

**BASF QUEENSBURY
CLOSED LANDFILL
FACILITY PART 373
DRAFT RENEWAL
PERMIT FOR PUBLIC
NOTICE
JULY 24, 2026**

EXECUTIVE SUMMARY/FACT SHEET



Department of Environmental Conservation

RCRA PART 373 PERMIT EXECUTIVE SUMMARY/FACILITY FACT SHEET

**BASF Queensbury Closed Landfill
EPA ID No. NYD000818419
DEC Permit No. 5-5234-00149/00002**

**Queensbury, New York
Warren County**

1.0 FACILITY PERMIT AND GENERAL INFORMATION

Permittee Name (Property Owner):	Town of Queensbury
Permittee Name (PCC Operator):	BASF Corporation
Facility Name:	BASF Queensbury Closed Landfill
Facility Location:	236 Jenkinsville Road Queensbury, New York 12804
EPA ID No.:	NYD000818419
DEC Permit No.:	5-5234-00149/00002
DEC DER No.:	557004
Facility Size:	4.64 Acres
Facility Latitude/Longitude:	43.39, -73.622789
Commercial/Non-Commercial TSDF:	Non-Commercial (Post-Closure Care)
Facility Contact (Property Owner):	Town of Queensbury johns@queensbury.net 518-761-8229
Facility Contact (PCC Operator):	Stephen Havlik steve.havlik@basf.com 914-557-6009
DEC Contact/Responsible Permit Writer:	Kevin Chazhikattu kevin.chazhikattu@dec.ny.gov 518-402-8652
Initial/Renewal Permit:	Renewal
Permit Type (Yes/No):	
Operating	No
Corrective Action	Yes
Post-Closure Care	Yes

Permit Term (5 or 10 years):	10 Years
Estimated Costs:	
Closure	\$0.00
Corrective Action	\$0.00
Post-Closure Care	\$1,543,701
Total	\$1,543,701
On-site Environmental Monitor(s):	Not Applicable

Facility Background

The BASF Queensbury Closed Landfill Facility (Facility or Site) is located in Warren County at 236 Jenkinville Road in Queensbury, New York. The facility is approximately 4.64 acres in size. The Facility is bounded to the north and west by the Town of Queensbury Solid Waste Landfill, to the east by Jenkinville Road and the McLaughlin C&D Landfill, and to the south by the Town of Queensbury Jenkinville Pit mine. The facility is inactive with only monitoring and maintenance activities on-going.

The Facility comprises of the closed hazardous waste landfill along with the associated monitoring wells and a less than 90-day container storage area for leachate collection and disposal off-site. The site was leased by Ciba-Geigy (acquired by BASF Corporation) from the Town of Queensbury for waste disposal. The landfill was constructed in 1976 in a former sand and gravel pit by Ciba-Geigy (along with the Glens Falls treatment plant) in 1979. The closed hazardous waste landfill contains sludge from the former Ciba-Geigy owned wastewater treatment plant associated with the Former Hercules/Ciba-Geigy facility in Glens Falls. The treatment plant generated approximately 100 to 125 cubic yards of dewatered sludge per week. The sludge material consisted primarily of metal hydroxides and were classified as hazardous waste. An adjacent surface impoundment was used to collect leachate from the landfill and runoff from a truck washing station. Closure activities began in the summer of 1989 and were completed in the summer of 1990. Closure certification was received on November 8, 1990, and was approved on March 26, 1991. Leachate flow rates have continued to decrease over time. Leachate from the landfill is now collected in a leachate sump and pumped to a new leachate collection system consisting of 55-gallon drums located on a drum spill containment platform (<90 day storage area) based on the permitted sump level. Brown and Caldwell staff regularly monitor the sump level and arrange for off-site disposal, which typically occurs immediately after removal from the sump. Post-closure inspections continue quarterly, and groundwater samples are collected annually.

2.0 RCRA PERMITTED UNITS

There are no active hazardous waste management units (HWMU) permitted to operate at the facility. All previously permitted HWMUs have been closed in accordance with state and federal regulations. The site is currently regulated under Post Closure Care and

Corrective Action under Title 6 of the New York Codes, Rules & Regulations (6 NYCRR) Part 373 as well as in the New York State (NYS) Inactive Hazardous Waste Disposal Site Remedial Program, Site No. 557011, both of which are administered by the New York State Department of Environmental Conservation (NYSDEC).

3.0 POST-CLOSURE CARE SUMMARY

The following table summarizes the ongoing post-closure activities occurring at the facility:

Unit Designation	Post-Closure Activities Completed	Remaining Activities
SWMU-1: Closed Hazardous Waste Landfill	The hazardous waste landfill is a regulated unit and was closed in 1990 in accordance with the Department-approved closure plan.	Groundwater monitoring continues under the 2026 Groundwater Monitoring Plan. All maintenance, inspection, and post closure requirements will continue under the Post-Closure Plan.
SWMU-2: Hazardous Leachate Surface Impoundment	The surface impoundment was closed in 1990 in accordance with the Department-approved closure plan and all waste and waste residues were removed and closure certification was approved by the Department.	No Further Action

4.0 CORRECTIVE ACTION SUMMARY

The following table summarizes the ongoing corrective action activities occurring at the facility:

SWMU/AOC Designation	Corrective Action Activities Completed	Remaining Activities
SWMU-1: Closed Hazardous Waste Landfill	Managed under Post-Closure Care (See Section 3.0 above)	Managed under Post-Closure Care (See Section 3.0 above)
SWMU-2: Hazardous Leachate Surface Impoundment	Managed under Post-Closure (See Section 3.0 above)	Managed under Post-Closure (See Section 3.0 above)
SWMU-3: Release from Hazardous Leachate Storage Tank	A release occurred from the Hazardous Leachate Storage Container during the first quarter of 2008. An estimated less than 300 gallons of leachate was released to the surrounding soil. The tank and support structures were repaired. Sampling of the surrounding soils revealed no measurable impact from the release.	No Further Action

5.0 SITE MANAGEMENT

The facility has an NYSDEC-approved:

Yes No

- ☒ ☐ Post-Closure Plan (Approved 09/26/18, Revised Plan included under this Permit Renewal)
- ☒ ☐ Groundwater Monitoring Program (Approved 09/26/18, Revised Plan included under this Permit Renewal)
- ☐ ☒ Site Management Plan (To be submitted under this Permit Renewal)

5.1 Institutional Controls

An environmental easement is required in this Permit under the deliverables in Module XIII. Once the easement is approved, it will specify soil and groundwater usage at the site and be attached to the Permit.

5.2 Engineering Controls

Numerous engineering controls are in place at the facility to prevent future exposure to contamination and/or restrict the further migration of contamination. These engineering controls are as follows:

- **Hazardous Waste Landfill Cap:** The landfill cap consists of 12 inches of topsoil and a 36 inch soil buffer layer above 2 layers of geotextile fabric overlaying a 36 millimeter Hypalon liner, with 24 inches of clay, 12 inches of sand, and a polypropylene geotextile (Mirafi 600x) overlaying the sludge deposition. This cap system covers the approximate 3 acres of landfill area.
- **Leachate Collection Sump:** Leachate from the hazardous waste landfill is collected in the concrete leachate sump. The leachate sump pump is manually operated to discharge into 55-gallon drums via flexible hose and stored on-site over secondary containment.
- **Site Fencing:** Access to the Facility is controlled by a seven (7) foot-high chain link fence surrounding the property. The gate is kept locked except when staff is on site for inspections or maintenance. Additionally, signage with the language “Danger – Unauthorized Personnel Keep Out” is posted and maintained at each entrance and around the perimeter of the site to be seen from any approach to the Facility.

6.0 ISSUES AND CONCERNS

The following sections describe any potential issues or concerns for the facility related to its hazardous waste permit. Additionally, it includes information on any major changes made between the last issued permit and this renewal permit.

6.1 Environmental Risk Assessment

The Facility was evaluated as part of a RCRA Corrective Action Environmental Indicators determination, 2009 CA725 Current Human Exposures Under Control and 2009 CA750 Migration of Contaminated Groundwater Under Control. Based on these reviews, it was determined that contamination at the Facility did not pose imminent danger to human health or the environment, but that corrective action was required to control risks to health and environment. Corrective action programs have been implemented to clean up, restrict migration of, and prevent exposure to contamination.

6.2 Climate Leadership and Community Protection Act (CLCPA)

- A. Pursuant to the requirements of Section 7(2) of the CLCPA, during its review of the permit renewal application the DEC has taken into consideration information regarding the facility's consistency with attainment of the statewide greenhouse gas (GHG) emission limits established in Article 75 of the environmental conservation law.
- B. Pursuant to the requirements of Section 7(3) of the CLCPA, review of the permit renewal application to the DEC found no proposed increase in GHGs or co-pollutants within a Disadvantaged Community (DAC).

6.3 Community Risk and Resiliency Act (CRRRA)

The Facility has demonstrated to the DEC that future physical climate risk, not limited to sea-level rise, storm surge and flood, was considered during the permit renewal process. The DEC has made a tentative assessment that the Facility is not at risk of adverse climate change impacts due to extreme weather events, and no additional actions are necessary at this time to improve the resiliency at the facility.

6.4 Environmental Justice (EJ)

- A. Commissioner's Policy 29 (CP-29) Environmental Justice and Permitting

The Facility is located in a mapped Potential Environmental Justice Area (PEJA), but the policy categorically excludes it from applying to renewals

- B. Environmental Justice Siting Law

This facility is located within a DAC. The EJ Siting Law requires that agencies undertaking State Environmental Quality Review (SEQR) consider whether an action may cause or increase a disproportionate pollution burden on a DAC, and for DEC to determine if permit actions will cause "de minimis" or a "significant increase" in existing disproportionate pollution burden on DACs. This action is a renewal and not subject to the SEQR, and DEC has determined that the action will not cause or increase the pollution burden on the DAC.

6.5 Unresolved Issues and Concerns

There are no unresolved issues or concerns with the Facility.

6.6 Compliance Schedule Items

The Permittee has not proposed to incorporate any items into the Permit renewal.

6.7 Public Participation

The draft Part 373\RCRA Renewal Permit will have a 45-day public notice comment period. Renewal Application documents and the draft Part 373\RCRA Renewal Permit as well as other pertinent documents are accessible at DEC Info Locator ([Index of /data/DecDocs/557004 \(ny.gov\)](#)), and at the Crandall Public Library, 251 Glen Street, Glens Falls, NY 12801. If no comments are received, the draft permit shall be issued as final. If comments are received, they shall be addressed in either a Response to Comments document or a direct response letter to the commentor(s).

6.8 Significant Permit Modifications

The Permittee closed all permitted operating hazardous waste management units (HWMU). As such, the Facility is subject to Post Closure and Corrective Action permitting and the Department has made minor modifications to the Permit to remove HWMU content, update formatting, implement any new regulatory requirements and address technical concerns raised during the renewal process. The Groundwater Monitoring Plan will be updated based on current site conditions and cleanup objectives.

6.9 Upcoming Remedial Activities

Various RCRA remedial activities associated with soil and groundwater will be performed and covered under this Permit. There are no anticipated closures of any operating HWMUs during the life of this Permit. Remaining SWMUs and AOCs will be retained until cleanup goals are achieved.

