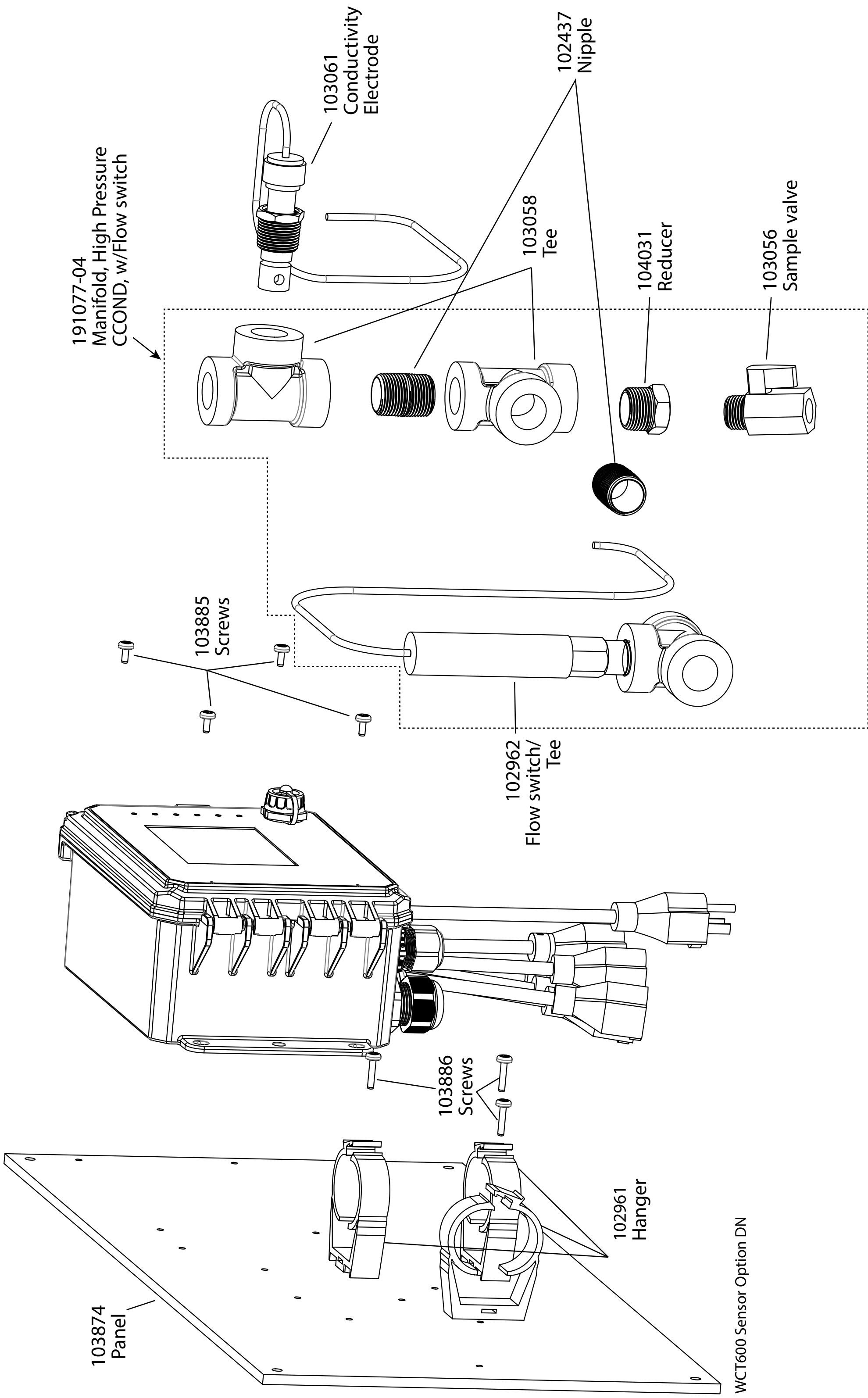
HK Electrodeless conductivity + LD + Flow Switch manifold on panel with Makeup graphite conductivity with threaded adapter



WCT600 Sensor option DE, DF

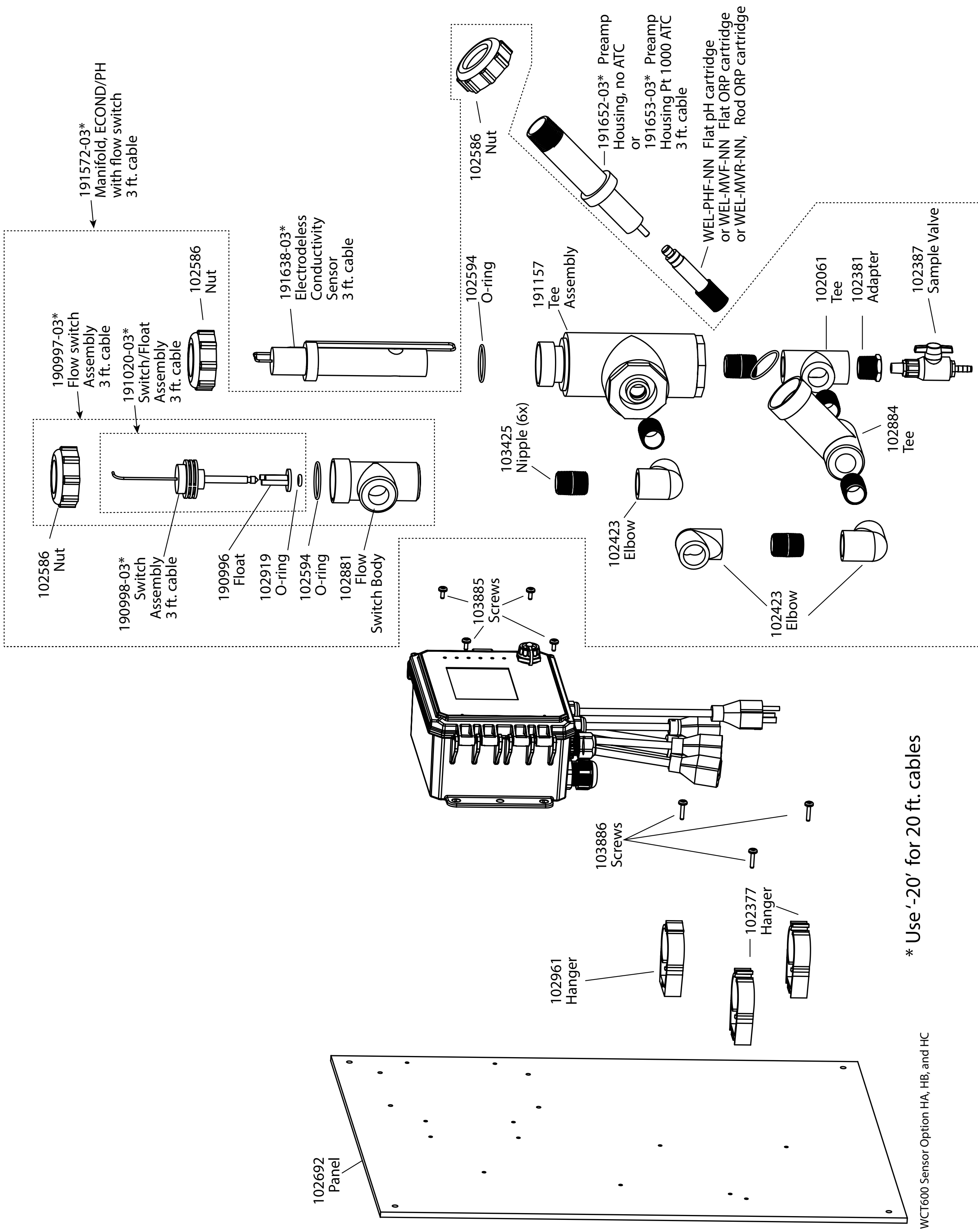
DE: High pressure contacting conductivity + Flow Switch manifold on panel + pH &190783

DF: High pressure contacting conductivity + Flow Switch manifold on panel + ORP & 190783



WCT600 Sensor option DN

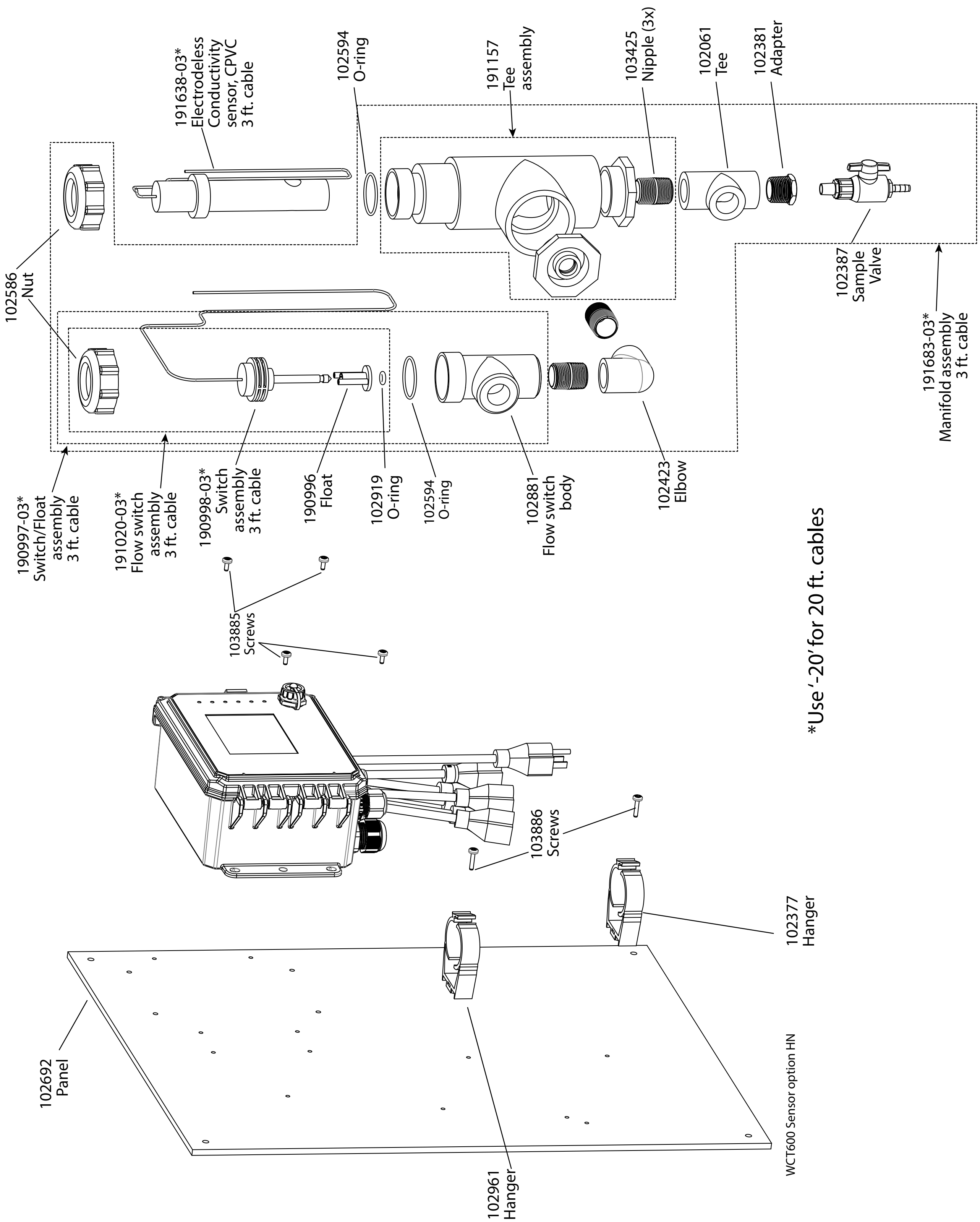
DN: High pressure contacting conductivity + Flow Switch manifold on panel



WCT600 Sensor option HA, HB and HC

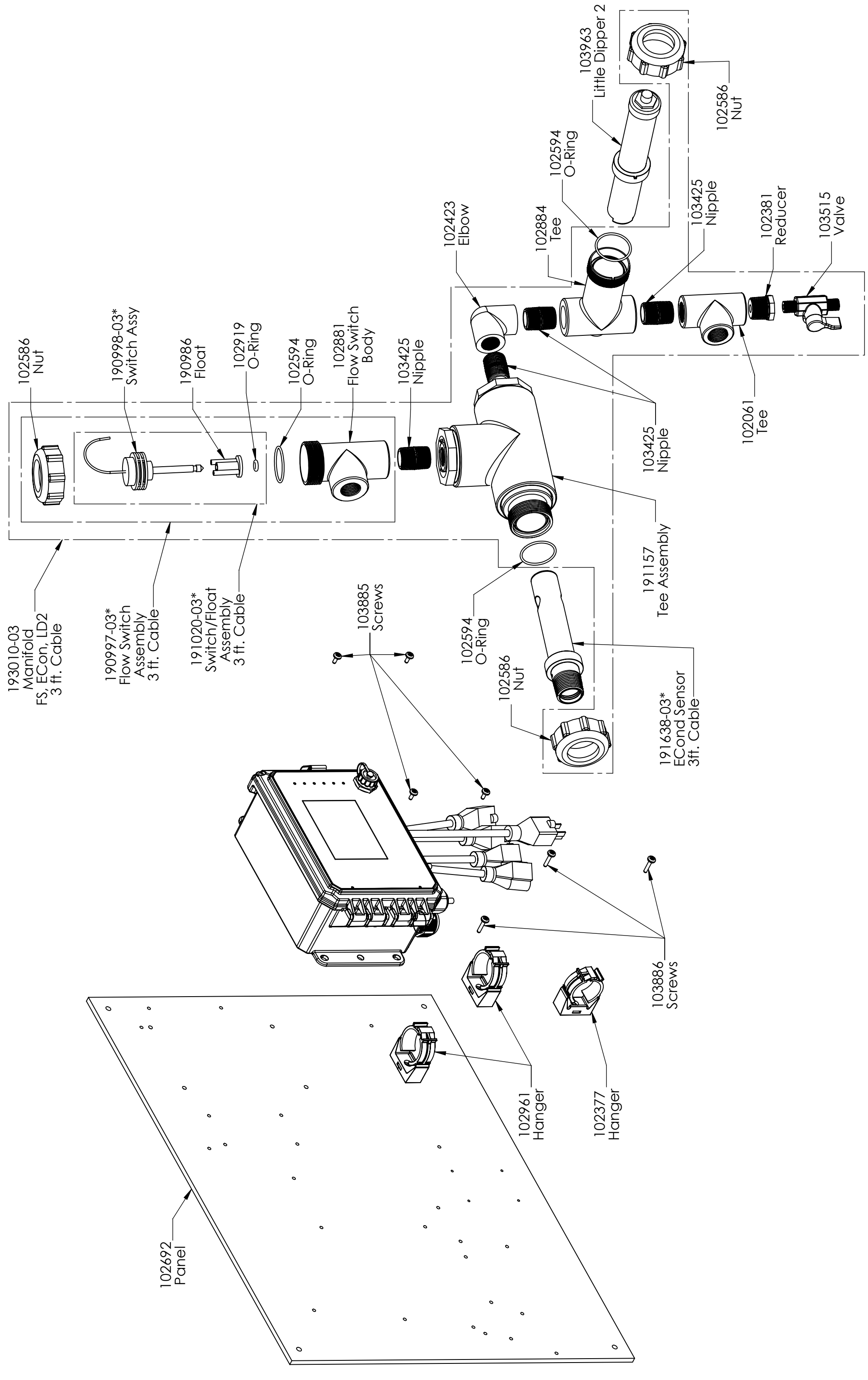
HA: Electrodeless conductivity + Flow Switch manifold on panel + WEL-PHF no ATC