Figure 1 – Facility Location

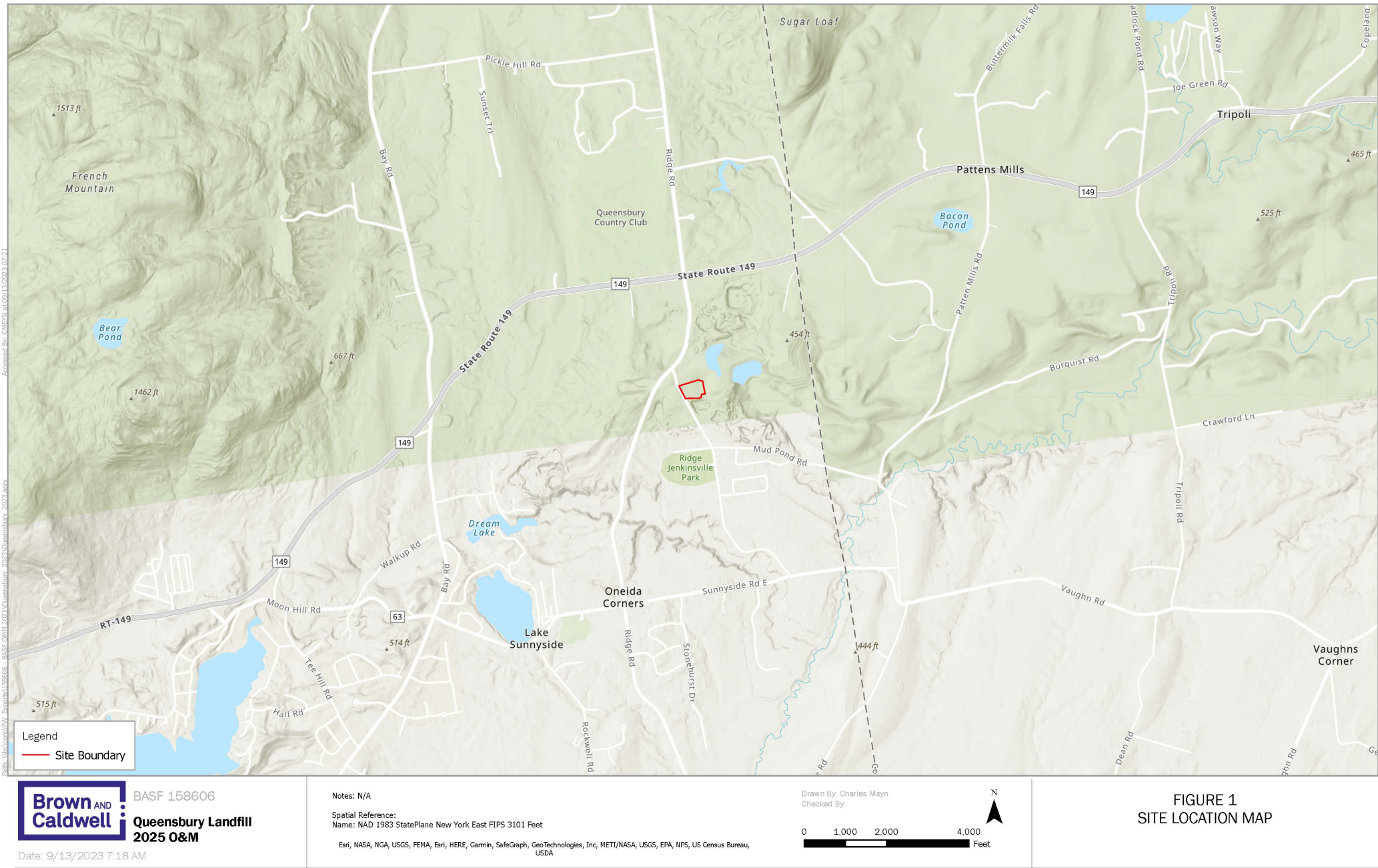


Figure 2 – Site Boundary Map



**FIGURE 3
SITE PLAN**

Figure 3 – Facility SWMUs and AOCs



MODULE I

General Conditions

MODULE I GENERAL CONDITIONS

The Permittee shall operate, monitor, and maintain the facility described herein, in compliance with the provisions of the New York State Environmental Conservation Law (ECL) Article 27, Title 9, Section 27-0900 et seq., the Federal Resource Conservation and Recovery Act (RCRA), including the Hazardous and Solid Waste Amendments of 1984 (HSWA) and the approved Permit application as further modified through Permit conditions set herein.

This Permit does not authorize the operation of any hazardous waste management unit requiring a 6 NYCRR Part 373 permit. This Permit is for Corrective Action and Post-Closure Care. The general conditions included herein related to Operating Permits are reserved in case facility hazardous waste operations change.

A. EFFECT OF PART 373 PERMIT

1. This Permit consists of the general and special conditions contained in this and the attached Modules, including the Attachments and documents incorporated by reference; and the applicable requirements of the New York State Environmental Conservation Law (ECL) Article 27, Title 9, Section 27-0900 et seq., and the following regulations:

6 NYCRR 370 - Hazardous Waste Management System-General

6 NYCRR 371 - Identification and Listing of Hazardous Wastes

6 NYCRR 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities

6 NYCRR 373 - Hazardous Waste Management Facilities

6 NYCRR 374 - Management of Specific Hazardous Waste

6 NYCRR 376 - Land Disposal Restrictions

6 NYCRR 621 - Uniform Procedures

6 NYCRR 624 - Permit Hearing Procedures

The applicable regulations or requirements would be those which are in effect prior to final issuance of this Permit.

2. **All documents and reports required by this Permit must be certified pursuant to conditions established in 6 NYCRR 373-1.4(a)(5)(iv) and Condition O.4 of this Module and submitted in accordance with requirements set forward in Conditions O and W of this Module. Additionally, unless specifically exempted in this Permit, all information (e.g., documents and reports) required to be submitted by the Permittee must be approved by DEC. DEC does not require certain plans, documents or reports to be certified. The Permittee should verify if certification is required prior to submittal to the DEC.**

3. The following Guidance and Policy Documents are potentially relevant to this Permit. The Permittee shall consider applicable Department guidance when conducting activities required by this Permit.

DAR-1 Guidelines for the Control of Toxic Ambient Air Contaminants

DEP 24-1 Permitting and Disadvantaged Communities

DER-10 Technical Guidance for Site Investigation and Remediation

DER-13 Strategy For Evaluating Soil Vapor Intrusion at Remedial Sites in New York

DER-23 Citizen Participation Handbook for Remedial Programs

DER-31 Green Remediation

DER-33 Institutional Controls: A Guide to Drafting and Recording Institutional Controls

PFAS Guidance: Sampling, Analysis, and Assessment of PFAS (revised April 2023)

TOGS 1.1.1 Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations

4. The following Commissioner Policies are potentially relevant to this Permit. The Permittee shall consider applicable Department policies when conducting activities required by this Permit.

CP-29 Environmental Justice and Permitting

CP-39 Use of Enforcement Discretion for Discarded Mercury-containing Equipment

CP-43 Groundwater Monitoring Well Decommissioning

CP-44 Natural Resource Damages

CP-45 Procedure to Demonstrate Compliance with Financial Test Requirements (for financial assurance)

CP-51 Soil Cleanup Guidance

5. Compliance with this Permit during its term constitutes compliance, for purposes of enforcement, with 6 NYCRR Parts 370 through 374 and 376 except for the following requirements not included in the Permit:

- a. Requirements which become effective by statute, including amendments thereto;

- b. Requirements which are promulgated under 6 NYCRR 376 restricting the placement of hazardous wastes in or on the land;
 - c. Requirements which are promulgated under 6 NYCRR 373-2 regarding leak detection systems for new and replacement surface impoundment, waste pile, and landfill units, and lateral expansions of surface impoundment, waste pile, and landfill units. The leak detections system requirements include double liners, Construction Quality Assurance (CQA) programs, monitoring, action leakage rates, and response action plans, and will be implemented through the procedures of 6 NYCRR 373-1.7 for major modifications; or
 - d. Requirements which are promulgated under 6 NYCRR 373-3.27, 373-3.28, and 373-3.29, limiting air emissions.
- 6. The Permittee is authorized to manage hazardous waste in accordance with the conditions of this Permit. Any storage, treatment or disposal of hazardous waste not authorized by this Permit is prohibited unless exempt under 6 NYCRR 373-1.1(d). Issuance of this Permit does not authorize any injury to persons or property, any invasion of other private rights, or any infringement of federal, state or local laws or regulations.
- 7. The Permittee is authorized to manage only hazardous wastes which are generated at the Permittee's facility.
- 8. The Permittee is required to conduct corrective action in accordance with the conditions of this Permit.
- 9. The Permittee must submit plans, reports, specifications, implementation schedules and any subsequent amendments to those documents required by this Permit to the Department for review and comment. Following its review of a document, if the document requires formal Department approval (as determined by the Department), the Department may either approve the document as submitted or issue comments on the submittal. If the Department issues comments on the document, subsequent activities for the document must proceed in accordance with the following schedule:
 - a. Meeting between the Permittee and the Department to discuss the document comments, if requested by the Permittee or deemed necessary by the Department; and,
 - b. Submission of a revised document to the Department for approval within thirty (30) calendar days of the above-described meeting. (If the above referenced meeting is determined not to be necessary, the Permittee must submit a revised document for Department approval, according to a schedule specified by the Department, not to exceed forty-five (45) calendar days of the Permittee's receipt of comments from the Department).

- c. If the submission is not revised to the Department's satisfaction, the Department may revise the document and send the Permittee a notice of intent to modify the Permit to incorporate the revised document into the Permit, pursuant to 6 NYCRR 621.13.
10. All plans, reports, specifications and schedules required by the terms of this Permit, and all subsequent amendments to those documents, are incorporated by reference into this Permit when written approval is issued by the DEC pursuant to 6 NYCRR 621.11, or 6 NYCRR 621.13. Upon incorporation, the provisions of each such document will be binding upon the Permittee and have the same legal force and effect as the requirements of this Permit.
11. The Permittee must place the submittal within the Facility's document repository within fifteen (15) calendar days of receipt of the Department's approval.
12. Informal advice, guidance, suggestion, or comment by the DEC must not be construed as relieving the Permittee of the Permittee's obligation to obtain such formal approvals as may be required by this Permit. The Permittee consents to and agrees not to contest the authority and jurisdiction of the DEC to enter into or enforce this Permit.
13. The Permittee must also comply with the following:
- 6 NYCRR 373-1.1(f) – Uniform Procedures
 - 6 NYCRR 373-1.1(g) – Enforcement
 - 6 NYCRR 373-1.1(h) – Severability
14. The Permittee must maintain a current and complete paper copy or electronic copy on an electronic storage device (or equivalent method) of this Permit, including all Modules, Attachments and documents incorporated by reference, in at least one (1) location at the Facility for review by the DEC upon request.
15. For any Environmental Monitor(s) assigned to the Facility, the Permittee must maintain a complete set of all submittals required by this Permit, in the format requested by the Environmental Monitor, in the office of the Environmental Monitor or as otherwise directed by the Environmental Monitor(s) as per **Condition T.2** of this Module.
16. In the event of a discrepancy between this Permit and any regulation, order on consent, other permit, or plans, reports, specifications, and schedules submitted pursuant to this Permit, the more stringent requirement applies, as determined by the Department.

B. PERMIT DOCUMENTS

attached, in whole or in part, to this Permit. Other documents pertinent to this Facility and that are listed below are incorporated by reference into this Permit. These documents are made part of this Permit, are binding upon the Permittee and have the same legal force and effect as the requirements of this Permit. The following documents are considered part of this Permit:

Modules

- I General Conditions
- II Corrective Action Requirements
- III RESERVED
- IV RESERVED
- V Land Disposal Unit(s) Post Closure Requirements
- VI RESERVED
- VII RESERVED
- VIII RESERVED
- IX RESERVED
- X RESERVED
- XI Groundwater Monitoring
- XII RESERVED
- XIII Scheduled Dates

Attachments

- A. Permit Modification Log
- B. Permit Renewal Application with overall Renewal Application Certification required per 6 NYCRR 373-1.4(a)(5)(iv), exclusive of its attachments
- C. SWMU/AOC Current Conditions Report
- D. Groundwater Monitoring Program
- E. Post Closure Plan
- F. Environmental Easement
- G. Site Management Plan
- H. Post Closure Cost Estimate
- I. On-going Corrective Actions Documents
- J. Other Laws

Footnotes:

1. Each document referenced above includes the dated original submission and any subsequent Department approved document revisions.
2. If a document is necessary under the Permit and was not provided with the Permit Renewal Application, it will be required in accordance with Module XIII.

Proposed modifications to this Permit, including modifications to the Permit Application documents incorporated into this Permit, shall be addressed according to 6 NYCRR 373-1.7. The Permittee shall place a revision date on all pages of the proposed Permit modification application.

The Permittee must provide and maintain a log of all modifications made to this Permit, including modifications made to the Permit Application documents that are made part of this Permit. The log shall contain at a minimum the following information regarding an approved modification: (1) the name of the specific document being modified (e.g., contingency plan, security requirements, hazardous waste unit operations, etc.); (2) the effective date of the modification to the Permit; (3) the pertinent pages, sections, and/or attachments of the Permit and Permit Application documents subject to the modifications; (4) the revision date of the modifications; and (5) a brief statement regarding the nature of the modifications. The Permittee shall place the log at the beginning of this Permit along with a copy of the Department's approval letters, when applicable. The Permittee must replace the pages, sections, and/or attachments in the Permit and Permit Application with the modified pages, sections, and/or attachments.