HB: + WEL-MVR no ATC HC: + WEL-MVF no ATC



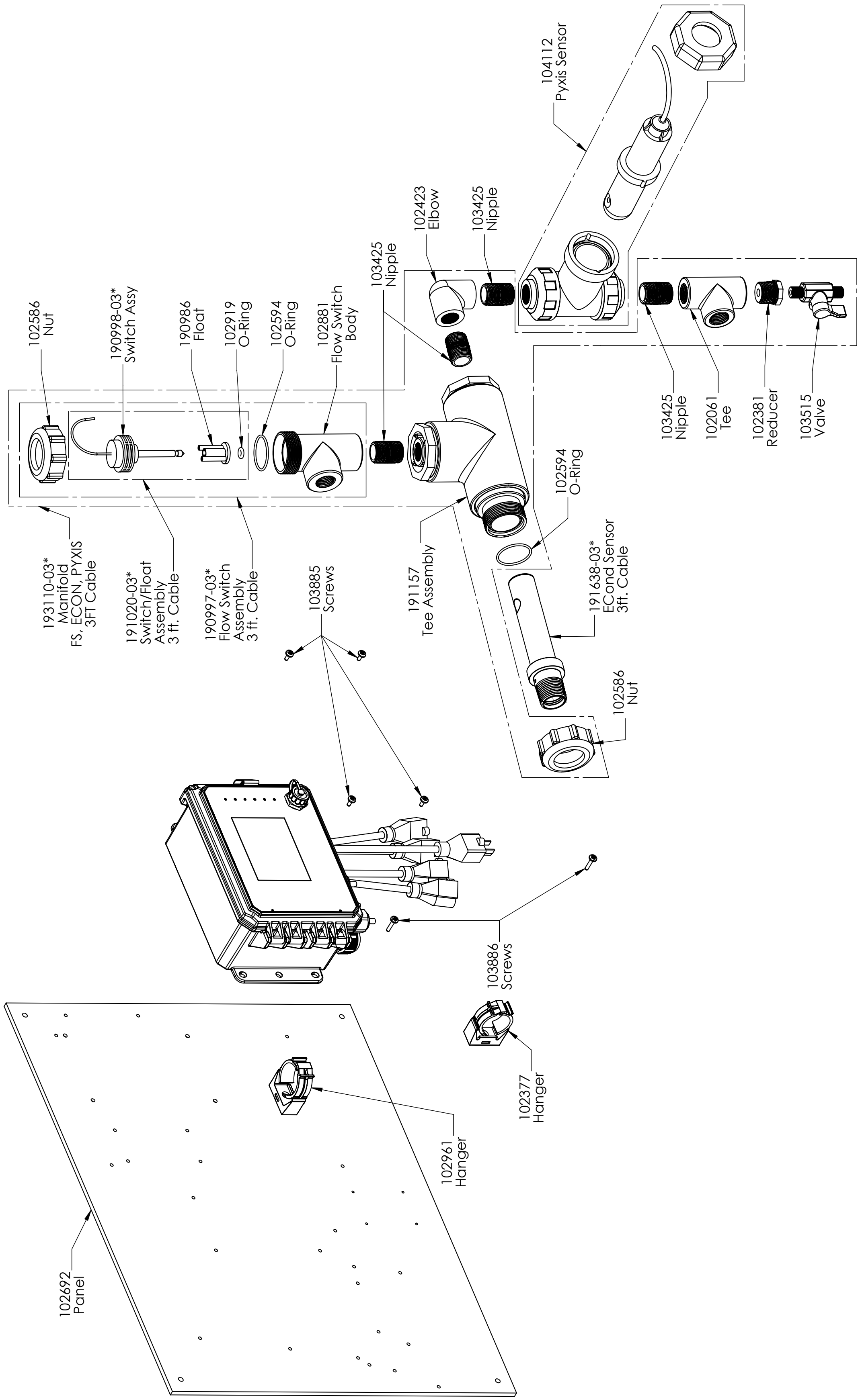
WCT600 Sensor option HN

HN: Electrodeless conductivity + Flow Switch manifold on panel



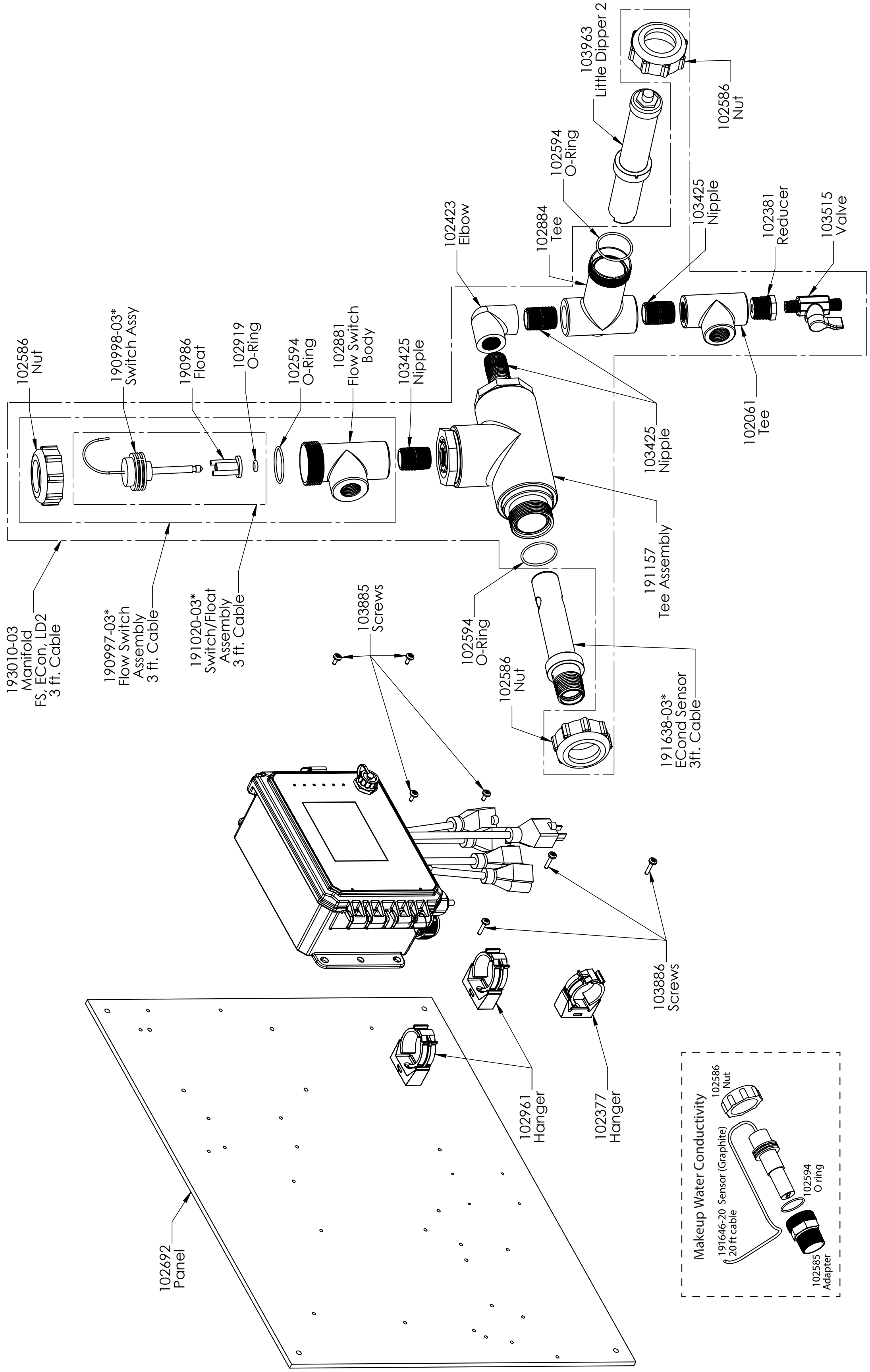
WCT600 Sensor option HD

HD: Electrodeless conductivity + Flow Switch manifold on panel + LD



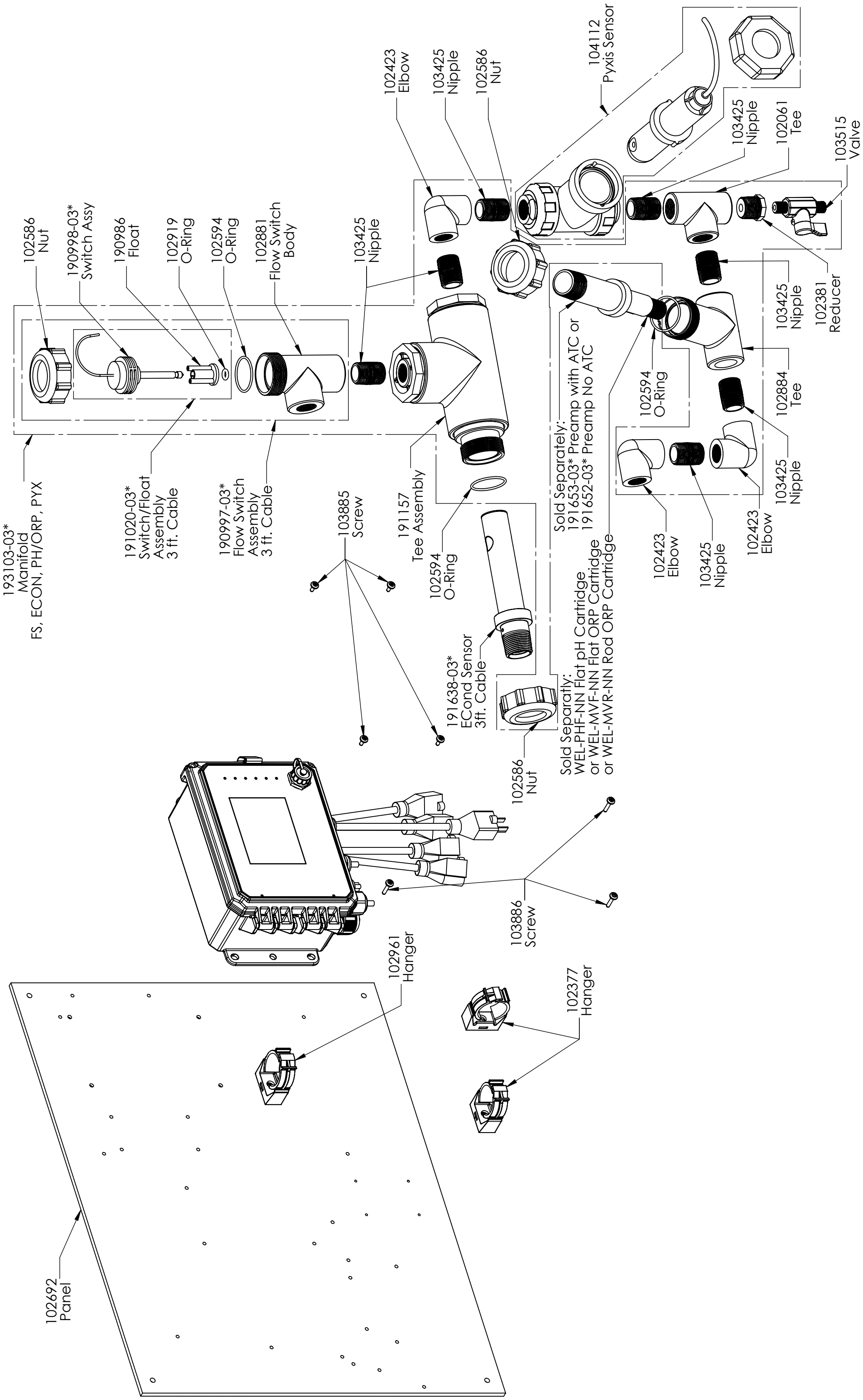
WCT600 Sensor option HQ

HQ: Electrodeless conductivity + Flow Switch manifold on panel + Pyxis



WCT600 Sensor option HU

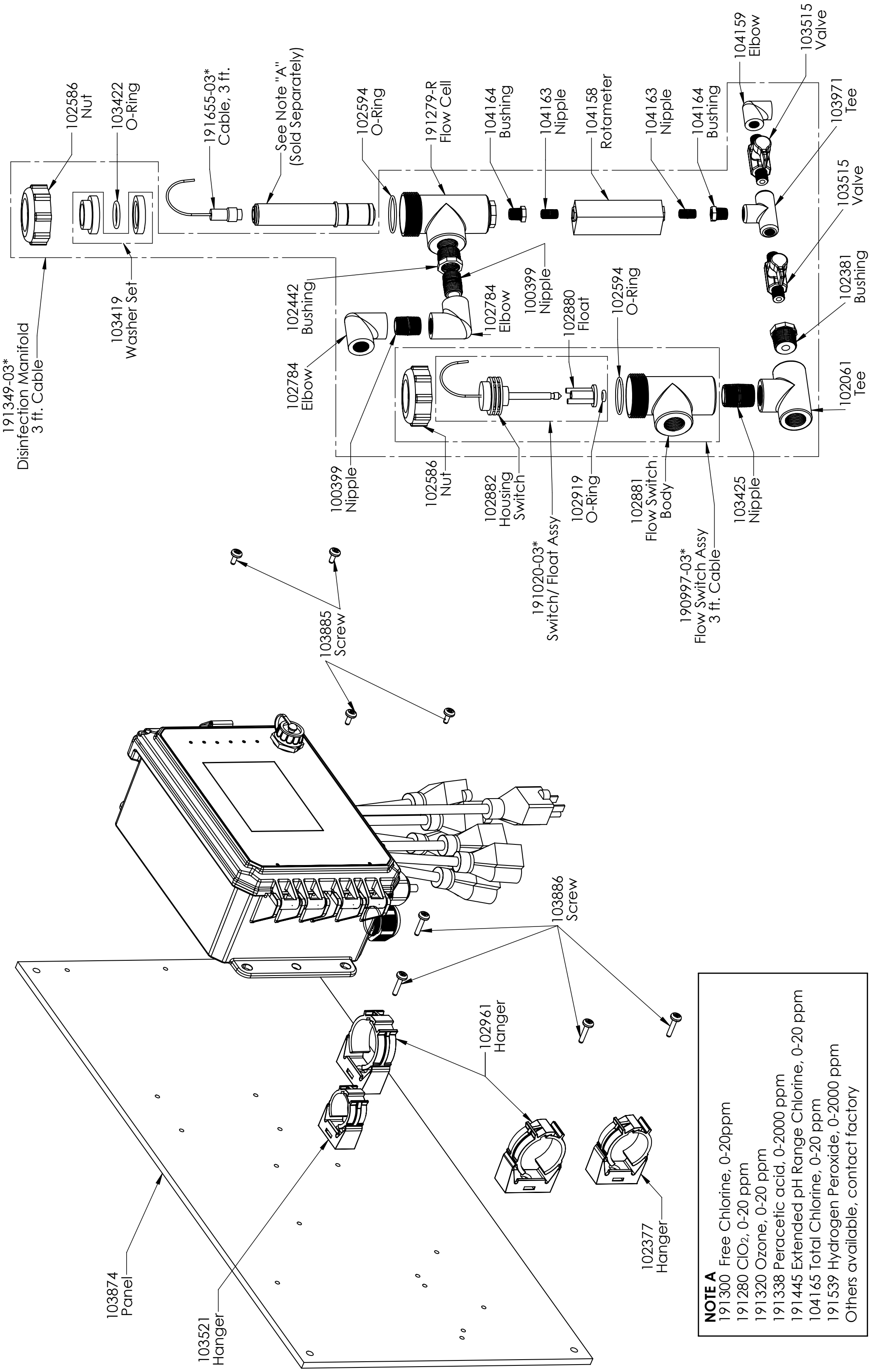
HU Electrodeless conductivity + Pyxis + Flow Switch manifold on panel with Makeup graphite conductivity with threaded adapter



WCT600 Sensor option HR, HS, HT

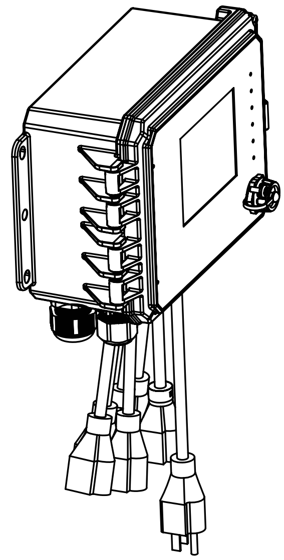
HR: Electrodeless conductivity + Flow Switch manifold on panel + WEL-PHF no ATC + Pyxis

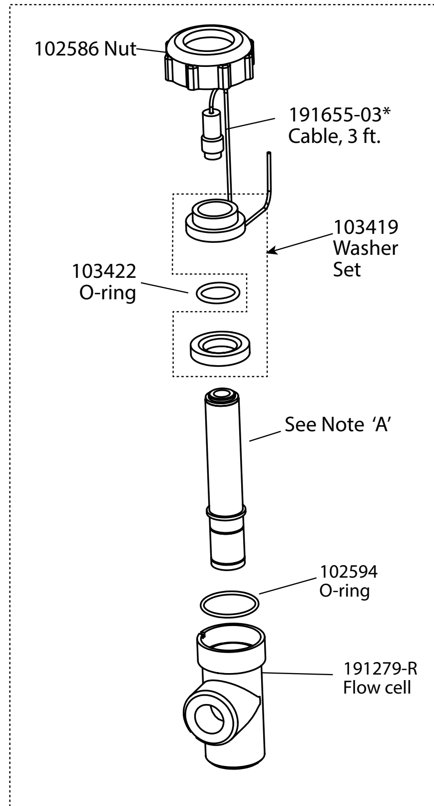
HS: + WEL-MVR no ATC + Pyxis HT: + WEL-MVF no ATC + Pyxis



WDS600 Sensor option PN

PN: Single DIS manifold on panel (Order disinfection sensor(s) separately)





-FF has two of these assemblies
-FN has one

NOTE A (Sold separately)

191300	Free Chlorine, 0-20 ppm
191280	ClO_2, 0-20 ppm
191320	Ozone, 0-20 ppm
191338	Peracetic acid, 0-2000 ppm
191445	Extended pH Range Chlorine, 0-20 ppm
104165	Total Chlorine, 0-20 ppm
191539	Hydrogen Peroxide, 0-2000 ppm

Others available, contact factory

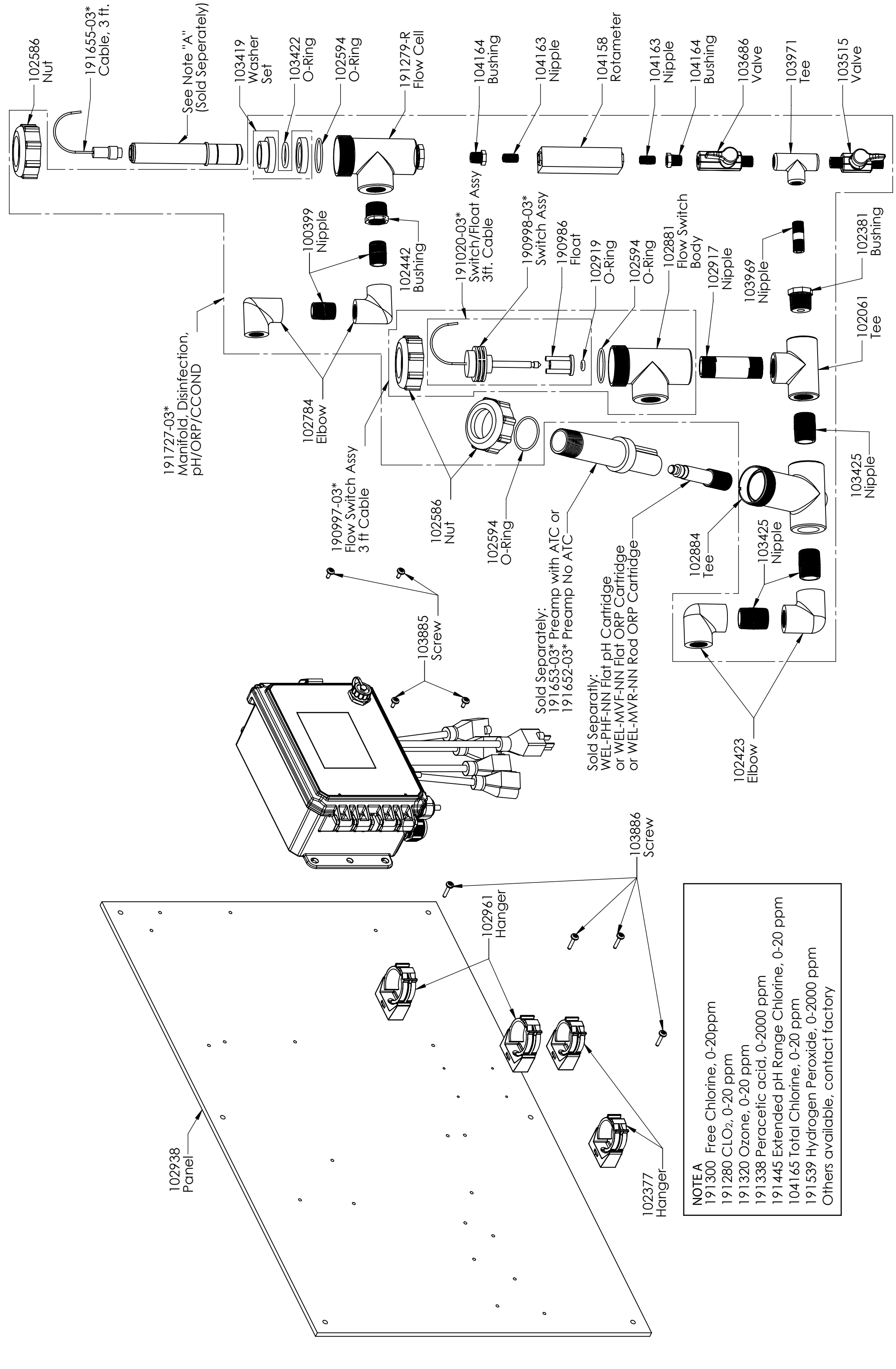
* Use '-20' for 20 ft. cables

WDS600 Sensor option FN and FF

WDS600 Sensor option FF or FN

FF: Two DIS flow cell/cable, no sensors (Order disinfection sensor(s) separately)

FN: Single DIS flow cell/cable, no sensor (Order disinfection sensor(s) separately)

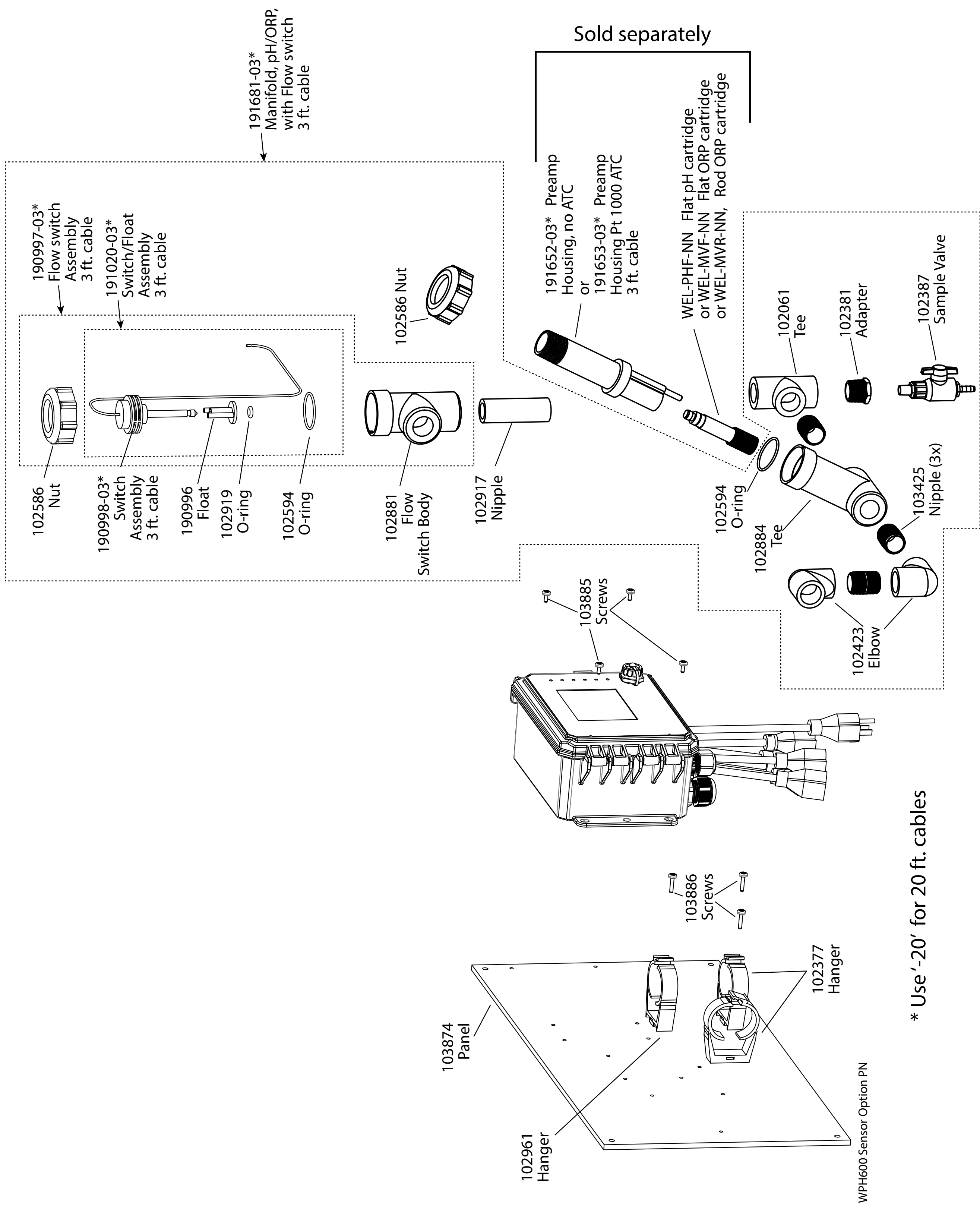


WDS600 Sensor option PX

PX: DIS manifold plus pH/ORP/cooling tower cond tee on panel

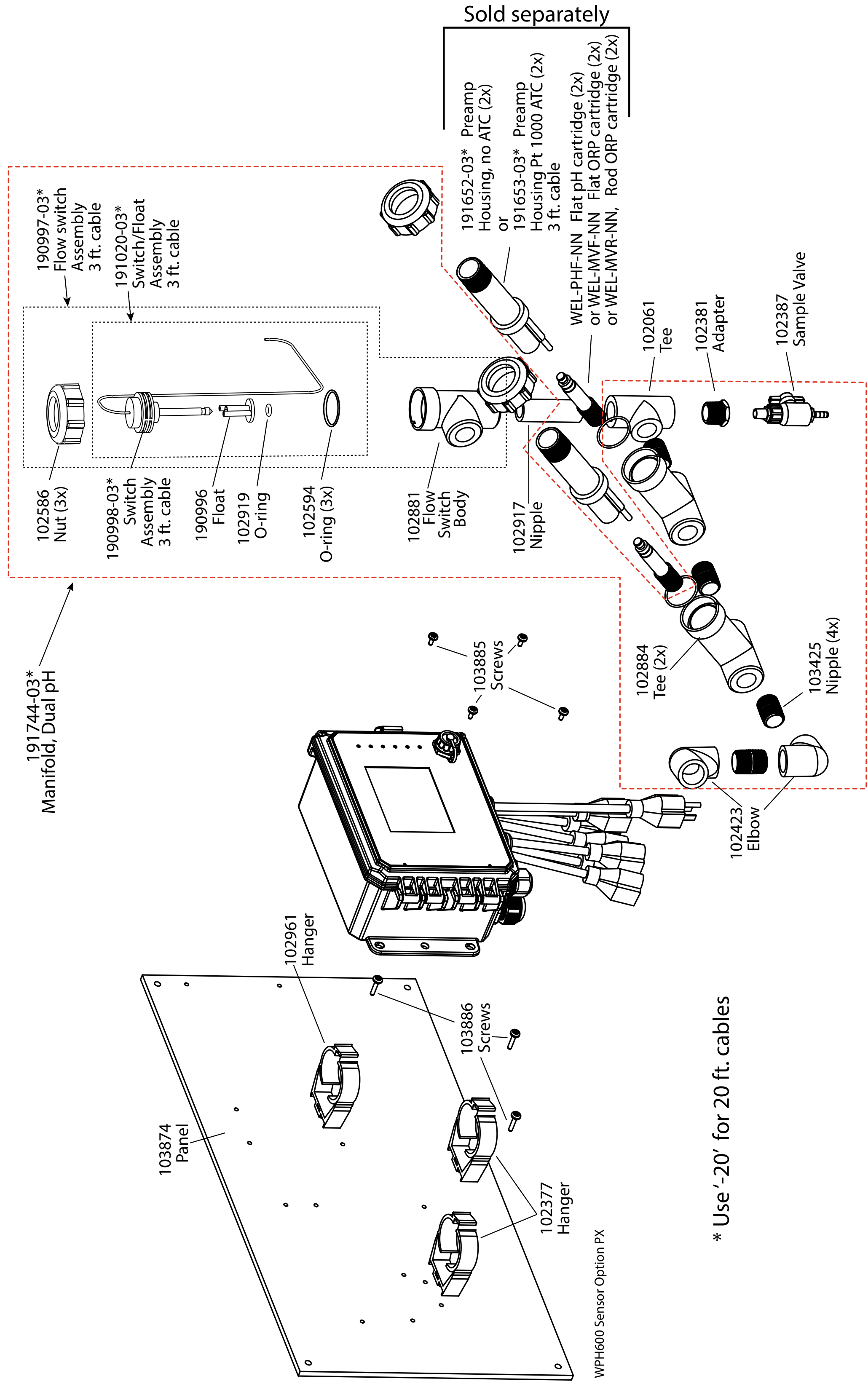
(Order disinfection sensor and WEL electrode and

preamplifier housing or cooling tower conductivity sensor separately)



WPH600 Sensor option PN

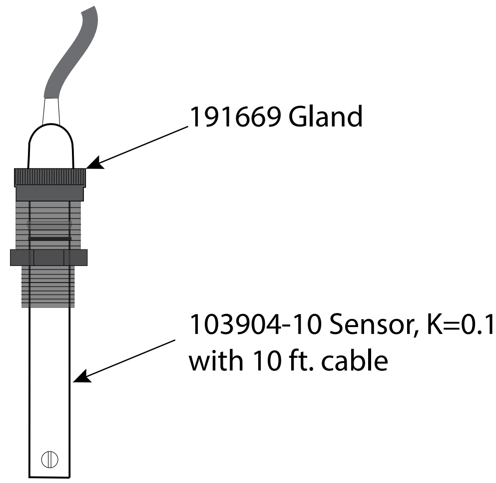
PN: Single low pressure manifold on panel (Order WEL electrode(s) and preamplifier housing(s) separately)