C. DEFINITIONS

1. For the purposes of this Permit, the terms used herein shall have the same meanings as those provided in 6 NYCRR 370 through 374 and 376, and the terms defined in this Permit, unless this Permit specifically states otherwise. Where the terms are not otherwise defined, the meanings associated with such terms shall be as defined by a standard dictionary reference or the generally accepted scientific or industry meaning of the term.
2. The following additional terms used in this Permit are defined as such:
 - a. Action Levels. For the purposes of this Permit, "action levels" are hazardous constituent concentrations for a specific environmental medium which if exceeded indicate a potential threat to human health or the environment. The exceedance of action levels may trigger further investigations, studies and corrective measures. Where available, action levels are based on appropriate promulgated standards established for a specific environmental medium. When promulgated standards are not available, action levels can be media-specific hazardous constituent concentrations derived from non-promulgated human health risk data or environmental risk data with the latter levels being protective of aquatic life or wildlife. An action level may be set at the background level for a hazardous constituent for which data are inadequate to set a human health or environmental health-based level. The action levels for groundwater are the more stringent of the following for

each compound or constituent: 6 NYCRR 703.5, New York State Department of Health's Drinking Water Standards and the United States Environmental Protection Agency's Maximum Contaminant Levels (MCLs).

- b. Areas of Concern (AOC). Pursuant to the authority granted by 6 NYCRR 373-1.6(c)(2), an "area of concern" has been defined for purposes of this Permit to mean an area at the facility, or an off-site area, which is not at this time known to be a solid waste management unit (SWMU), where hazardous waste and/or hazardous constituents are present, or are suspected to be present, as a result of a release from the facility. The term shall include areas of potential or suspected contamination as well as actual contamination. Such area(s) may require study and a determination of what, if any, corrective action may be necessary. All Permit references to and conditions for SWMUs shall apply to areas of concern.
- c. Contamination. The presence of any hazardous constituent in a concentration which exceeds the naturally occurring concentration of that constituent in areas which should not be affected by the operations of the facility.
- d. Corrective Action. For the purposes of this Permit, "corrective action" is a process that includes all activities related to the investigation, characterization and cleanup of a release of hazardous wastes or hazardous constituents from a solid waste management unit (SWMU) at a permitted or interim status treatment, storage and disposal facility (TSDF) to any environmental medium. The "corrective action" process includes all activities necessary to protect human health and the environment for all releases of hazardous waste or hazardous constituents at the facility, regardless of the time at which waste was placed in the unit. Corrective action may address releases to air, soil, surface water sediment, groundwater, or subsurface gas. Module II of this Permit contains a more detailed discussion of the corrective action process.
- e. DEC or Department. New York State Department of Environmental Conservation
- f. DER. Division of Environmental Remediation.
- g. Environment or environmental media. "Environment" or "environmental media" means any water; water vapor; land, including land surface or subsurface; air; and, fish, wildlife, biota and all other natural resources.
- h. Extent of Contamination. The horizontal and vertical area in which the concentrations of hazardous constituents in the environmental media being investigated are above the naturally occurring concentration of that constituent in areas which should not be affected by the operations of the facility.
- i. Hazardous Constituents. For the purposes of this Permit, "hazardous

constituents” are those constituents listed in Appendix 23 of 6 NYCRR 371 or any constituent listed in Appendix 33 of 6 NYCRR 373-2 as well as any emerging contaminants listed in 6 NYCRR Part 597.

- j. Permittee. For the purposes of this Permit, “Permittee” herein refers to the party(ies) subject to this Permit. In addition, refer to Conditions S.2 and S.3 of this Module.
- k. Priority Pollutant. Pursuant to 6 NYCRR 750-1.2(a)(67), “priority pollutant” means those pollutants listed in 40 CFR 122, Appendix D (see 6 NYCRR 750-1.24) as Organic Toxic Pollutants (volatiles, acid compounds, base/neutral compounds and pesticides), Metals, Cyanide and Total Phenols.
- l. Release. For purposes of this Permit, “release” includes, but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping or disposing into the environment of any hazardous waste, including hazardous constituents, unless expressly authorized under the terms of this Permit or otherwise permitted under law (e.g., SPDES permitted discharges).
- m. Solid Waste Management Unit (SWMU). For purposes of this Permit, a “solid waste management unit” includes any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of hazardous or solid wastes. Such units include any area at the facility at which solid wastes have been routinely and systematically released. These units include certain areas associated with production processes that have become contaminated as a result of routine and systematic releases.
- n. Unit. Includes, but is not limited to, any landfill, surface impoundment, waste pile, land treatment unit, incinerator, injection well, tank, container storage area, wastewater treatment unit, elementary neutralization unit, or recycling unit.

D. GENERAL PERMIT CONDITIONS [6 NYCRR 373-1.6]

- 1. 6 NYCRR 373-1.6 provide conditions applicable to all Part 373 Permits which are therefore incorporated into this Permit. The provisions are incorporated into and made enforceable under this Permit.
- 2. Oral Reports: The Permittee must orally report any noncompliance that may endanger health or the environment within 24 hours from the time the Permittee becomes aware of the circumstances. This noncompliance includes, but is not limited to:
 - a. Information concerning release of any hazardous waste(s), hazardous constituents(s) or emerging contaminant(s) that may cause an endangerment to public drinking water supplies; and

- b. Any information of a release or discharge of hazardous waste(s), hazardous constituents(s) or emerging contaminant(s) or of a fire or explosion from the hazardous waste management (HWM) facility, which could threaten the environment or human health outside the facility.

The oral reports must be made to the DEC using the New York State 24-hour oil and hazardous material spill notification number (800) 457-7362 and the National Response Center using its 24-hour number (800) 424-8802, or any designated telephone numbers which may subsequently replace those listed above. The Permittee must also provide such oral reports to DEC staff that are on-site at the time of, or subsequent to, a reportable incident. The information reported must include that listed at 6 NYCRR 373-1.6(a)(12)(vi)(b') and 6 NYCRR 373-2.4(g)(4)(ii).

For a fire, explosion or release to the environment, the Permittee must also comply with the reporting requirements in **Condition L.3** of this Module.

3. Entry Upon Facility:

- a. The Permittee must allow, pursuant to 6 NYCRR 373-1.6(a)(9), entry upon the Facility (or areas in the vicinity of the Facility which may be under the control of the Permittee) at reasonable times by any duly designated officer or employee of the United States Environmental Protection Agency (USEPA), the DEC or any State agency having jurisdiction with respect to matters addressed pursuant to this Permit, and by any agent, consultant, contractor or other person so authorized by the DEC, upon presenting identification, for inspecting, sampling, copying records that must be maintained by this Permit, testing, and any other activities necessary to evaluate the Permittee's compliance with this Permit.
- b. Upon request, the Permittee must: (i) provide the DEC with suitable workspace at the Facility, including access to a telephone, to the extent available; and, (ii) allow the DEC full access to all records relating to matters addressed by this Permit. Raw data must be provided to the DEC upon request.
- c. In the event the Permittee is not the owner of the Facility property and is unable to obtain any authorization from third-party property owners necessary to provide access, the Permittee must immediately notify the Department and provide any requested assistance in obtaining such authorizations.
- d. The DEC shall have the right to take its own photographs, samples and scientific measurements and to obtain split samples, duplicate samples or both, as necessary to evaluate the Permittee's compliance with this Permit. The DEC shall make the results available to the Permittee in accordance with DEC policy.

4. Reservation of Rights

- a. Nothing contained in this Permit shall be construed as barring, diminishing, adjudicating, or in any way affecting any of the DEC's rights or authorities, including, but not limited to, the right to require performance of further investigations and/or response action(s), the right to, at any time, issue a notice of intent to modify, suspend or revoke this Permit in accordance with 6 NYCRR 621.13 and/or to exercise any summary abatement powers with respect to any person, including the Permittee.
- b. Except as otherwise provided in this Permit, the Permittee specifically reserves all rights and defenses under applicable law, and further reserves all rights respecting the enforcement of this Permit, including the rights to notice, to be heard, to appeal, and to any other due process. The existence of this Permit or the Permittee's compliance with it shall not be construed as an admission of liability, fault, wrongdoing, or breach of standard of care by the Permittee, and shall not give rise to any presumption of law or finding of fact, or create any rights, or grant any cause of action, which shall inure to the benefit of any third party.

E. PERMIT MODIFICATION AND PERMIT TRANSFER [6 NYCRR 373-1.7 and 621]

1. Proposed modifications to this Permit, including modifications to the Attachments and documents incorporated by reference into this Permit, must be addressed in accordance with 6 NYCRR 373-1.7 and 621.
2. The Permittee must contact the DEC with respect to any and all proposed permit modifications requested by the Permittee. The DEC shall make the determination as to whether a proposed permit modification is a minor or major modification in accordance with 6 NYCRR 373-1.7 and 40 CFR 270.42. For the purposes of this Permit, as described in **Condition E.2.a** of this Module, the DEC will entertain proposed administrative modifications to this Permit that would not otherwise be required to follow the requirements of **Conditions E.2.b and/or E.2.c** of this Module. Administrative changes generally include in-kind replacements or minor updates to plans attached to this Permit or incorporated by reference. **However, the DEC must determine whether any and all changes are administrative modifications to this Permit.**
 - a. For modifications determined by the DEC to be administrative, the Permittee shall make the change in the Permittee's copy of all affected Attachment(s) and/or document(s) incorporated by reference. Submittal to the DEC of a change that the DEC has determined is administrative in nature is not necessary. However, at the time of Permit renewal, the Permittee must incorporate all administrative changes into this Permit. The Permittee must record all administrative changes in the Permit Modification Log provided as **Attachment A** of this Permit in accordance with **Condition E.3** of this Module. **Note:** The DEC reserves the right to have its project manager, environmental monitor and/or permit writer request proposed administrative changes in writing by the Permittee's submission

of a cover letter, written description of the proposed administrative modification and a clean copy of the modified affected pages for the DEC's review and approval.

- b. For modifications determined by the DEC to be minor pursuant to 6 NYCRR 373-1.7(c) and 40 CFR 270.42(a), the Permittee must receive written approval from the DEC before implementing the modification into this Permit, and subsequently follow the requirements of 6 NYCRR 373-1.7, 6 NYCRR Part 621 and DEC guidance for minor modifications.
 - c. For modifications determined by the DEC to be major, the Permittee must treat the modification as a new application in accordance with 6 NYCRR 621.11 and follow the applicable requirements of 6 NYCRR 621.
3. The Permittee must maintain a log of all modifications requested and made to this Permit, including modifications made to the Attachments and documents incorporated by reference into this Permit. The log must conform to the DEC-approved format presented in **Attachment A** of this Permit and must be submitted with each modification request. The log must be filled out in its entirety, except for the issuance date. Upon issuance of each Permit modification, the Permittee must place the updated log in **Attachment A** of this Permit along with a copy of the DEC's approval letters, when applicable, and replace all affected pages in the Modules, Attachments and/or documents incorporated by reference with the modified pages.
4. The DEC may at any time, at its discretion, modify this Permit under the terms of 6 NYCRR 621.13 in accordance with the requirements contained therein.
5. Permit Transfer: The Permittee must process all changes in Facility ownership and/or operational control in accordance with the requirements of 6 NYCRR 373-1.7(a), including the timeframes specified therein. Prior to undertaking a change in Facility ownership and/or operational control, the Permittee must provide written notification to the DEC and receive written approval from the DEC to allow transfer of this Permit. The Permittee must demonstrate to the DEC's satisfaction that the prospective transferee will be able to comply with all applicable laws and regulations, Permit conditions, financial assurance and other requirements to which the Permittee is subject. The written notification must include the identity of the transferee and of the nature and proposed date of the conveyance, and must notify the transferee in writing, with a copy to the DEC, of the applicability of this Permit including the corrective action program, as appropriate. The DEC will determine whether transfer of this Permit is acceptable and will require either a minor or major modification.