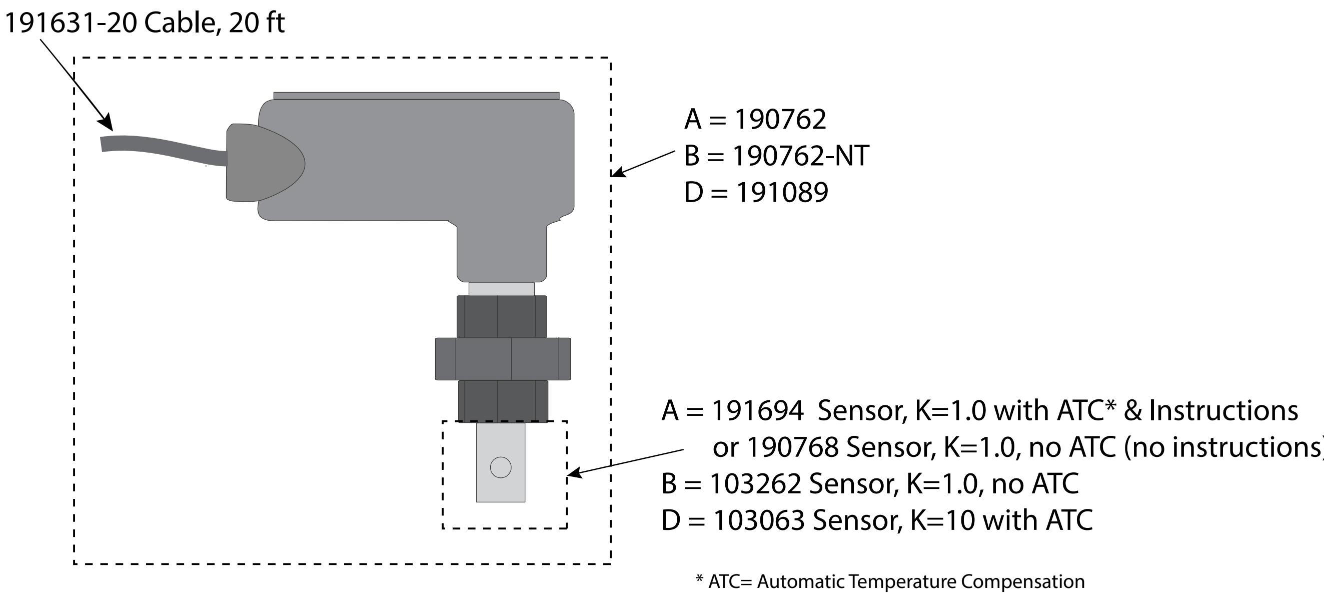
WPH600 Sensor option PX

PX: Dual low pressure manifold on panel (Order WEL electrode(s) and preamplifier housing(s) separately)

SENSOR OPTION C



SENSOR OPTION A, B, D



WBL600 Sensor options A,B,C,D

A: Boiler sensor with ATC, 250 psi, 1.0 cell constant, 20 ft. cable

B: Boiler sensor without ATC, 250 psi, 1.0 cell constant, 20 ft. cable

C: Condensate sensor with ATC, 200 psi, 0.1 cell constant, 10 ft. cable

D: Boiler sensor with ATC, 250 psi, 10 cell constant, 20 ft. cable

10.0 Service Policy

Walchem controllers have a 2-year warranty on electronic components and a 1-year warranty on mechanical parts and electrodes. See Statement of Limited Warranty in front of manual for details.

Walchem controllers are supported by a worldwide network of authorized master distributors. Contact your authorized Walchem distributor for troubleshooting support, replacement parts, and service. If a controller is not functioning properly, circuit boards may be available for exchange after the problem has been isolated. Authorized distributors will provide a Return Material Authorization (RMA) number for any products being returned to the factory for repair. Repairs are generally completed in less than one week. Repairs that are returned to the factory by next-day-air freight will receive priority service. Out-of-warranty repairs are charged on a time and material basis.

FIVE BOYNTON ROAD **HOPPING BROOK PARK** **HOLLISTON, MA 01746 USA**

TEL: 508-429-1110 **Web: www.walchem.com**

APPENDIX M - ALLOWABLE CONSTITUENT LEVELS FOR IMPORTED FILL OR SOIL (DER-10)

Appendix 5
Allowable Constituent Levels for Imported Fill or Soil
Subdivision 5.4(e)

Source: This table is derived from soil cleanup objective (SCO) tables in 6 NYCRR 375. Table 375-6.8(a) is the source for unrestricted use and Table 375-6.8(b) is the source for restricted use.

Note: For constituents not included in this table, refer to the contaminant for supplemental soil cleanup objectives (SSCOs) in the Commissioner Policy on *Soil Cleanup Guidance*. If an SSCO is not provided for a constituent, contact the DER PM to determine a site-specific level.

Constituent	Unrestricted Use	Residential Use	Restricted Residential Use	Commercial or Industrial Use	If Ecological Resources are Present
Metals					
Arsenic	13	16	16	16	13
Barium	350	350	400	400	433
Beryllium	7.2	14	47	47	10
Cadmium	2.5	2.5	4.3	7.5	4
Chromium, Hexavalent[1]	1 [3]	19	19	19	1 [3]
Chromium, Trivalent[1]	30	36	180	1500	41
Copper	50	270	270	270	50
Cyanide	27	27	27	27	NS
Lead	63	400	400	450	63
Manganese	1600	2000	2000	2000	1600
Mercury (total)	0.18	0.73	0.73	0.73	0.18
Nickel	30	130	130	130	30
Selenium	3.9	4	4	4	3.9
Silver	2	8.3	8.3	8.3	2
Zinc	109	2200	2480	2480	109
PCBs/Pesticides					
2,4,5-TP Acid (Silvex)	3.8	3.8	3.8	3.8	NS
4,4'-DDE	0.0033 [3]	1.8	8.9	17	0.0033 [3]
4,4'-DDT	0.0033 [3]	1.7	7.9	47	0.0033 [3]
4,4'-DDD	0.0033 [3]	2.6	13	14	0.0033 [3]
Aldrin	0.005	0.019	0.097	0.19	0.14
Alpha-BHC	0.02	0.02	0.02	0.02	0.04 [4]
Beta-BHC	0.036	0.072	0.09	0.09	0.6
Chlordane (alpha)	0.094	0.91	2.9	2.9	1.3
Delta-BHC	0.04	0.25	0.25	0.25	0.04 [4]
Dibenzofuran	7	14	59	210	NS
Dieldrin	0.005	0.039	0.1	0.1	0.006
Endosulfan I	2.4[2]	4.8	24	102	NS
Endosulfan II	2.4[2]	4.8	24	102	NS
Endosulfan sulfate	2.4[2]	4.8	24	200	NS
Endrin	0.014	0.06	0.06	0.06	0.014
Heptachlor	0.042	0.38	0.38	0.38	0.14
Lindane	0.1	0.1	0.1	0.1	6
Polychlorinated biphenyls	0.1	1	1	1	1

Constituent	Unrestricted Use	Residential Use	Restricted Residential Use	Commercial or Industrial Use	If Ecological Resources are Present
Semi-volatile Organic Compounds					
Acenaphthene	20	98	98	98	20
Acenaphthylene	100	100	100	107	NS
Anthracene	100	100	100	500	NS
Benzo(a)anthracene	1	1	1	1	NS
Benzo(a)pyrene	1	1	1	1	2.6
Benzo(b)fluoranthene	1	1	1	1.7	NS
Benzo(g,h,i)perylene	100	100	100	500	NS
Benzo(k)fluoranthene	0.8	1	1.7	1.7	NS
Chrysene	1	1	1	1	NS
Dibenz(a,h)anthracene	0.33 [3]	0.33 [3]	0.33 [3]	0.56	NS
Fluoranthene	100	100	100	500	NS
Fluorene	30	100	100	386	30
Indeno(1,2,3-cd)pyrene	0.5	0.5	0.5	5.6	NS
m-Cresol(s)	0.33 [3]	0.33 [3]	0.33 [3]	0.33 [3]	NS
Naphthalene	12	12	12	12	NS
o-Cresol(s)	0.33 [3]	0.33 [3]	0.33 [3]	0.33 [3]	NS
p-Cresol(s)	0.33	0.33	0.33	0.33	NS
Pentachlorophenol	0.8 [3]	0.8 [3]	0.8 [3]	0.8 [3]	0.8 [3]
Phenanthrene	100	100	100	500	NS
Phenol	0.33 [3]	0.33 [3]	0.33 [3]	0.33 [3]	30
Pyrene	100	100	100	500	NS
Volatile Organic Compounds					
1,1,1-Trichloroethane	0.68	0.68	0.68	0.68	NS
1,1-Dichloroethane	0.27	0.27	0.27	0.27	NS
1,1-Dichloroethene	0.33	0.33	0.33	0.33	NS
1,2-Dichlorobenzene	1.1	1.1	1.1	1.1	NS
1,2-Dichloroethane	0.02	0.02	0.02	0.02	10
1,2-Dichloroethene(cis)	0.25	0.25	0.25	0.25	NS
1,2-Dichloroethene(trans)	0.19	0.19	0.19	0.19	NS
1,3-Dichlorobenzene	2.4	2.4	2.4	2.4	NS
1,4-Dichlorobenzene	1.8	1.8	1.8	1.8	20
1,4-Dioxane	0.1 [3]	0.1 [3]	0.1 [3]	0.1 [3]	0.1
Acetone	0.05	0.05	0.05	0.05	2.2
Benzene	0.06	0.06	0.06	0.06	70
Butylbenzene	12	12	12	12	NS
Carbon tetrachloride	0.76	0.76	0.76	0.76	NS
Chlorobenzene	1.1	1.1	1.1	1.1	40
Chloroform	0.37	0.37	0.37	0.37	12
Ethylbenzene	1	1	1	1	NS
Hexachlorobenzene	0.33 [3]	0.33 [3]	1.2	3.2	NS
Methyl ethyl ketone	0.12	0.12	0.12	0.12	100
Methyl tert-butyl ether	0.93	0.93	0.93	0.93	NS
Methylene chloride	0.05	0.05	0.05	0.05	12

Volatile Organic Compounds (continued)					
Propylbenzene-n	3.9	3.9	3.9	3.9	NS
Sec-Butylbenzene	11	11	11	11	NS
Tert-Butylbenzene	5.9	5.9	5.9	5.9	NS
Tetrachloroethene	1.3	1.3	1.3	1.3	2
Toluene	0.7	0.7	0.7	0.7	36
Trichloroethene	0.47	0.47	0.47	0.47	2
Trimethylbenzene-1,2,4	3.6	3.6	3.6	3.6	NS
Trimethylbenzene-1,3,5	8.4	8.4	8.4	8.4	NS
Vinyl chloride	0.02	0.02	0.02	0.02	NS
Xylene (mixed)	0.26	1.6	1.6	1.6	0.26

All concentrations are in parts per million (ppm)
NS = Not Specified

Footnotes:
[1] The SCO for Hexavalent or Trivalent Chromium is considered to be met if the analysis for the total species of this contaminant is below the specific SCO for Hexavalent Chromium.
[2] The SCO is the sum of endosulfan I, endosulfan II and endosulfan sulfate.
[3] For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the Track 1 SCO value.
[4] This SCO is derived from data on mixed isomers of BHC.