F. EXPIRATION AND CONTINUATION OF PERMITS [6 NYCRR 373-1.8]

1. Requests for continuation of this Permit must be submitted in accordance with 6 NYCRR 373-1.8 and 621.11.

2. No sooner than one (1) year and no later than one hundred eighty (180) calendar days before the expiration of this Permit, the Permittee must provide the DEC with a report regarding the matters identified in ECL 27-0913(3) occurring within two (2) years of the date of the report. The report must include any such matters involving the permitted Facility, all other facilities owned or operated by the Permittee and any duly incorporated parent or subsidiary managing hazardous wastes within the United States. The Permittee must supply such documents and pertinent details regarding the matters in the report as may be requested by the DEC.
3. The Permittee must schedule a "Pre-Application" meeting with the DEC at least two hundred seventy (270) calendar days prior to the expiration date of this Permit. Renewal applications with a significant change (as defined at 6 NYCRR 373-1.10(a)(1)) are subject to the requirements of 6 NYCRR 373-1.10.
4. Complete applications for permit renewal must be submitted at least one hundred eighty (180) calendar days before the expiration date of this Permit pursuant to 6 NYCRR 373-1.8(b).
5. At any time during the review of the renewal application, the DEC may request that the Permittee submit any additional information in writing which is necessary for determining the completeness of the application. Failure to provide such information by the date specified in the request may be grounds for denial of the application and the extension allowed pursuant to Section 401(2) of the State Administrative Procedures Act.

G. TERMINATION OF PERMIT ACTIVITIES

1. Should the Permittee cease the hazardous waste management activities allowed by this Permit prior to the expiration of this Permit, then, pursuant to 6 NYCRR 373-1.6(d), the Permittee must continue to comply with the applicable closure, post-closure and corrective action conditions and requirements stipulated in this Permit.
2. If the Permittee certifies closure of all hazardous waste management units at the Facility, and the DEC accepts these closure certifications during the term of this Permit, and post-closure care or corrective action is determined to be necessary by the DEC, the Permittee may request to enter into another enforceable commitment document which is appropriate, pursuant to Environmental Conservation Law (ECL) Section 71-2727(3) in lieu of this Permit. The Permittee must enter into the appropriate enforceable commitment prior to the expiration of this Permit, or submit a renewal application as required by **Condition F. 4** of this Module.

H. FACILITY OPERATION

1. In accordance with 6 NYCRR 373-2.3(b), the facility must be designed, constructed, maintained and operated to minimize the possibility of fire, explosion, or any unplanned sudden or non-sudden release of hazardous

waste(s) or hazardous waste constituents to air, soil, surface water or groundwater that could threaten human health or the environment.

2. The Permittee must at all times construct, operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittee as designed in accordance with this Permit.
3. The Permittee must inspect the Facility to prevent malfunctions and deterioration, operator errors, and discharges that may cause or lead to the release of hazardous waste(s) or hazardous waste constituents to the environment, or a threat to human health pursuant to 6 NYCRR 373-2.2(g).

I. COMPLIANCE SCHEDULE

1. The Permittee must complete any activities referenced in **Condition A of Module XIII** of this Permit within the timeframes set forth therein and in accordance with 6 NYCRR 373-1.6(d).
2. The Permittee must submit reports in a DEC-approved format no later than 14 calendar days following each interim and the final compliance date that summarize the status of each of the activities listed in this Permit. These reports must be signed and certified pursuant to 373-1.6(a)(11) and 373-1.4(a)(5).

J. WASTE ANALYSIS [6 NYCRR 373-2.2(e)]

1. The Permittee must perform general waste analysis in accordance with the requirements of 6 NYCRR 373-2.2(e) and this Permit.
2. All laboratories utilized for the analysis of any closure, post-closure and/or corrective action samples must be certified under the New York State Department of Health's Environmental Laboratory Approval Program (ELAP). Any laboratory tests or sample analyses for which the commissioner of the New York State Department of Health (NYSDOH) issues certificates of approval must be performed by a laboratory certified to perform such tests or analyses pursuant to the NYSDOH Environmental Laboratory Approval Program.

K. PERSONNEL TRAINING PROGRAM [6 NYCRR 373-2.2(h)]

1. The Permittee must conduct personnel training in accordance with 6 NYCRR 373-2.2(h)(1), (2) and (3), and this Permit.
2. The Permittee must maintain training documents in accordance with 6 NYCRR 373-2.2(h)(4) and (5), and this Permit.

L. PREPAREDNESS AND PREVENTION, CONTINGENCY PLAN AND EMERGENCY PROCEDURES [6 NYCRR 373-2.3 and 2.4]

1. The Permittee must comply with the preparedness and prevention requirements in accordance with 6 NYCRR 373-2.3 and this Permit.

2. The Permittee must comply with contingency plan and emergency procedure requirements in accordance with 6 NYCRR 373-2.4 and this Permit.

3. Reporting of Fires, Explosions or Releases to the Environment

a. Oral Reports: For fires, explosions or releases which could threaten human health or the environment outside of the facility, the Facility's Emergency Coordinator must immediately notify the DEC (using the New York State 24-hour oil and hazardous material spill notification number (518) 457-7362) and the local governmental official designated as the on-scene coordinator for that governmental area. This notification must be made in accordance with, and include the information required by 6 NYCRR 373-2.4(g)(4)(ii).

b. Written Report: For any fire, explosion or release to the environment, except if the release is less than or equal to one (1) pound and immediately cleaned up, the Permittee must, within fifteen (15) calendar days of the incident, submit a written report to the DEC in accordance with, and include the information required by 6 NYCRR 373-2.4(g)(10).

M. WASTE REDUCTION REQUIREMENTS

1. The Permittee must comply with the requirements of Article 27, Title 9, Section 27-0908 of the ECL and 6 NYCRR 373-2.5(c)(2)(ix) relative to waste reduction requirements.

N. REQUIREMENTS FOR RECORDING AND REPORTING OF MONITORING RESULTS [6 NYCRR 373-1.6(b)]

1. The Permittee must comply with the recording, reporting and monitoring requirements listed in this Permit.

2. The Permittee must install, use and maintain monitoring equipment, utilize the approved methods, and report monitoring results as specified in this Permit, and 6 NYCRR 373-2.

O. DATA AND DOCUMENT STANDARDS

1. All analytical data required by this Permit, as well as all analytical data requested by the Department, must be submitted to the DEC in the standardized format in accordance with the DEC's Electronic Data Deliverable guidance (i.e., NYSDEC EQuIS™ database) within thirty (30) calendar days of receipt from the laboratory or at a schedule approved by the Department (see <http://www.dec.ny.gov/chemical/62440.html>). The Permittee may obtain Category A deliverables for routine sampling activities. At decision points where determinations of final actions are taken, the Permittee must obtain Category B deliverables and have all closure, post-closure and corrective action data validated by a third party prior to submission to the DEC. The individual performing the third-party validation must prepare a Data Usability Summary

Report (DUSR) consistent with the guidelines of the DEC's Technical Guidance for Site Investigation and Remediation, DER-10. The DUSR must be submitted with the report containing the data in accordance with **Condition O.2** of this Module. The data deliverable submitted to the DEC must include the results of the data validation.

2. The Permittee must deliver to the DEC preliminary or final reports, specifications or drawings prepared pursuant to this Permit in an electronic format that complies with the DEC's Electronic Document Standards (EDS) or as otherwise directed by the DEC. All final documents are to be submitted in an electronic format that complies with the most recent DER EDS. Until such time as the DEC establishes an EDS, final documents are to be submitted as a PDF document (see [Requirements For Submittal Of Electronic Documents - NYSDEC](#)). Also, the Permittee must, at the request of the DEC, provide electronic versions of technical documents in MS Word and/or MS Excel, and plan drawings and/or other site drawings in AutoCAD, or other format suitable to the DEC.
3. In addition to electronic copies, the Permittee must provide paper copies of any document (e.g., reports, plans, data, specifications, drawings, etc.) requested by the Department in paper format or as may be specified in paper format in this Module.
4. All Permit Applications and Reports required by this Permit and other information requested by the DEC must be signed in accordance with the provisions of 6 NYCRR 373-1.4(a)(5), and include the following statement required by 6 NYCRR 373-1.4(a)(5)(iv): "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

P. FINANCIAL ASSURANCE

1. The Permittee must comply with all of the applicable requirements of 6 NYCRR 373-2.8 and this Permit. The definitions contained in 6 NYCRR 373-2.8(b) are applicable to the financial requirements within this Permit.
2. The Permittee must comply with this Permit and 6 NYCRR 373-2.6(l) for meeting the financial assurance requirements for corrective action for releases from any solid waste management unit located at the Facility, regardless of the time the waste was placed in the unit.
3. The Permittee must adjust for inflation all cost estimates required by 6 NYCRR 373-2.6(l), 373-2.8 and this Permit annually by April 1st or another DEC

approved date, and provide additional financial assurance for this adjustment in accordance with 6 NYCRR 373-2.8 and **Condition P.6**. These adjustments must be independent of any requests to decrease cost estimates, unless the DEC has previously approved such a decrease (i.e., the inflationary adjustment must be made separately from any unapproved request for a decrease in the cost estimate). In addition, the total amount of any post-closure cost estimate must be established and maintained throughout the life of this Permit in at least the amount derived by multiplying the annual post-closure cost estimate by a minimum of thirty (30) years unless the DEC has approved a decrease in the post-closure care period for a unit or the Facility in accordance with 6 NYCRR 373-2.7(g)(1)(ii).

4. The Department-approved closure, post-closure and corrective action cost estimates are in **Attachments H** of this Permit. These cost estimates must be adjusted annually either by recalculating the cost estimate in current dollars, or by using an inflation factor in accordance with **Conditions P.3 and P.6** of this Module.
5. The Permittee must obtain approval in writing from the DEC prior to any reduction in the approved cost estimates and for any changes to the instrument(s) and/or mechanism(s) (e.g., type of instrument(s) and/or mechanism(s), the issuing company(ies)/institution(s) and/or a reduction in the dollar amount(s)).
6. Corrective Action Cost Estimates: For any and all corrective actions required under the authority of this Permit for any Solid Waste Management Units, both final and interim, the Permittee must submit for the DEC's approval, written estimates, in current dollars, which reflect all costs involved in implementing corrective action through DEC-approved completion. Such estimates must reflect the cost of hiring a third party to perform the corrective action in accordance with 6 NYCRR 373-2.8(e)(1)(i). For the final corrective measure(s), the Permittee must provide such estimates with the submission of the Corrective Measures Implementation (CMI) work plan. For Interim Corrective Measures (ICM) requiring work plans, the Permittee must provide such estimates with the submission of each ICM work plan required by this Permit.
7. Short-Term Corrective Measures: For financial assurance of final or interim corrective measures for any Solid Waste Management Units required by DEC-approved work plans where the implementation schedule in the approved work plan(s) indicates anticipated completion of said action(s) within one (1) year, the Permittee must provide the DEC with a letter certifying that the Permittee has sufficient liquid financial resources to perform and complete the approved corrective measure(s) based on the DEC-approved cost estimate(s) required by **Condition P.6** of this Module. This letter must include a certification in accordance with 6 NYCRR 373-1.4(a)(5) and must be provided for the DEC's acceptance with the Permittee's submission of a final or interim corrective measures work plan(s). If the DEC notifies the Permittee that the certification is not acceptable, the Permittee must establish financial assurance for corrective measures in accordance with the requirements of financial

assurance for Long-Term Corrective Measures as specified in **Condition P.8** of this Module within sixty (60) calendar days of said notification. If the corrective action(s) are not completed within one (1) year of the initial certification, the Permittee may request and the DEC, at its discretion, may approve up to a one (1) year extension of the certification. If the corrective action(s) has not been completed to the DEC's satisfaction at the end of the first year or a DEC-approved extension, the Permittee must, within sixty (60) calendar days, provide financial assurance in accordance with the requirements of financial assurance for Long-Term Corrective Measures as specified in **Condition P.8** of this Module.

8. Long-Term Corrective Measures: For final or interim corrective measures required for any Solid Waste Management Units by a DEC-approved work plan(s) where the implementation schedule in the approved work plan(s) indicates that the anticipated completion of the final or interim corrective action(s) will take longer than one (1) year, the Permittee must establish and maintain a DEC-approved financial assurance instrument(s) in accordance with 6 NYCRR 373-2.8(f). This financial assurance must be equal to the current dollar amount of the most recent DEC-approved final or interim corrective measures cost estimate(s) required by **Condition P.6** of this Module. The DEC-approved financial assurance must be one, or an allowable combination, of the financial assurance instruments, specified in 6 NYCRR 373-2.8(f)(1) through (4) and these instruments must be issued by an entity, or entities, that are legally and fiscally separate and distinct from the Permittee and any parent or subsidiary thereof. If the Permittee chooses to use either 6 NYCRR 373-2.8(f)(2) or (3) (or a combination thereof), the Permittee must revise or establish a Standby Trust Fund in accordance with said regulations. The Permittee must submit the instrument(s), for the DEC's approval, no later than sixty (60) calendar days after the DEC's approval of corrective measures work plan(s), or as required by the requirements of financial assurance for Short-Term Corrective Measures as specified in **Condition P.7** of this Module.
9. For any Permit modification request pertaining to the Closure Plan or Post-Closure Plan provided as **Attachment E.** of this Permit involving an increase in cost, the Permittee must also submit a revised cost estimate, in current dollars, which includes the cost increases with appropriate third-party justification. For any new or modified corrective measure required by this Permit and submitted by the Permittee subsequent to the issuance of this Permit which involves an increase in the cost of corrective action, the Permittee must also submit for DEC approval, a revised cost estimate, as discussed in the preceding sentence.
10. Within sixty (60) calendar days of a modification of this Permit or DEC approval of a new or modified corrective measure involving an increase in a cost estimate, the Permittee must establish additional financial assurance to cover the amount of the increase in the cost estimate in accordance with the requirements of 6 NYCRR 373-2.8.

11. The Permittee must maintain the DEC-approved financial assurance instruments for closure, post-closure, corrective action, and third-party liability coverage. Changes in existing financial assurance instruments or replacement of existing financial assurance instruments must be approved by the DEC. The Permittee must provide annual evidence to the DEC within thirty (30) calendar days prior to the anniversary on which the initial approved financial assurance instrument was established, that all required instruments have been maintained and not allowed to lapse.
12. Within sixty (60) calendar days after any increase in the approved cost estimate, the Permittee must, in accordance with 6 NYCRR 373-2.8, either:
 - a. Revise one or more of the DEC approved financial assurance instrument(s) to increase the instrument(s) amount by at least the amount of the increase in the approved cost estimate and submit the revised instrument(s) for DEC approval; or
 - b. Submit an additional financial assurance instrument, or instruments from the allowable instrument types specified in 6 NYCRR 373-2.8 with an amount equal to at least the amount of the increase in the approved cost estimate and submit the additional instrument(s) for DEC approval.
13. If the Permittee elects to replace any instrument with new financial assurance instrument(s) as specified by 6 NYCRR 373-2.8, the new instruments must be issued by an entity, or entities, that are legally and fiscally separate and distinct from the Permittee and any parent or subsidiary thereof. Also, if applicable, any replacement instruments pertaining to post-closure and corrective action must be worded in accordance with 6 NYCRR 373-2.8(j) except that the words "post-closure and corrective action" must be substituted for the words "post-closure" in any such replacement instrument.

Q. COMMUNICATIONS

1. The Permittee must transmit all communications pursuant to this Permit to the DEC via electronic delivery to the recipients specified in **Condition W.1** of this Module. All deliverables must be transmitted in a DEC-approved format as specified in **Condition O** of this Module.
2. If requested by the DEC in lieu of or in addition to an electronic deliverable, the Permittee must transmit the requested written communications pursuant to this Permit to the DEC by United States Postal Service, by private courier service or by hand delivery to the following address:

Supervisor, HW Corrective Action & Post Closure
Division of Materials Management
New York State Department of Environmental Conservation
625 Broadway
Albany, NY 12233-7256

3. The Permittee must submit additional copies of the specific deliverables identified in **Condition W** of this Module to the addresses and agencies listed therein.

R. PENALTIES

1. The Permittee's failure to comply with any term of this Permit constitutes a violation of this Permit and the ECL. Nothing herein abridges the Permittee's right to contest any allegation that it has failed to comply with this Permit.
2. Payment of any penalties must not in any way alter the Permittee's obligations under this Permit.

S. MISCELLANEOUS

1. The paragraph headings set forth in this Permit are included for convenience of reference only and must be disregarded in the construction and interpretation of any provisions of this Permit.
2. If there are multiple parties subject to this Permit, except where stated otherwise, the term "Permittee" must be read in the plural, the obligations of each such party under this Permit are joint and several, and the insolvency of or failure by any Permittee to implement any obligations under this Permit must not affect the obligations of the remaining Permittee(s) under this Permit.
3. If the Permittee is a partnership, the obligations of all general partners (including limited partners who act as general partners) under this Permit are joint and several and the insolvency or failure of any general partner to implement any obligations under this Permit must not affect the obligations of the remaining partner(s) under this Permit.
4. In any administrative or judicial action to enforce a condition of this Permit, the Permittee waives any objection to the admissibility as evidence of any data generated pursuant to this Permit.
5. Whenever materials or equipment are specified or described in this Permit using the name of a proprietary item or the name of a particular supplier, the naming of the item is intended to establish the type, function, quality, performance and design criteria required. In all cases, unless the name is followed by words indicating that "no 'or equal' or substitution is allowed" or similar language, materials or equipment of other suppliers may be accepted by the DEC if sufficient information is submitted by the Permittee to allow the DEC to determine that the material or equipment proposed is equivalent or

equal to that named. Requests for review of “or equal” or substitute items of material and equipment will not be accepted by the DEC from anyone other than the Permittee. If the Permittee wishes to furnish or use an “or equal” or substitute item of material or equipment, the Permittee must make written application to the DEC for acceptance thereof, certifying that the proposed “or equal” or substitute will perform the same functions and achieve the same results called for by the general design, be similar and of equal substance and quality to that specified, and be suited to the same use as that specified.

6. The Permittee may submit a written request to the DEC for a clarification on compliance with any condition in this Permit. Any such request must be submitted at least thirty (30) calendar days prior to the date on which the Permittee must comply with the condition identified in the clarification request. In response, the DEC will provide the Permittee with a written clarification, detailing what constitutes compliance with the identified Permit condition. This clarification process shall in no way relieve the Permittee from the obligation to comply with all the terms and conditions of this Permit.
7. All data, information, and records concerning, created for or maintained by the Permittee for the operation, investigation or remediation of the facility and any contamination that has emanated from the facility, shall be preserved and made available to the DEC upon request, except for attorney-client privilege or work product protection doctrine material(s). The Permittee shall use its best efforts to ensure that all employees of the Permittee and all persons, including contractors and subcontractors who engage in activities under this Permit, are made reasonably available to, and cooperate with the DEC if information, whether written or oral, is sought.
8. Special Conditions Concerning Future State and/or Federal Laws or Regulations
 - a. In the event that any State statutory or regulatory requirements are enacted, adopted, or promulgated which are applicable to the Permittee’s Facility and address the need for and/or the nature and extent of post-closure care and/or corrective action, and such statutory or regulatory requirements are deemed by the Department to be more stringent than the post-closure care and/or corrective action requirements stipulated in this Permit, such statutory and regulatory requirements shall supersede the pertinent requirements of this Permit.
 - b. In the event that any Federal statutory or regulatory requirements are enacted, adopted, or promulgated which are applicable to the Permittee’s Facility and address the need for and/or the nature and extent of post-closure care and/or corrective action, such statutory or regulatory requirements shall supersede the pertinent requirements of this Permit to the extent that it is determined by the Department that such statutory or regulatory requirements afford equal or greater protection to continuing post-closure care and/or corrective action as is afforded by this Permit.

T. REQUIREMENTS FOR AN ON-SITE DEC ENVIRONMENTAL MONITOR

1. Number of DEC Environmental Monitors assigned to Facility: **Zero (0)**
2. The Permittee shall fund environmental monitoring services to be performed by or on behalf of the Department. These monitoring services will include, but not be limited to, the scope of work in an annual environmental monitoring work plan which is incorporated by reference and enforceable under this Permit.
3. The Permittee shall provide to the Department on an annual basis the funds necessary to support the activities set forth in the annual environmental monitoring work plan. The sum to be provided will be based on the annual budgeted amount and is subject to annual revision. Subsequent annual payments shall be made for the duration of this Permit or until the environmental monitoring services are no longer necessary, whichever comes first. The Permittee shall be billed annually, prior to the start of each State Fiscal Year (SFY) (April 1). If this Permit is to first become effective subsequent to April 1, the initial bill will be for an amount sufficient to meet the anticipated cost of the environmental monitoring services through the end of the current SFY.
4. The DEC may revise the required payment on an annual basis to include all costs of environmental monitoring services to the DEC. The annual revision may take into account factors such as inflation, salary increases, changes in the fringe benefits rate, changes in operating hours and procedures, changes in non-personal service costs (including travel, training, sampling and analytical, and equipment costs, etc.), and changes in the need for and level of environmental monitor services and supervision of such Environmental Monitor(s). Upon written request by the Permittee, the DEC shall provide that entity with a written explanation of the basis for any modification. If such a revision is required, the DEC will notify the Permittee of such a revision no later than sixty (60) calendar days in advance of any such revision.
5. Prior to making its annual payment, the Permittee will receive and have an opportunity to review an annual work plan that the DEC will undertake during the year.
6. Payments are to be in advance of the period in which they will be expended. Payments shall be made in full within thirty (30) calendar days of written notice by the DEC that a payment is due. The notice from the Department to the Permittee will provide information regarding to whom payments should be made payable and the address to which payments should be sent.
7. Failure to make the required payments is a violation of this Permit. The DEC reserves all rights to take appropriate action to enforce the above payment provisions.
8. The Environmental Monitor(s) shall, when present at the Permittee's facility, abide by all of the Permittee's health and safety and operational requirements and policies; if such requirements and policies exist and provided they are not

inconsistent with Department policies and labor management contracts, and further provided, however, that this shall not be construed as limiting the environmental monitor's powers as otherwise provided for by law and shall not result in the Environmental Monitor(s) being less protected than the Environmental Monitor(s) would be if they were to abide by State and Federal health and safety requirements.

9. The DEC's Environmental Monitor(s) must receive from the Permittee all general and site- specific safety training which is normally given to new facility/site employees for all areas of the facility or site. This training will be a supplement to the mandatory safety training that Environmental Monitors receive from the Department. Upon selection of the Environmental Monitor(s), the Permittee shall immediately furnish to the Environmental Monitor(s) any facility/site health and safety and operational requirements and policies. Within five (5) calendar days of any revision to the facility/site health and safety and operational requirements and policies, the Permittee shall furnish to the Environmental Monitor(s) the health and safety and operational requirements and policies.
10. The Environmental Monitor(s) shall be permitted to use environmental monitoring and data collection devices (e.g., photo ionization detectors, cameras, video recording devices, computers, cell phones, etc.) deemed necessary by the Department to evaluate and document observed conditions. Copies of the data or images collected from areas where confidentiality is a concern shall be provided to the Permittee upon their request. The Permittee may request the data and images be considered confidential information if appropriate.
11. It will remain the responsibility of the Permittee to contact the Spill Hotline or any Division within the Department regarding any required notification of any spill, release, exceedances etc. Notification to the Environmental Monitor(s) will not be considered sufficient to replace any required notifications.
12. The Environmental Monitor's office space in a building is to be kept in good operating condition, including watertightness, lighting, appropriate heating and cooling, electrical power, telephone service and prompt snow removal. Adequate parking shall be provided for the monitor.

U. SPECIFIC CONDITIONS

1. The Permittee must make reasonable attempts to organize training events for local fire companies or departments, and to also arrange inspections of the Facility by these entities. During each inspection the Permittee shall solicit recommendations from the fire company or department concerning minimum suggested inventories for firefighting and safety equipment to be maintained at the facility. A report of each inspection, including any and all recommendations made by fire company or department inspectors and the Permittee's plans for addressing these recommendations, must be submitted to the DEC by the Permittee within seven (7) calendar days of each inspection.