APPENDIX N – SAMPLING, ANALYSIS, AND ASSESSMENT OF PER-AND POLYFUOROAKLYL SUBSTANCES

NEW YORK STATE OF OPPORTUNITY. | Department of Environmental Conservation

SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

Under NYSDEC's Part 375 Remedial Programs

November 2022

Table of Contents

November 2022

ERRATA SHEET for

SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) Under NYSDEC's Part 375 Remedial Programs Issued January 17, 2020

Citation and Page Number	Current Text	Corrected Text	Date
Title of Appendix I, page 32	Appendix H	Appendix I	2/25/2020
Document Cover, page 1	Guidelines for Sampling and Analysis of PFAS	Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs	9/15/2020
Routine Analysis, page 9	"However, laboratories analyzing environmental samples…PFOA and PFOS in drinking water by EPA Method 537, 537.1 or ISO 25101."	"However, laboratories analyzing environmental samples…PFOA and PFOS in drinking water by EPA Method 537, 537.1, ISO 25101, or Method 533."	9/15/2020
Additional Analysis, page 9, new paragraph regarding soil parameters	None	"In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (EPA Method 9060), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils."	9/15/2020
Data Assessment and Application to Site Cleanup Page 10	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFAS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Target levels for cleanup of PFAS in other media, including biota and sediment, have not yet been established by the DEC.	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Water Sample Results Page 10	PFAS should be further assessed and considered as a potential contaminant of concern in groundwater or surface water (…) If PFAS are identified as a contaminant of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.	PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water (…) If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.	9/15/2020
Soil Sample Results, page 10	"The extent of soil contamination for purposes of delineation and remedy selection should be determined by having certain soil samples tested by Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed for PFAS. Soil exhibiting SPLP results above 70 ppt for either PFOA or PFOS (individually or combined) are to be evaluated during the cleanup phase."	"Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values. " [Interim SCO Table] "PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP. As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf. "	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Testing for Imported Soil Page 11	Soil imported to a site for use in a soil cap, soil cover, or as backfill is to be tested for PFAS in general conformance with DER-10, Section 5.4(e) for the PFAS Analyte List (Appendix F) using the analytical procedures discussed below and the criteria in DER-10 associated with SVOCs. If PFOA or PFOS is detected in any sample at or above 1 µg/kg, then soil should be tested by SPLP and the leachate analyzed for PFAS. If the SPLP results exceed 10 ppt for either PFOA or PFOS (individually) then the source of backfill should be rejected, unless a site-specific exemption is provided by DER. SPLP leachate criteria is based on the Maximum Contaminant Levels proposed for drinking water by New York State's Department of Health, this value may be updated based on future Federal or State promulgated regulatory standards. Remedial parties have the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable. PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Footnotes	None	[1] TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances. [2] The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the soil cleanup objective for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	9/15/2020
Additional Analysis, page 9	In cases… soil parameters, such as Total Organic Carbon (EPA Method 9060), soil…	In cases… soil parameters, such as Total Organic Carbon (Lloyd Kahn), soil…	1/8/2021
Appendix A, General Guidelines, fourth bullet	List the ELAP-approved lab(s) to be used for analysis of samples	List the ELAP- certified lab(s) to be used for analysis of samples	1/8/2021
Appendix E, Laboratory Analysis and Containers	Drinking water samples collected using this protocol are intended to be analyzed for PFAS by ISO Method 25101.	Drinking water samples collected using this protocol are intended to be analyzed for PFAS by EPA Method 537, 537.1, 533, or ISO Method 25101	1/8/2021
Water Sample Results Page 9	"In addition, further assessment of water may be warranted if either of the following screening levels are met: a. any other individual PFAS (not PFOA or PFOS) is detected in water at or above 100 ng/L; or b. total concentration of PFAS (including PFOA and PFOS) is detected in water at or above 500 ng/L"	Deleted	6/15/2021

Citation and Page Number	Current Text	Corrected Text	Date
Routine Analysis, Page XX	Currently, New York State Department of Health's Environmental Laboratory Approval Program (ELAP)… criteria set forth in the DER's laboratory guidelines for PFAS in non-potable water and solids (Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids).	Deleted	5/31/2022
Analysis and Reporting, Page XX	As of October 2020, the United States Environmental Protection Agency (EPA) does not have a validated method for analysis of PFAS for media commonly analyzed under DER remedial programs (non-potable waters, solids). DER has developed the following guidelines to ensure consistency in analysis and reporting of PFAS.	Deleted	5/31/2022
Routine Analysis, Page XX	LC-MS/MS analysis for PFAS using methodologies based on EPA Method 537.1 is the procedure to use for environmental samples. Isotope dilution techniques should be utilized for the analysis of PFAS in all media.	EPA Method 1633 is the procedure to use for environmental samples.	
Soil Sample Results, Page XX	Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6	Soil cleanup objectives for PFOA and PFOS have been proposed in an upcoming revision to 6 NYCRR Part 375-6	
Appendix A	"Include in the text… LC-MS/MS for PFAS using methodologies based on EPA Method 537.1"	"Include in the text ….EPA Method 1633"	
Appendix A	"Laboratory should have ELAP certification for PFOA and PFOS in drinking water by EPA Method 537, 537.1, EPA Method 533, or ISO 25101"	Deleted	
Appendix B	"Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1"	"Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633"	

Citation and Page Number	Current Text	Corrected Text	Date
Appendix C	"Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1"	"Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633"	
Appendix D	"Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1"	"Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633"	
Appendix G		Updated to include all forty PFAS analytes in EPA Method 533	
Appendix H		Deleted	
Appendix I	Appendix I	Appendix H	
Appendix H	"These guidelines are intended to be used for the validation of PFAS analytical results for projects within the Division of Environmental Remediation (DER) as well as aid in the preparation of a data usability summary report."	"These guidelines are intended to be used for the validation of PFAS using EPA Method 1633 for projects within the Division of Environmental Remediation (DER)."	
Appendix H	"The holding time is 14 days…"	"The holding time is 28 days…"	
Appendix H, Initial Calibration	"The initial calibration should contain a minimum of five standards for linear fit…"	"The initial calibration should contain a minimum of six standards for linear fit…"	
Appendix H, Initial Calibration	Linear fit calibration curves should have an R^2 value greater than 0.990.	Deleted	
Appendix H, Initial Calibration Verification	Initial Calibration Verification Section	Deleted	
Appendix H	secondary Ion Monitoring Section	Deleted	
Appendix H	Branched and Linear Isomers Section	Deleted	

Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs

Objective

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) performs or oversees sampling of environmental media and subsequent analysis of PFAS as part of remedial programs implemented under 6 NYCRR Part 375. To ensure consistency in sampling, analysis, reporting, and assessment of PFAS, DER has developed this document which summarizes currently accepted procedures and updates previous DER technical guidance pertaining to PFAS.

Applicability

All work plans submitted to DEC pursuant to one of the remedial programs under Part 375 shall include PFAS sampling and analysis procedures that conform to the guidelines provided herein.

As part of a site investigation or remedial action compliance program, whenever samples of potentially affected media are collected and analyzed for the standard Target Analyte List/Target Compound List (TAL/TCL), PFAS analysis should also be performed. Potentially affected media can include soil, groundwater, surface water, and sediment. Based upon the potential for biota to be affected, biota sampling and analysis for PFAS may also be warranted as determined pursuant to a Fish and Wildlife Impact Analysis. Soil vapor sampling for PFAS is not required.

Field Sampling Procedures

DER-10 specifies technical guidance applicable to DER's remedial programs. Given the prevalence and use of PFAS, DER has developed "best management practices" specific to sampling for PFAS. As specified in DER-10 Chapter 2, quality assurance procedures are to be submitted with investigation work plans. Typically, these procedures are incorporated into a work plan, or submitted as a stand-alone document (e.g., a Quality Assurance Project Plan). Quality assurance guidelines for PFAS are listed in Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS.

Field sampling for PFAS performed under DER remedial programs should follow the appropriate procedures outlined for soils, sediments, or other solids (Appendix B), non-potable groundwater (Appendix C), surface water (Appendix D), public or private water supply wells (Appendix E), and fish tissue (Appendix F).

QA/QC samples (e.g. duplicates, MS/MSD) should be collected as specified in DER-10, Section 2.3(c). For sampling equipment coming in contact with aqueous samples only, rinsate or equipment blanks should be collected. Equipment blanks should be collected at a minimum frequency of one per day per site or one per twenty samples, whichever is more frequent.

Analysis and Reporting

The investigation work plan should describe analysis and reporting procedures, including laboratory analytical procedures for the methods discussed below. As specified in DER-10 Section 2.2, laboratories should provide a full Category B deliverable. In addition, a Data Usability Summary Report (DUSR) should be prepared by an independent, third party data validator. Electronic data submissions should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html.

DER has developed a *PFAS Analyte List* (Appendix G) for remedial programs to understand the nature of contamination at sites. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any analytes, the DER project manager, in consultation with the DER chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site. As with other contaminants that are analyzed for at a site, the *PFAS Analyte List* may be refined for future sampling events based on investigative findings.

Routine Analysis

EPA Method 1633 is the procedure to use for environmental samples. Reporting limits for PFOA and PFOS in aqueous samples should not exceed 2 ng/L. Reporting limits for PFOA and PFOS in solid samples should not exceed 0.5 µg/kg. Reporting limits for all other PFAS in aqueous and solid media should be as close to these limits as possible. If laboratories indicate that they are not able to achieve these reporting limits for the entire *PFAS Analyte List*, site-specific decisions regarding acceptance of elevated reporting limits for specific PFAS can be made by the DER project manager in consultation with the DER chemist. Data review guidelines were developed by DER to ensure data comparability and usability (Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids).

Additional Analysis

Additional laboratory methods for analysis of PFAS may be warranted at a site, such as the Synthetic Precipitation Leaching Procedure (SPLP) and Total Oxidizable Precursor Assay (TOP Assay).

In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (Lloyd Kahn), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils.

SPLP is a technique used to determine the mobility of chemicals in liquids, soils and wastes, and may be useful in determining the need for addressing PFAS-containing material as part of the remedy. SPLP by EPA Method 1312 should be used unless otherwise specified by the DER project manager in consultation with the DER chemist.

Impacted materials can be made up of PFAS that are not analyzable by routine analytical methodology. A TOP Assay can be utilized to conceptualize the amount and type of oxidizable PFAS which could be liberated in the environment, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized. For example, some polyfluoroalkyl substances may degrade or transform to form perfluoroalkyl substances (such as PFOA or PFOS), resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from a source. The TOP Assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by routine analytical methodology.[1]

[1] TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances.

Commercial laboratories have adopted methods which allow for the quantification of targeted PFAS in air and biota. The EPA's Office of Research and Development (ORD) is currently developing methods which allow for air emissions characterization of PFAS, including both targeted and non-targeted analysis of PFAS. Consult with the DER project manager and the DER chemist for assistance on analyzing biota/tissue and air samples.

Data Assessment and Application to Site Cleanup

Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.

Water Sample Results

PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water if PFOA or PFOS is detected in any water sample at or above 10 ng/L (ppt) and is determined to be attributable to the site, either by a comparison of upgradient and downgradient levels, or the presence of soil source areas, as defined below.

If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.

Soil Sample Results

Soil cleanup objectives for PFOA and PFOS have been proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values:

Guidance Values for Anticipated Site Use	PFOA (ppb)	PFOS (ppb)
Unrestricted	0.66	0.88
Residential	6.6	8.8
Restricted Residential	33	44
Commercial	500	440
Industrial	600	440
Protection of Groundwater[2]	1.1	3.7

PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP.

As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange

[2] The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).

capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf.

Testing for Imported Soil

Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable.

PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.

Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS

The following guidelines (general and PFAS-specific) can be used to assist with the development of a QAPP for projects within DER involving sampling and analysis of PFAS.