2. The Permittee must make a copy of the Emergency Response Plan containing and inventory sheet listing the amount and location of all emergency equipment available on-site, to all employees involved in emergency response.
3. Upon notification by the Permittee of any partial closure of a unit or portion thereof, or of final closure of the Facility, the DEC will determine at the time of said closures whether additional samples, sampling points, sampling techniques/methods and/or sample analysis (i.e., in addition to Closure Plan requirements in **Attachment E** of this Permit) will be necessary to verify the effectiveness of decontamination or removal of components, equipment, structures and contaminated soils. These determinations will be based upon the history of operating practices and types of wastes handled at the unit/Facility and on the closure regulations and other requirements in effect at the time of closure of the unit/Facility. The operating record, the record of spills, the types of waste released, location of spills and the condition of any secondary containment systems will also provide data to be used in these determinations. Also, at the time of said closures, the DEC will determine whether more restrictive and/or additional criteria (i.e., more restrictive than, or in addition to Closure Plan criteria in **Attachment E** of this Permit) will be necessary to verify the effectiveness of decontamination or removal of components, equipment, structures and contaminated soils, based on the DEC's regulatory cleanup standards in effect at the time of said closures.
4. If the DEC determines that additional sampling and analysis or more restrictive and/or additional criteria are necessary at the time of unit/Facility closure, the DEC shall send the Permittee a notice of intent to modify this Permit in accordance with 6 NYCRR 621 to incorporate these requirements into the Permit. In the event the DEC issues such a notice of intent, the Permittee will be restricted from issuing a certification of closure for the unit/facility in accordance with 6 NYCRR 373-2.7(f), until the associated 6 NYCRR 621 Permit modification process is completed and any associated closure requirement(s) that might result from this modification process are satisfied.
5. The Permittee must submit to the Department the requisite ninety (90) calendar day notice for any sale and sixty (60) calendar day notice for any new proposed use or activities on the Site, including but not limited to any new tenant uses or activities, prior to any and all construction or fitting up or any other activity related to the commencement of that new activity, and otherwise comply with the Department's requirements.
6. The Permittee must obtain approval in writing from the Department for any sale of property within the facility boundary as well as for new proposed uses or activities on the Site, including but not limited to any new tenant uses or activities, prior to any and all construction or fitting up or any other activity related to the commencement of that new activity. The Department's review and approval shall take into consideration the proposed activities' use classification (i.e., industrial, commercial, etc.) and the current use restrictions in place at the Facility.

V. PUBLIC PARTICIPATION (INCLUDING 6 NYCRR 373-1.10)

1. Information Repository (6 NYCRR 373-1.10(c))

The Permittee shall establish and maintain an Information Repository at the Crandall Public Library, 251 Glen Street, Glens Falls, NY 12801. The Permittee shall provide the DEC with thirty (30) calendar day notice of any change to the location of the repository. The Permittee will continue to maintain the information repository for the life of the Permit or until otherwise notified by the DEC.

The repository shall contain a copy of the final approved Part 373 Permit application, approved documents such as plans, reports, other relevant documents, the Part 373 Permit Executive Summary/Fact Sheet, public notices pertaining to the Part 373 Permit, copies of correspondence including enclosures and attachments from the effective date of the Permit between the DEC and the Permittee pertaining to the Permit or to compliance. Certain portions of the Permit, and other information within the repository, may be redacted as necessary to protect national security or due to public sensitivity.

The Permittee shall provide a written notice of the availability of the information repository to all individuals on the facility mailing list within one (1) month from the effective date of this Permit (except to those previously notified within one (1) year prior to the effective date of the Permit) and to all individuals on the facility mailing list one year before the expiration date of this Permit.

2. Other public participation activities to consider maintaining good community relations:
 - a. Public Meetings
 - b. Citizens Advisory Group Meeting

W. PLANS, REPORTS, SPECIFICATIONS, IMPLEMENTATION SCHEDULES AND OTHER SUBMITTALS

Submittals required by the Permit must be provided to the DEC and other identified Agencies as listed below. The list below identifies the DEC/Agencies staff by title that must receive submissions and indicates the types of submissions each must receive. At any time during the life of this Permit, the DEC may designate alternate titles or addresses to receive submissions (different than those indicated below), and direct the Permittee to make submissions to the alternate title or address. The list below also indicates whether the submission must be a paper or electronic copy. Where electronic copies are indicated, the submission must be in a form as required by **Condition O** of this Module. Submissions of electronic copies may be by e-mail or other methods acceptable to the DEC. Appropriate email addresses will be provided to the Facility at Permit issuance and whenever there is a staffing or email address change.

1. One (1) electronic copy of all submittals to:

Project Manager, HW Corrective Action & Post Closure
Bureau of Hazardous and Waste and Radiation Management
New York State Department of Environmental Conservation
625 Broadway, 9th Floor
Albany, NY 12233-7256
kevin.chazhikattu@dec.ny.gov

Supervisor, HW Corrective Action & Post Closure
Bureau of Hazardous and Waste and Radiation Management
New York State Department of Environmental Conservation
625 Broadway, 9th Floor
Albany, NY 12233-7256
P373permitting@dec.ny.gov

Regional Materials Management Engineer
New York State Department of Environmental Conservation
232 Golf Course Road
Warrensburg, NY 12885
katelyn.white@dec.ny.gov

Manager, Land and Redevelopment Programs Branch
Land, Chemicals & Redevelopment Division
U.S. Environmental Protection Agency, Region II
290 Broadway [25th floor]
New York, NY 10007-1866

2. One (1) paper copy and one (1) electronic copy of all financial assurance documents to:

Supervisor, HW Corrective Action & Post Closure
Division of Materials Management
New York State Department of Environmental Conservation
625 Broadway, 9th Floor
Albany, NY 12233-7256

3. One (1) electronic copy of all waste reduction documents to:

Pollution Prevention Unit
Division of Materials Management
New York State Department of Environmental Conservation
625 Broadway
Albany, NY 12233-7253
pollutionprevention@dec.ny.gov

4. One (1) paper copy of all modification requests pertaining to this Permit to:

Deputy Regional Permit Administrator
Division of Environmental Permits
New York State Department of Environmental Conservation
232 Golf Course Road
Warrensburg, NY 12885-1172
dep.r5@dec.ny.gov

5. Where additional DEC staff are copied on the above submittals, the Permittee shall submit these copies electronically. In addition, the Permittee shall provide hard copies of any of the above submittal(s) when specifically requested by the Department.

MODULE II

Corrective Action Requirements

MODULE II CORRECTIVE ACTION REQUIREMENTS

A. APPLICABILITY

1. Statute and Regulations: Article 27, Title 9, Section 27-0913, and 6 NYCRR 373-2.6(l) requires corrective action, including corrective action beyond the Facility boundary where necessary to protect human health and the environment, for all releases of hazardous wastes, including hazardous constituents listed in Appendix 23 of 6 NYCRR 371 or Appendix 33 of 6 NYCRR 373-2 as well as any newly added hazardous substances (i.e., emerging contaminants) in 6 NYCRR Part 597 (defined together as constituents), from any solid waste management unit (SWMU) at a storage, treatment or disposal facility that has ever sought a 6 NYCRR Part 373 or a federal RCRA permit, regardless of the time at which waste was placed in such unit. Pursuant to 6 NYCRR 373-1.6(c)(2), the Department may impose Permit Conditions as the Department determines necessary to protect human health and the environment (e.g., areas of concern (AOCs) as defined in **Module I** of this Permit).
2. **All documents and reports required by this Permit must be certified pursuant to conditions established in 6 NYCRR 373-1.4(a)(5)(iv) and Condition O.4 of Module I and submitted in accordance with requirements set forward in Conditions O and W of Module I. Additionally, unless specifically exempted in this Permit, all information (e.g., documents and reports) required to be submitted by the Permittee must be approved by DEC. DEC does not require certain plans, documents or reports to also be certified by NYS licensed professionals. The Permittee should verify if certification is required prior to submittal to the DEC.**
3. Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs): The Permittee must initiate and complete the corrective action process for all SWMUs and AOCs at the Facility. The conditions of this Module apply to:
 - a. All the SWMUs and AOCs listed in **Table 1 of the SWMU/AOC Current Conditions Report in Attachment C** of this Module individually or in combinations.
 - b. Any additional SWMU(s) and AOC(s) identified during the course of groundwater monitoring, field investigations, environmental audits or other means as described in **Condition C** of this Module.
 - c. All SWMUs and AOCs located on-site and/or off-site are identified in **Table 1 of the SWMU/AOC Current Conditions Report in Attachment C** as SWMUs/AOCs requiring Further Corrective Action or No Further Action.
 - d. The Permittee need not undertake corrective action at any SWMU(s) and/or AOC(s) identified as No Further Action in **Table 1 of the SWMU/AOC Current Conditions Report in Attachment C** provided there is no

evidence of the release(s) of hazardous waste(s), constituent(s) from the SWMU(s) and/or AOC(s) threatening human health or the environment.

- e. A determination of No Further Action shall not preclude the DEC from modifying this Permit in accordance with 6 NYCRR 621.13 in order to require further investigations, studies, monitoring, or corrective measures, if new information, subsequent analysis or new contamination indicates the release(s) or likelihood of release(s) that could pose a threat to human health or the environment.

NOTE: If the SWMU/AOC Current Conditions Report was submitted prior to issuance of this Permit, then it is included in **Attachment C** with the abovementioned table (**Table 1**) as required. If it is listed as an item to be submitted following Permit issuance under the Schedule of Deliverables (**Module XIII, Condition B**), then the abovementioned table (**Table 1**) must be included in the document as required. Upon the DEC's acceptance of said report, it will automatically be included in **Attachment C**.

B. STANDARD CONDITIONS FOR CORRECTIVE ACTION

1. The Permittee must perform any and all corrective action specified by **Condition A.3** of this Module and all conditions in this Permit.
2. The Permittee must follow the requirements for groundwater protection as specified in **Module XI** of this Permit, including any groundwater sampling and analysis plan which may be required therein.
3. The Permittee and its consultants/contractors performing corrective action activities must demonstrate completion of appropriate training in accordance with the information required in the health and safety plans.
4. Work Plans. All work plans submitted pursuant to this Module shall include:
 - a. Quality Assurance/Quality Control protocols to ensure that data generated is valid and supported by documented procedures;
 - b. Other plans (e.g., Quality Assurance Project Plan (QAPP)), specifications and protocols, as applicable;
 - c. A schedule for starting specific tasks, completing the work and submitting progress and final reports; and
 - d. Plans for the treatment, storage, discharge or disposal of wastes to be generated by activities described therein.
5. Quality Assurance/Quality Control. Any laboratory to be used pursuant to sampling required by this Module must be approved by the DEC prior to implementation. Certification by the New York State Department of Health (DOH) Environmental Laboratory Approval Program (ELAP) in the relevant

analytical services is required. All laboratory deliverables must be submitted in accordance with **Condition O.1 of Module I**.

6. Health/Safety Plans. The Permittee shall develop, according to applicable Federal, State and local requirements, and submit to the DEC, health and safety plans that will be implemented to ensure that the health and safety of project personnel, plant personnel and the general public are protected. These plans are not subject to approval by the DEC.
7. Guidance Documents. When preparing the submissions described in this Permit Module, the Permittee shall take account of applicable guidance documents issued by the DEC and U.S. Environmental Protection Agency in a manner reflecting reasonable technical considerations.
8. Prior Submissions. The Permittee may have already submitted portions of information, plans, or reports required by this Permit Module and its attachments to the DEC pursuant to the terms of previous applications, consent orders, or plans. For those items the Permittee contends were submitted to the DEC, the Permittee may cite the specific document(s) it believes adequately addresses each of the individual items requested by this Permit Module and its attachments. The references, by document(s) shall be placed in the appropriate sections of the submissions that require the referenced information and data. If the DEC determines that it does not possess any of the referenced information, plans, or reports that the Permittee claims were previously submitted, the DEC will notify the Permittee and the Permittee shall submit the referenced documents within the time frame specified within the notification.
9. Compliance Schedule For Reporting And Submissions.
 - a. The Permittee shall submit, to the DEC, signed progress reports, as specified in approved work plans pursuant to this Permit, of all activities (i.e., SWMU Assessment, Interim Measures, RCRA Facility Investigation, Corrective Measures Study) conducted pursuant to the provisions of the Corrective Action Compliance Schedules of this Permit Module, beginning no later than thirty (30) calendar days after the Permittee is first required to begin implementation of any requirement herein. These reports shall contain:
 - i. A description of the work completed during the reporting periods;
 - ii. Summaries of all findings made during the reporting period;
 - iii. Summaries of all changes made during the reporting period;
 - iv. Summaries of all contacts made with representatives of the local community and public interest groups during the reporting period;

- v. Summaries of all problems or potential problems encountered during the reporting period and actions taken to rectify problems;
 - vi. Changes in personnel conducting or managing the corrective action activities during the reporting period;
 - vii. Projected work for the next reporting period; and
 - viii. Copies of daily reports, inspection reports, laboratory/monitoring data, etc., generated during the reporting period.
- b. Upon request, copies of other relevant reports and data not identified in **Condition B.9.a** of this Module shall be made available to the DEC.
 - c. The DEC may require the Permittee to conduct new or more extensive assessments, investigations, or studies, based upon information provided in the progress reports referred to in **Condition B.9.a** of this Module, or upon other supporting information.
 - d. All work plans, reports, studies, designs and schedules required by the conditions of this Permit Module and its attachments are upon approval of the DEC, incorporated into this Permit by reference and become an enforceable part of this Permit. Any noncompliance with such approved work plans, reports, studies, designs and schedules shall constitute noncompliance with this Permit. Extensions of the specified final compliance dates for submissions may be granted by the DEC in accordance with the major permit modification procedures stipulated in **Module I** of this Permit.
10. Compliance with Governmental Requirements: During investigative activities, interim corrective measures and final corrective measures (including, but not limited to, equipment decommissioning, excavation and unit demolition) required by this Module, the Permittee must ensure that the transportation, treatment, storage, discharge, and disposal of all contaminated materials generated as a result of such activities (including, but not limited to, soil, sediments, liquids, tanks, pipes, pumps, rubble, debris and structural materials) are performed in an environmentally sound manner pursuant to all applicable federal, State and local requirements, and in a way that is protective of human health and the environment. Nothing in this Module shall be construed to require the Permittee to proceed in a manner which is in violation of any such requirements.
11. Notifications:
- a. Groundwater Contamination: If at any time the Permittee discovers that hazardous constituents in groundwater released from the Facility have migrated beyond the Facility boundary in concentrations that exceed action levels in the DEC's TOGS 1.1.1 (ambient values) and EPA's MCLs (see

Condition C.2(a) of Module I, the Permittee must, within fifteen (15) calendar days of discovery, provide written notice to the DEC.

- b. **Air Contamination:** If at any time the Permittee discovers that hazardous constituents in air have been released from a SWMU or AOC at the Facility, and have or are migrating to areas beyond the Facility boundary in concentrations that exceed action levels in the DEC's DAR-1, and that residences or other places at which continuous, long-term human exposure to such constituents might occur are located within such areas (see DER-13), the Permittee must immediately initiate all appropriate actions necessary to mitigate the release to concentrations below the action levels or cease operation immediately. In addition, the Permittee must:
 - i. Immediately initiate any actions that might be necessary to provide notice to all individuals who have been, may have been or may become exposed to the released constituents; and
 - ii. Provide written notification to the DEC as well as DOH within fifteen (15) calendar days of such discovery.
- c. **Residual Contamination:** If hazardous wastes or hazardous constituents are located within or have been released from SWMUs or AOCs and will remain in or on the land, including groundwater, after the term of this Permit has expired, the Permittee must record such information in an environmental easement and/or restrictive covenant to run with the land in favor of the State in accordance with **Condition F.2** of this Module or in some other instrument acceptable to the DEC which is normally examined during title search that will, in perpetuity, notify any potential purchaser of the property, of the types, concentrations and locations of such hazardous wastes or hazardous constituents.
- d. **Newly Discovered SWMUs and AOCs:** The Permittee must notify the DEC, in writing, of any additional SWMUs and AOCs discovered during the course of groundwater monitoring, field investigations, environmental audits or other means within fifteen (15) calendar days of discovery. Thereafter, the Permittee must proceed with the assessment, investigation, evaluation and remediation of the SWMU and/or AOC as set forth in **Condition C** of this Module.
- e. **Newly Discovered Releases:** The Permittee must notify the DEC, in writing, of any release(s) of hazardous wastes, including hazardous constituents, discovered during the course of groundwater monitoring, field investigations, environmental audits, or other activities no later than fifteen (15) calendar days of discovery. Such newly discovered release(s) may be from newly identified unit(s)/area(s), from unit(s)/area(s) for which, based on the findings of the RCRA Facility Assessment (RFA), the DEC had previously determined that no further investigation was necessary, or from unit(s)/area(s) investigated as part of a RCRA Facility Investigation (RFI). Based on the information provided in the notification, the DEC shall

determine the need for further investigation of the release(s). If the DEC determines that such investigations are needed, the DEC shall, by written notification, require the Permittee to prepare an RFI Work Plan in accordance with **Condition D** of this Module. The DEC may, at its discretion, also require the Permittee to prepare an Interim Corrective Measures (ICM) Work Plan.

- f. Emerging Contaminants: The DEC will notify the Permittee, in writing, of any additional investigations for emerging contaminants that may be necessary for the facility's SMWUs and AOCs. Once notified, the Permittee will have thirty (30) calendar days to prepare and submit a schedule for the investigation to DEC. Once the DEC approves the schedule, the Permittee must proceed with the assessment, investigation, evaluation and remediation of the SWMU and/or AOC as set forth therein.

12. Determination of No Further Action

- a. Based on the results of an RFA or an RFI for a particular SWMU or AOC, or combination of SWMUs and/or AOCs, and any other relevant information, the Permittee may submit an application to the DEC for a permit modification in accordance with **Section E of Module I**, 6 NYCRR 373-1.7(b) and 621 to terminate the subsequent corrective action requirements of this Module for the subject SWMU(s) or AOC(s). The permit modification application must contain information demonstrating:
 - i. Hazardous waste or hazardous constituents are not detected in any applicable environmental media; or
 - ii. Hazardous waste or hazardous constituents which have been detected are below background concentrations (pre-released conditions); or
 - iii. Hazardous waste or hazardous constituents which have been detected do not pose a threat to human health or the environment.
 - iv. The permit modification application must also include the information required in 6 NYCRR 373-1, 373-2 and 621.4(n).
- b. If, based upon review of the Permittee's request for a permit modification, the results of the RFI, and other information, including comments received during the forty-five (45) calendar day public comment period required for major permit modifications, the DEC determines that the release(s) or the suspected release(s) investigated are either non-existent or do not pose a threat to human health or the environment, the DEC may grant the requested modification.
- c. A determination of no further action shall not preclude the DEC from modifying this Permit in accordance with 6 NYCRR 621.13 in order to implement the following actions:

- i. Require the Permittee to perform such investigations as necessary to comply with the requirements of this Module if new information or subsequent analysis indicates that there are, or are likely to be, releases from SWMUs/AOCs/operable units that may pose a threat to human health or the environment; and/or,
- ii. Require continual or periodic monitoring of environmental media, if necessary, to protect human health and the environment, when site-specific circumstances indicate the release(s) of hazardous waste(s), including hazardous constituents, are likely to occur from any SWMU(s) and/or AOC(s) and/or operable units.

13. SWMU/AOC Current Conditions Report. With the completion of remedial requirements at a SWMU/AOC or when requested by the Department, the Permittee shall submit to the Department an updated **SWMU/AOC Current Conditions Report in Attachment C** providing current information regarding the status of investigations or remedial work for all SWMUs and AOCs. The report must include, at a minimum, information regarding physical and operational description, waste types/characteristics, any known or suspected releases, and current status of corrective action, including beginning and completion dates of each applicable phase.

C. SCHEDULE FOR ASSESSMENT OF NEWLY IDENTIFIED OR DISCOVERED SWMUs AND AOCs

The information required herein must be submitted in accordance with the Newly Discovered SWMUs and AOCs Assessment Schedule as outlined in **Table II-1** of this Module.

1. Notification of Assessment: The Permittee must notify the DEC, in writing, of any additional SWMU(s) and/or AOC(s) not listed in the **SWMU/AOC Current Conditions Report and Table 1 in Attachment C**, which are identified during the course of groundwater monitoring, field investigations, environmental audits, or other means. For new units managing solid waste only, or for other new unit(s), the Permittee may seek clarification from the Department as to whether the unit constitutes a SWMU requiring notification under this permit condition. Once such notification has been made, a newly installed SWMU (i.e., new use with no history of release) will receive a determination of no further action and will be processed by the Department as a notification. Should a subsequent release occur at such a unit, then the full notification, assessment and reporting procedures of this Module will apply.
2. SWMU/AOC Assessment Report: The Permittee must submit a SWMU/AOC Assessment Report to be included in **Attachment C**. This report must provide, at a minimum, the following information for each newly identified SWMU/AOC:
 - a. Type of unit/area;
 - b. Location of each unit/area on a topographic map of appropriate scale;

- c. Dimensions, capacities, and structural descriptions of the unit/area (supply available engineering drawings);
 - d. Function of unit/area;
 - e. Dates that the unit/area was operated;
 - f. Description of the wastes that were placed or spilled at the unit/area;
 - g. Description of any known releases from the unit/area (to include groundwater data, soil analyses, air monitoring data, and/or surface water/sediment data);
 - h. The results of any sampling and analysis required for the purpose of determining whether releases of hazardous wastes, including hazardous constituents, have occurred, are occurring, or are likely to occur from the unit/area;
 - i. Whether this unit/area, individually or in combination with other units/areas listed in the **SWMU/AOC Current Conditions Report** in **Attachment C**, is a significant source of contaminant release; and
 - j. Proposed status (i.e., No Further Action/Supplemental Investigation/ Further Action).
3. SWMU/AOC Sampling and Analysis Plan: If determined necessary, the Permittee must submit to the DEC for approval a plan for sampling and analysis of specific environmental media including, but not limited to, groundwater, land surface and subsurface strata, surface water/sediment or air, as necessary to determine whether a release of hazardous waste, including hazardous constituents, from such unit(s) and/or area(s) has occurred, is likely to have occurred, or is likely to occur. The SWMU/AOC Sampling and Analysis Plan must demonstrate that the sampling and analysis program, if applicable, is capable of yielding representative samples and must include parameters sufficient to identify migration of hazardous waste, including hazardous constituents, from the newly discovered SWMU(s) and/or AOC(s) to the environment.
4. Subsequent Assessment Actions: Following submission of the SWMU/AOC Assessment Sampling and Analysis Plan set forth in **Condition C.3** of this Module, the Department may either approve the Sampling and Analysis Plan as submitted or issue comments on the Plan. If approved, the Permittee must implement sampling in accordance with **Table II-1**. If comments are issued, then subsequent activities for the Sampling and Analysis Plan shall proceed in accordance with **Condition A.9 of Module I** of this Permit.
5. SWMU/AOC Sampling and Analysis Report: The Permittee must follow the reporting requirements in the approved Plan and submit a SWMU/AOC

Sampling and Analysis Report to the DEC. The Sampling and Analysis Report must describe all results obtained from the implementation of the approved Sampling and Analysis Plan.

6. Assessment Conclusions: Based on the results of the SWMU/AOC Sampling and Analysis Report, the DEC shall determine the need for further investigations at the specific unit(s) covered in the SWMU/AOC Assessment Report. If the DEC determines that such investigations are needed, the DEC shall, by written notification, require the Permittee to prepare and submit for approval an RFI Work Plan. In addition, the DEC may, at its discretion, require the Permittee to submit a Corrective Measures Study (CMS) or an ICM Work Plan if either is deemed necessary by the DEC to safeguard human health and the environment. Any additional activities required by the DEC must be undertaken in accordance with **Condition D** of this Module.

D. CORRECTIVE ACTION REQUIREMENTS

1. RCRA Facility Investigation: The Permittee must conduct, or have conducted, a RCRA Facility Investigation (RFI) to determine the nature and extent of known and suspected releases of hazardous constituents in groundwater and soil, originating from any location at the Facility, including a SWMU and/or AOC, as identified in **Table 1 of the SWMU/AOC Current Conditions Report in Attachment C**, and to gather data to support the Corrective Action Plan (CAP). The Permittee must conduct all items associated with the RFI in accordance with schedule specified in **Table II-2** (RCRA Facility Investigation Schedule) of this Module and must address both on-site and off-site contamination.
 - a. The Permittee must submit, or have submitted, an RFI work plan to the DEC for the SWMU(s) and/or AOC(s) identified in **Table 1 of the SWMU/AOC Current Conditions Report in Attachment C**.
 - b. The RFI Work Plan shall include:
 - i. A Project Management Plan detailing a discussion of the technical approach to the investigation, schedules, and milestone reports;
 - ii. A Quality Assurance Project Plan to establish and document all sampling and monitoring procedures;
 - iii. A Data Management Plan to track investigation data and results; and
 - iv. A Health and Safety Plan for safe conduct of corrective action activities.
 - c. Along with RFI Work Plan, the Permittee shall include a section for a Description of Current Conditions. The section shall include, at a minimum:
 - i. Background information gathered during previous investigations or inspections and other relevant data;

- ii. Nature, extent, and rate of migration of contamination, if known; and
- iii. Past or current activities at the Facility.
- d. Any proposed RFI Work Plan must be submitted for the DEC's review and approval/acceptance, and must include, at a minimum, a chronological description of the anticipated activities, a schedule for performance of those activities, and sufficient detail to allow the DEC to evaluate that RFI Work Plan.
- e. All work plans prepared pursuant to this Module must be certified in accordance with 6 NYCRR 373-1.4(a)(5) and **Condition A.2** of this Module.