General Guidelines in Accordance with DER-10

- Document/work plan section title – Quality Assurance Project Plan
- Summarize project scope, goals, and objectives
- Provide project organization including names and resumes of the project manager, Quality Assurance Officer (QAO), field staff, and Data Validator
    - The QAO should not have another position on the project, such as project or task manager, that involves project productivity or profitability as a job performance criterion
- List the ELAP certified lab(s) to be used for analysis of samples
- Include a site map showing sample locations
- Provide detailed sampling procedures for each matrix
- Include Data Quality Usability Objectives
- List equipment decontamination procedures
- Include an "Analytical Methods/Quality Assurance Summary Table" specifying:
    - Matrix type
    - Number or frequency of samples to be collected per matrix
    - Number of field and trip blanks per matrix
    - Analytical parameters to be measured per matrix
    - Analytical methods to be used per matrix with minimum reporting limits
    - Number and type of matrix spike and matrix spike duplicate samples to be collected
    - Number and type of duplicate samples to be collected
    - Sample preservation to be used per analytical method and sample matrix
    - Sample container volume and type to be used per analytical method and sample matrix
    - Sample holding time to be used per analytical method and sample matrix
- Specify Category B laboratory data deliverables and preparation of a DUSR

Specific Guidelines for PFAS

- Include in the text that sampling for PFAS will take place
- Include in the text that PFAS will be analyzed by EPA Method 1633
- Include the list of PFAS compounds to be analyzed (*PFAS Analyte List*)
- Include the laboratory SOP for PFAS analysis
- List the minimum method-achievable Reporting Limits for PFAS
    - Reporting Limits should be less than or equal to:
        - Aqueous – 2 ng/L (ppt)
        - Solids – 0.5 µg/kg (ppb)
- Include the laboratory Method Detection Limits for the PFAS compounds to be analyzed
-
- Include detailed sampling procedures
    - Precautions to be taken
    - Pump and equipment types
    - Decontamination procedures
    - Approved materials only to be used
- Specify that regular ice only will be used for sample shipment
- Specify that equipment blanks should be collected at a minimum frequency of 1 per day per site for each matrix

Appendix B - Sampling Protocols for PFAS in Soils, Sediments and Solids

General

The objective of this protocol is to give general guidelines for the collection of soil, sediment and other solid samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Containers

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in to contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel spoon
- stainless steel bowl
- steel hand auger or shovel without any coatings

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Sampling is often conducted in areas where a vegetative turf has been established. In these cases, a pre-cleaned trowel or shovel should be used to carefully remove the turf so that it may be replaced at the conclusion of sampling. Surface soil samples (e.g. 0 to 6 inches below surface) should then be collected using a pre-cleaned, stainless steel spoon. Shallow subsurface soil samples (e.g. 6 to ~36 inches below surface) may be collected by digging a hole using a pre-cleaned hand auger or shovel. When the desired subsurface depth is reached, a pre-cleaned hand auger or spoon shall be used to obtain the sample.

When the sample is obtained, it should be deposited into a stainless steel bowl for mixing prior to filling the sample containers. The soil should be placed directly into the bowl and mixed thoroughly by rolling the material into the middle until the material is homogenized. At this point the material within the bowl can be placed into the laboratory provided container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A soil log or sample log shall document the location of the sample/borehole, depth of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix C - Sampling Protocols for PFAS in Monitoring Wells

General

The objective of this protocol is to give general guidelines for the collection of groundwater samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including plumbers tape and sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel inertia pump with HDPE tubing
- peristaltic pump equipped with HDPE tubing and silicone tubing
- stainless steel bailer with stainless steel ball
- bladder pump (identified as PFAS-free) with HDPE tubing

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Monitoring wells should be purged in accordance with the sampling procedure (standard/volume purge or low flow purge) identified in the site work plan, which will determine the appropriate time to collect the sample. If sampling using standard purge techniques, additional purging may be needed to reduce turbidity levels, so samples contain a limited amount of sediment within the sample containers. Sample containers that contain sediment may cause issues at the laboratory, which may result in elevated reporting limits and other issues during the sample preparation that can compromise data usability. Sampling personnel should don new nitrile gloves prior to sample collection due to the potential to contact PFAS containing items (not related to the sampling equipment) during the purging activities.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Additional equipment blank samples may be collected to assess other equipment that is utilized at the monitoring well
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A purge log shall document the location of the sample, sampling equipment, groundwater parameters, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix D - Sampling Protocols for PFAS in Surface Water

General

The objective of this protocol is to give general guidelines for the collection of surface water samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel cup

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Where conditions permit, (e.g. creek or pond) sampling devices (e.g. stainless steel cup) should be rinsed with site medium to be sampled prior to collection of the sample. At this point the sample can be collected and poured into the sample container.

If site conditions permit, samples can be collected directly into the laboratory container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification.   Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A sample log shall document the location of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix E - Sampling Protocols for PFAS in Private Water Supply Wells

General

The objective of this protocol is to give general guidelines for the collection of water samples from private water supply wells (with a functioning pump) for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Drinking water samples collected using this protocol are intended to be analyzed for PFAS by EPA Method 537, 537.1, 533, or ISO Method 25101. The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials (e.g. plumbers tape), including sample bottle cap liners with a PTFE layer.

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Locate and assess the pressure tank and determine if any filter units are present within the building. Establish the sample location as close to the well pump as possible, which is typically the spigot at the pressure tank. Ensure sampling equipment is kept clean during sampling as access to the pressure tank spigot, which is likely located close to the ground, may be obstructed and may hinder sample collection.

Prior to sampling, a faucet downstream of the pressure tank (e.g., washroom sink) should be run until the well pump comes on and a decrease in water temperature is noted which indicates that the water is coming from the well. If the homeowner is amenable, staff should run the water longer to purge the well (15+ minutes) to provide a sample representative of the water in the formation rather than standing water in the well and piping system including the pressure tank. At this point a new pair of nitrile gloves should be donned and the sample can be collected from the sample point at the pressure tank.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- If equipment was used, collect one equipment blank per day per site and a minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers.
- A field reagent blank (FRB) should be collected at a rate of one per 20 samples. The lab will provide a FRB bottle containing PFAS free water and one empty FRB bottle. In the field, pour the water from the one bottle into the empty FRB bottle and label appropriately.
- Request appropriate data deliverable (Category B) and an electronic data deliverable
- For sampling events where multiple private wells (homes or sites) are to be sampled per day, it is acceptable to collect QC samples at a rate of one per 20 across multiple sites or days.

Documentation

A sample log shall document the location of the private well, sample point location, owner contact information, sampling equipment, purge duration, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate and available (e.g. well construction, pump type and location, yield, installation date). Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appendix F - Sampling Protocols for PFAS in Fish

This appendix contains a copy of the latest guidelines developed by the Division of Fish and Wildlife (DFW) entitled "General Fish Handling Procedures for Contaminant Analysis" (Ver. 8).

Procedure Name: General Fish Handling Procedures for Contaminant Analysis

Number: FW-005

Purpose: This procedure describes data collection, fish processing and delivery of fish collected for contaminant monitoring. It contains the chain of custody and collection record forms that should be used for the collections.

Organization: Environmental Monitoring Section
Bureau of Ecosystem Health
Division of Fish and Wildlife (DFW)
New York State Department of Environmental Conservation (NYSDEC)
625 Broadway
Albany, New York 12233-4756

Version: 8

Previous Version Date: 21 March 2018

Summary of Changes to this Version: Updated bureau name to Bureau of Ecosystem Health. Added direction to list the names of all field crew on the collection record. Minor formatting changes on chain of custody and collection records.

Originator or Revised by: Wayne Richter, Jesse Becker

Date: 26 April 2019

Quality Assurance Officer and Approval Date: Jesse Becker, 26 April 2019

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

GENERAL FISH HANDLING PROCEDURES FOR CONTAMINANT ANALYSES

A. Original copies of all continuity of evidence (i.e., Chain of Custody) and collection record forms must accompany delivery of fish to the lab. A copy shall be directed to the Project Leader or as appropriate, Wayne Richter. All necessary forms will be supplied by the Bureau of Ecosystem Health. Because some samples may be used in legal cases, it is critical that each section is filled out completely. Each Chain of Custody form has three main sections:

   1. The top box is to be filled out **and signed** by the person responsible for the fish collection (e.g., crew leader, field biologist, researcher). This person is responsible for delivery of the samples to DEC facilities or personnel (e.g., regional office or biologist).

   2. The second section is to be filled out **and signed** by the person responsible for the collections while being stored at DEC, before delivery to the analytical lab. This may be the same person as in (1), but it is still required that they complete the section. Also important is the **range of identification numbers** (i.e., tag numbers) included in the sample batch.

   3. Finally, the bottom box is to record any transfers between DEC personnel and facilities. Each subsequent transfer should be **identified, signed, and dated**, until laboratory personnel take possession of the fish.

B. The following data are required on each **Fish Collection Record** form:

   1. Project and Site Name.

   2. DEC Region.

   3. All personnel (and affiliation) involved in the collection.

   4. Method of collection (gill net, hook and line, etc.)

   5. Preservation Method.

C. The following data are to be taken on each fish collected and recorded on the **Fish Collection Record** form:

   1. Tag number - Each specimen is to be individually jaw tagged at time of collection with a unique number. Make sure the tag is turned out so that the number can be read without opening the bag. Use tags in sequential order. For small fish or composite samples place the tag inside the bag with the samples. The Bureau of Ecosystem Health can supply the tags.

   2. Species identification (please be explicit enough to enable assigning genus and species). Group fish by species when processing.

   3. Date collected.

   4. Sample location (waterway and nearest prominent identifiable landmark).

   5. Total length (nearest mm or smallest sub-unit on measuring instrument) and weight (nearest g or

smallest sub-unit of weight on weighing instrument). Take all measures as soon as possible with calibrated, protected instruments (e.g. from wind and upsets) and prior to freezing.

6. Sex - fish may be cut enough to allow sexing or other internal investigation, but do not eviscerate. Make any incision on the right side of the belly flap or exactly down the midline so that a left-side fillet can be removed.

D. General data collection recommendations:

1. It is helpful to use an ID or tag number that will be unique. It is best to use metal striped bass or other uniquely numbered metal tags. If uniquely numbered tags are unavailable, values based on the region, water body and year are likely to be unique: for example, R7CAY11001 for Region 7, Cayuga Lake, 2011, fish 1. If the fish are just numbered 1 through 20, we have to give them new numbers for our database, making it more difficult to trace your fish to their analytical results and creating an additional possibility for errors.

2. Process and record fish of the same species sequentially. Recording mistakes are less likely when all fish from a species are processed together. Starting with the bigger fish species helps avoid missing an individual.

3. If using Bureau of Ecosystem Health supplied tags or other numbered tags, use tags in sequence so that fish are recorded with sequential Tag Numbers. This makes data entry and login at the lab and use of the data in the future easier and reduces keypunch errors.

4. Record length and weight as soon as possible after collection and before freezing. Other data are recorded in the field upon collection. An age determination of each fish is optional, but if done, it is recorded in the appropriate "Age" column.

5. For composite samples of small fish, record the number of fish in the composite in the Remarks column. Record the length and weight of each individual in a composite. All fish in a composite sample should be of the same species and members of a composite should be visually matched for size.

6. Please submit photocopies of topographic maps or good quality navigation charts indicating sampling locations. GPS coordinates can be entered in the Location column of the collection record form in addition to or instead for providing a map. These records are of immense help to us (and hopefully you) in providing documented location records which are not dependent on memory and/or the same collection crew. In addition, they may be helpful for contaminant source trackdown and remediation/control efforts of the Department.

7. When recording data on fish measurements, it will help to ensure correct data recording for the data recorder to call back the numbers to the person making the measurements.

E. Each fish is to be placed in its own individual plastic bag. For small fish to be analyzed as a composite, put all of the fish for one composite in the same bag but use a separate bag for each composite. It is important to individually bag the fish to avoid difficulties or cross contamination when processing the fish for chemical analysis. Be sure to include the fish's tag number inside the bag, preferably attached to the fish with the tag number turned out so it can be read. Tie or otherwise secure the bag closed. **<u>The Bureau of Ecosystem Health will supply the bags.</u>** If necessary, food grade bags may be procured from a suitable vendor (e.g., grocery store). It is preferable to redundantly label each bag with a manila tag tied between the knot and the body of the bag. This tag should be labeled with the project name, collection location, tag number, collection date, and fish species. If scales are collected, the scale envelope should be labeled with the same information.

F. Groups of fish, by species, are to be placed in one large plastic bag per sampling location. **The Bureau of Ecosystem Health will supply the larger bags.** Tie or otherwise secure the bag closed. Label the site bag with a manila tag tied between the knot and the body of the bag. The tag should contain: project, collection location, collection date, species and **tag number ranges**. Having this information on the manila tag enables lab staff to know what is in the bag without opening it.

G. Do not eviscerate, fillet or otherwise dissect the fish unless specifically asked to. If evisceration or dissection is specified, the fish must be cut along the exact midline or on the right side so that the left side fillet can be removed intact at the laboratory. If filleting is specified, the procedure for taking a standard fillet (SOP PREPLAB 4) must be followed, including removing scales.

H. Special procedures for PFAS: Unlike legacy contaminants such as PCBs, which are rarely found in day to day life, PFAS are widely used and frequently encountered. Practices that avoid sample contamination are therefore necessary. While no standard practices have been established for fish, procedures for water quality sampling can provide guidance. The following practices should be used for collections when fish are to be analyzed for PFAS:

    No materials containing Teflon.
    No Post-it notes.
    No ice packs; only water ice or dry ice.
    Any gloves worn must be powder free nitrile.
    No Gore-Tex or similar materials (Gore-Tex is a PFC with PFOA used in its manufacture).
    No stain repellent or waterproof treated clothing; these are likely to contain PFCs.
    Avoid plastic materials, other than HDPE, including clipboards and waterproof notebooks.
    Wash hands after handling any food containers or packages as these may contain PFCs. Keep pre-wrapped food containers and wrappers isolated from fish handling.
    Wear clothing washed at least six times since purchase.
    Wear clothing washed without fabric softener.
    Staff should avoid cosmetics, moisturizers, hand creams and similar products on the day of sampling as many of these products contain PFCs (Fujii et al. 2013). Sunscreen or insect repellent should not contain ingredients with "fluor" in their name. Apply any sunscreen or insect repellent well downwind from all materials. Hands must be washed after touching any of these products.

I. All fish must be kept at a temperature <45° F (<8° C) immediately following data processing. As soon as possible, freeze at -20° C ± 5° C. Due to occasional freezer failures, daily freezer temperature logs are required. The freezer should be locked or otherwise secured to maintain chain of custody.

J. In most cases, samples should be delivered to the Analytical Services Unit at the Hale Creek field station. Coordinate delivery with field station staff and send copies of the collection records, continuity of evidence forms and freezer temperature logs to the field station. For samples to be analyzed elsewhere, non-routine collections or other questions, contact Wayne Richter, Bureau of Ecosystem Health, NYSDEC, 625 Broadway, Albany, New York 12233-4756, 518-402-8974, or the project leader about sample transfer. Samples will then be directed to the analytical facility and personnel noted on specific project descriptions.

K. A recommended equipment list is at the end of this document.

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NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF FISH AND WILDLIFE
FISH COLLECTION RECORD

Project and Site Name ____ DEC Region ____________

Collections made by (include all crew) ____

Sampling Method: ☐Electrofishing ☐Gill netting ☐Trap netting ☐Trawling ☐Seining ☐Angling ☐Other ____________________

Preservation Method: ☐Freezing ☐Other ______________________ Notes (SWFDB survey number): ____________________

FOR LAB USE ONLY- LAB ENTRY NO.	COLLECTION OR TAG NO.	SPECIES	DATE TAKEN	LOCATION	AGE	SEX &/OR REPROD. CONDIT	LENGTH ( )	WEIGHT ( )	REMARKS

richter: revised 2011, 5/7/15, 10/4/16, 3/20/17; becker: 3/23/17, 4/26/19

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
CHAIN OF CUSTODY

I, ______________________________, of ____ collected the
(Print Name) (Print Business Address)

following on ____________________, 20____ from ____
(Date) (Water Body)

in the vicinity of ____
(Landmark, Village, Road, etc.)

Town of _______________________________________, in _________________________________ County.

Item(s) ____

____

Said sample(s) were in my possession and handled according to standard procedures provided to me prior to collection. The sample(s) were placed in the custody of a representative of the New York State Department of Environmental Conservation on ___________________________________, 20______.

____ ____________________________
Signature Date

I, __________________________________, received the above mentioned sample(s) on the date specified and assigned identification number(s) ____ to the sample(s). I have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

_______________________________________ ___________________
Signature Date

SECOND RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
THIRD RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
FOURTH RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
RECEIVED IN LABORATORY BY (Print Name)	TIME & DATE	REMARKS
SIGNATURE	UNIT	
LOGGED IN BY (Print Name)	TIME & DATE	ACCESSION NUMBERS
SIGNATURE	UNIT	

richter: revised 21 April 2014; becker: 23 March 2017, 26 April, 2019

NOTICE OF WARRANTY

By signature to the chain of custody (reverse), the signatory warrants that the information provided is truthful and accurate to the best of his/her ability. The signatory affirms that he/she is willing to testify to those facts provided and the circumstances surrounding the same. Nothing in this warranty or chain of custody negates responsibility nor liability of the signatories for the truthfulness and accuracy of the statements provided.

HANDLING INSTRUCTIONS

On day of collection, collector(s) name(s), address(es), date, geographic location of capture (attach a copy of topographic map or navigation chart), species, number kept of each species, and description of capture vicinity (proper noun, if possible) along with name of Town and County must be indicated on reverse.

Retain organisms in manila tagged plastic bags to avoid mixing capture locations. Note appropriate information on each bag tag.

Keep samples as cool as possible. Put on ice if fish cannot be frozen within 12 hours. If fish are held more than 24 hours without freezing, they will not be retained or analyzed.

Initial recipient (either DEC or designated agent) of samples from collector(s) is responsible for obtaining and recording information on the collection record forms which will accompany the chain of custody. This person will seal the container using packing tape and writing his signature, the time and the date across the tape onto the container with indelible marker. Any time a seal is broken, for whatever purpose, the incident must be recorded on the Chain of Custody (reason, time, and date) in the purpose of transfer block. Container then is resealed using new tape and rewriting signature, with time and date.

EQUIPMENT LIST

Scale or balance of appropriate capacity for the fish to be collected.

Fish measuring board.

Plastic bags of an appropriate size for the fish to be collected and for site bags.

Individually numbered metal tags for fish.

Manila tags to label bags.

Small envelops, approximately 2” x 3.5”, if fish scales are to be collected.

Knife for removing scales.

Chain of custody and fish collection forms.

Clipboard.

Pens or markers.

Paper towels.

Dish soap and brush.

Bucket.

Cooler.

Ice.

Duct tape.

Appendix G – PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonic acids	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluoropentanesulfonic acid	PFPeS	2706-91-4
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorononanesulfonic acid	PFNS	68259-12-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
	Perfluorododecanesulfonic acid	PFDoS	79780-39-5
Perfluoroalkyl carboxylic acids	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUnA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTeDA	376-06-7
Per- and Polyfluoroether carboxylic acids	Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
	4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
	Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
	Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
	Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6
Fluorotelomer sulfonic acids	4:2 Fluorotelomer sulfonic acid	4:2-FTS	757124-72-4
	6:2 Fluorotelomer sulfonic acid	6:2-FTS	27619-97-2
	8:2 Fluorotelomer sulfonic acid	8:2-FTS	39108-34-4
Fluorotelomer carboxylic acids	3:3 Fluorotelomer carboxylic acid	3:3 FTCA	356-02-5
	5:3 Fluorotelomer carboxylic acid	5:3 FTCA	914637-49-3
	7:3 Fluorotelomer carboxylic acid	7:3 FTCA	812-70-4
Perfluorooctane sulfonamides	Perfluorooctane sulfonamide	PFOSA	754-91-6
	N-methylperfluorooctane sulfonamide	NMeFOSA	31506-32-8
	N-ethylperfluorooctane sulfonamide	NEtFOSA	4151-50-2
Perfluorooctane sulfonamidoacetic acids	N-methylperfluorooctane sulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethylperfluorooctane sulfonamidoacetic acid	N-EtFOSAA	2991-50-6
Perfluorooctane sulfonamide ethanols	N-methylperfluorooctane sulfonamidoethanol	MeFOSE	24448-09-7
	N-ethylperfluorooctane sulfonamidoethanol	EtFOSE	1691-99-2

Group	Chemical Name	Abbreviation	CAS Number
Ether sulfonic acids	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (F-53B Major)	9Cl-PF3ONS	756426-58-1
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor)	11Cl-PF3OUdS	763051-92-9
	Perfluoro(2-ethoxyethane) sulfonic acid	PFEESA	113507-82-7

Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

These guidelines are intended to be used for the validation of PFAS using EPA Method 1633 for projects within the Division of Environmental Remediation (DER). Data reviewers should understand the methodology and techniques utilized in the analysis. Consultation with the end user of the data may be necessary to assist in determining data usability based on the data quality objectives in the Quality Assurance Project Plan. A familiarity with the laboratory's Standard Operating Procedure may also be needed to fully evaluate the data. If you have any questions, please contact DER's Quality Assurance Officer, Dana Barbarossa, at dana.barbarossa@dec.ny.gov.

Preservation and Holding Time

Samples should be preserved with ice to a temperature of less than 6°C upon arrival at the lab. The holding time is 28 days to extraction for aqueous and solid samples. The time from extraction to analysis for aqueous samples is 28 days and 40 days for solids.

Temperature greatly exceeds 6ºC upon arrival at the lab*	Use professional judgement to qualify detects and non-detects as estimated or rejected
Holding time exceeding 28 days to extraction	Use professional judgement to qualify detects and non-detects as estimated or rejected if holding time is grossly exceeded

*Samples that are delivered to the lab immediately after sampling may not meet the thermal preservation guidelines. Samples are considered acceptable if they arrive on ice or an attempt to chill the samples is observed.

Initial Calibration

The initial calibration should contain a minimum of six standards for linear fit and six standards for a quadratic fit. The relative standard deviation (RSD) for a quadratic fit calibration should be less than 20%.

The low-level calibration standard should be within 50% - 150% of the true value, and the mid-level calibration standard within 70% - 130% of the true value.

%RSD >20%	J flag detects and UJ non detects

Continuing Calibration Verification

Continuing calibration verification (CCV) checks should be analyzed at a frequency of one per ten field samples. If CCV recovery is very low, where detection of the analyte could be in question, ensure a low level CCV was analyzed and use to determine data quality.

CCV recovery <70 or >130%	J flag results

Blanks

There should be no detections in the method blanks above the reporting limits. Equipment blanks, field blanks, rinse blanks etc. should be evaluated in the same manner as method blanks. Use the most contaminated blank to evaluate the sample results.

Blank Result	Sample Result	Qualification
Any detection	<Reporting limit	Qualify as ND at reporting limit
Any detection	>Reporting Limit and >10x the blank result	No qualification
>Reporting limit	>Reporting limit and <10x blank result	J+ biased high

Field Duplicates

A blind field duplicate should be collected at rate of one per twenty samples. The relative percent difference (RPD) should be less than 30% for analyte concentrations greater than two times the reporting limit. Use the higher result for final reporting.

RPD >30%	Apply J qualifier to parent sample

Lab Control Spike

Lab control spikes should be analyzed with each extraction batch or one for every twenty samples. In the absence of lab derived criteria, use 70% - 130% recovery criteria to evaluate the data.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects

Matrix Spike/Matrix Spike Duplicate

One matrix spike and matrix spike duplicate should be collected at a rate of one per twenty samples. Use professional judgement to reject results based on out of control MS/MSD recoveries.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only
RPD >30%	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only

Extracted Internal Standards (Isotope Dilution Analytes)

Problematic analytes (e.g. PFBA, PFPeA, fluorotelomer sulfonates) can have wider recoveries without qualification. Qualify corresponding native compounds with a J flag if outside of the range.

Recovery <50% or >150%	Apply J qualifier
Recovery <25% or >150% for poor responding analytes	Apply J qualifier
Isotope Dilution Analyte (IDA) Recovery <10%	Reject results

Signal to Noise Ratio

The signal to noise ratio for the quantifier ion should be at least 3:1. If the ratio is less than 3:1, the peak is discernable from the baseline noise and symmetrical, the result can be reported. If the peak appears to be baseline noise and/or the shape is irregular, qualify the result as tentatively identified.

Reporting Limits

If project-specific reporting limits were not met, please indicate that in the report along with the reason (e.g. over dilution, dilution for non-target analytes, high sediment in aqueous samples).

Peak Integrations

Target analyte peaks should be integrated properly and consistently when compared to standards. Ensure branched isomer peaks are included for PFAS where standards are available. Inconsistencies should be brought to the attention of the laboratory or identified in the data review summary report.

APPENDIX O – REMEDIAL SYSTEM OPTIMIZATION OUTLINE

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REMEDIAL SYSTEM OPTIMIZATION FOR FARWELL

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