2. RFI Implementation

- a. Upon approval of an RFI Work Plan by the DEC, the Permittee must implement such work plan in accordance with schedule specified in **Table II-2** of this Module. The Permittee shall present data of adequate technical quality to support the contention that no further action is required, or the development and evaluation of corrective measures alternatives presented in the CAP. RFI Implementation shall consist of:
 - i. Characterization of the environmental setting at the Facility, including the hydrogeology, soils, surface water, sediment, and air;
 - ii. Source characterization of all waste management areas at the Facility, including the nature of the unit and the type of waste place in the unit as described by chemical and physical characteristics;
 - iii. Contamination characterization, including analysis of hazardous waste or hazardous constituents from SWMUs and/or AOCs and the effects of such hazardous waste or hazardous constituents on environmental media; and
 - iv. Potential receptor identification describing the potential for human and environmental impact from contaminant exposure from the Facility.
- b. The DEC must be notified at least seven (7) calendar days in advance of, and be allowed to attend, any field activities to be conducted under a DEC-approved work plan, as well as any pre-bid meetings, job progress meetings, substantial completion meeting and inspection, and final inspection and meeting.
- c. During all field activities conducted under a DEC-approved work plan, the Permittee must have, on-site, a representative who is qualified to supervise the activities undertaken. Such representative may be an employee, or a consultant retained to perform such supervision.

- d. The Permittee shall prepare an analysis and summary of the RFI(s) including results. This task, designated as Investigation Analysis, shall be included in the RFI Report. The objective of Investigation Analysis shall be to ensure that the investigation data are sufficient in quality and quantity to describe the nature and extent of contamination, potential threat to human health and the environment, and to produce the CAP. Investigation Analysis shall consist of:
 - i. Data analysis of the type and extent of contamination at each SWMU and/or AOC including sources and migration pathways; and
 - ii. Protection standards for environmental media must be compared to pre-released conditions, or other relevant protection standard.
 - e. Any final RFI report or final engineering report that includes construction activities must include “as built” drawings showing any changes made to the remedial design or the IRM.
 - f. The Permittee shall submit a schedule of activities and reports, to the DEC as required by **Table II-2** of this Module.
 - g. All final reports and final engineering reports prepared pursuant to this Module must be certified in accordance with 6 NYCRR 373-1.4(a)(5) and **Condition A.2** of this Module.
3. Compliance Schedule for Interim Corrective Measures (ICMs)
- a. If at any time it is determined by the DEC that a release or, based on site-specific circumstances, a threatened release of hazardous wastes, including hazardous constituents from a SWMU, an AOC or a combination of SWMUs and/or AOCs poses a significant and immediate threat to human health or the environment, or that such condition jeopardizes the Permittee’s ability to comply with any governmental permit, an ICM shall be submitted to the DEC for approval within thirty (30) calendar days of notice of such a determination. This study shall consider, among other relevant factors, the character, the extent, direction, the rate of release, the proximity to population, the exposure pathways, the effects of delayed action, and the evaluations of appropriate ICM(s) or the selection of a pragmatic and presumptive ICM. Upon approval of the study by the DEC, the Permittee shall implement the required ICM as specified by the DEC. Should a selected ICM involve an engineered action (e.g., pump and treat), then its design, implementation schedule and subsequent construction completion certification shall require approvals by the DEC. Nothing herein precludes the Permittee from taking immediate action to address the conditions described herein and promptly notifying the DEC.
 - b. In the event the Permittee discovers a release or based on site-specific circumstances, a threatened release of hazardous waste, including hazardous constituents, from a SWMU, an AOC, or a combination of

SWMUs and/or AOCs, that poses a significant and immediate threat to human health or the environment, the Permittee shall identify ICMs to mitigate this threat. The Permittee shall immediately summarize the nature and magnitude of the actual or potential threat and the nature of the ICM being considered and notify the DEC. Within thirty (30) calendar days of notifying the DEC, the Permittee shall submit to the DEC, for approval, a focused CMS and follow the progression of events identified in **Conditions D.4, D.5 and D.6** of this Module as well as **Table II-3** of this Module.

- c. The following factors may be considered by the DEC or Permittee in determining the need for interim corrective measures:
 - i. Time required to develop and implement a final corrective measure:
 - ii. Actual or potential exposure of human and environmental receptors:
 - iii. Actual or potential contamination of groundwater and sensitive ecosystems;
 - iv. Concentration of hazardous constituents in soils that have the potential to migrate to the air, groundwater or surface water; and
 - v. Other situations that may pose threats to human health and the environment.

4. Corrective Measures Study (CMS)

- a. Should a CMS be required, the DEC shall notify the Permittee in writing. This notice shall identify the hazardous constituent(s) which have exceeded the action level(s) as well as those which have been determined to threaten human health and the environment given site-specific exposure conditions or due to additive exposure risk. The notification shall specify target cleanup levels for hazardous constituents detected in each medium of concern and may also specify corrective measure alternatives to be evaluated by the Permittee during the CMS.
- b. The DEC may require a CMS under the following conditions:
 - i. If the concentrations of hazardous constituents in environmental media exceed their corresponding individual cleanup levels; or
 - ii. If the concentrations of hazardous constituents in environmental media do not exceed their corresponding individual cleanup levels, but additive exposure risk due to the presence of multiple constituents is not protective of human health; or
 - iii. If the concentrations of hazardous constituents in environmental media do not exceed corresponding individual cleanup levels, but still pose a

threat to human health or the environment, given site-specific exposure conditions.

- c. The Permittee shall submit to the DEC for review and approval a CMS for all SWMUs and/or AOCs that have been identified to have a release of hazardous waste or hazardous constituents, in accordance with the schedule specified in **Table II-3** (Corrective Measure Study Schedule) of this Module.
- d. The CMS shall include:
 - i. Identification and Development of the Corrective Measure Alternative or Alternatives:
 - (1) Description of Current Situation
 - (2) Establishment of Corrective Action Objectives
 - (3) Screening of Corrective Measures Technologies
 - (4) Identification of the Corrective Measure Alternative or Alternatives
 - ii. Evaluation of the Corrective Measure Alternative or Alternatives:
 - (1) Technical/Environmental/Human Health/Institutional
 - (2) Cost Estimate
 - iii. Justification and Recommendation of the Corrective Measure or Measures
 - (1) Technical
 - (2) Human Health
 - (3) Environmental
 - iv. Target cleanup levels;
 - v. Provide a detailed description of the corrective measures evaluated and include an evaluation of how each corrective measure alternative meets the standards;
 - vi. Schedule for implementation of the corrective action(s) according to the timeframe and schedule contained in **Table II-3** of this Module;
 - vii. The Permittee in conjunction with the DEC shall establish site specific objectives for the corrective action. These objectives shall be based on public health and environmental criteria, information gathered during the

RFI, EPA and New York State guidance, and the requirements of any applicable federal and state statutes. At a minimum, all corrective actions concerning groundwater releases from regulated units must be consistent with, and as stringent as, those required under 6 NYCRR 373-2.6; and

- viii. Contain any additional information to support the DEC in the corrective measure selection decision-making process.
 - e. Upon approval of the CMS, the Permittee shall implement the corrective action(s) according to the schedule as approved in the CMS. The approved schedule for the CMS shall be incorporated in **Table II-3** of this Module.
 - f. The Permittee shall furnish or retain all personnel, materials, and services necessary for the implementation of the CMS.
5. Corrective Measures Selection: The DEC shall review and respond in writing to each corrective action submittal (e.g., plans, studies, reports, schedules, written submittals, etc) that the Permittee makes pursuant to this Permit Module in accordance with **Condition A.9 of Module I** of this Permit.
- a. Under **Condition D.4** of this Module and any further evaluations of additional corrective measures under this study, the DEC shall select the corrective measure(s) that at a minimum will meet the following standards:
 - i. Be protective of human health and the environment;
 - ii. Attain media target cleanup levels selected by the DEC during the corrective measures selection process;
 - iii. Control the source(s) of release(s) so as to reduce or eliminate, to the maximum extent practicable, further releases of hazardous waste, including hazardous constituents, that might pose a threat to human health and the environment; and
 - iv. Meet all applicable waste management requirements.
 - b. In selecting the corrective measure(s) which meets the standards for corrective measures established under **Condition D.5.a** of this Module, the DEC shall consider the following evaluation factors, as appropriate:
 - i. Long-term reliability and effectiveness. Any potential corrective measure(s) may be assessed for the long-term reliability and effectiveness it affords, along with the degree of certainty that the corrective measure(s) will prove successful. Factors that shall be considered in this evaluation include:

- (1) Magnitude of residual risks in terms of amounts and concentrations of hazardous waste, including hazardous constituents, remaining

following implementation of the corrective measure(s), considering the persistence, toxicity, mobility and propensity to bioaccumulate of such hazardous wastes, including hazardous constituents:

- (2) The type and degree of long-term management required, including monitoring and operation and maintenance;
 - (3) Potential for exposure of humans and environmental receptors to remaining hazardous wastes, including hazardous constituents, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal or containment;
 - (4) Long-term reliability of the engineering and institutional controls, including uncertainties associated with land disposal of untreated hazardous wastes, including hazardous constituents, and their residuals; and
 - (5) Potential need for replacement of the corrective measure(s).
- ii. Reduction of toxicity, mobility or volume. A potential corrective measure(s) may be assessed as to the degree to which it employs treatment that reduces toxicity, mobility or volume of hazardous and/or mixed wastes, including hazardous constituents. Factors that shall be considered in such assessments include:
- (1) The treatment processes the corrective measure(s) employs and materials it would treat;
 - (2) The amount of hazardous and/or mixed wastes, including hazardous constituents, that would be destroyed or treated;
 - (3) The degree to which the treatment is irreversible;
 - (4) The residuals that will remain following treatment, considering the persistence, toxicity, mobility and propensity to bioaccumulate such hazardous and/or mixed wastes, including hazardous constituents; and
 - (5) All concentration levels of hazardous and/or mixed waste, including hazardous constituents, in each medium that the corrective measure(s) must achieve to be protective of human health and the environment.
- iii. The short-term effectiveness of a potential corrective measure(s) may be assessed considering the following:
- (1) Magnitude of reduction of existing risks;

- (2) Short-term risks that might be posed to the community, workers, or the environment during implementation of such a corrective measure(s), including potential threats to human health and the environment associated with excavation, transportation, and re-disposal or containment; and
 - (3) Time until full protection is achieved.
 - iv. Implementability. The ease or difficulty of implementing a potential corrective measure(s) may be assessed by considering the following types of factors:
 - (1) Degree of difficulty associated with constructing the technology;
 - (2) Expected operational reliability of the technologies;
 - (3) Need to coordinate with and obtain necessary approvals and permits from other agencies;
 - (4) Availability of necessary equipment and specialists;
 - (5) Available capacity and location of needed treatment, storage and disposal services; and
 - (6) Requirements for removal, decontamination, closure, or post-closure of units, equipment, devices or structures that will be used to implement the corrective measure(s).
 - v. Cost. The types of costs that may be assessed include the following:
 - (1) Capital costs;
 - (2) Operation and maintenance costs;
 - (3) Net present value of capital and operation and maintenance costs; and
 - (4) Potential future corrective measure costs.
- c. The DEC shall select the final corrective measure(s) based on the information submitted by the Permittee in the RFI Report, the CMS, and/or other documents or reports. The proposed remedy shall be set forth in a draft Statement of Basis (SB) prepared by the DEC for the Facility.
- d. The selected remedy(ies) will be public noticed. The public will have the opportunity to review the reports and documents associated with the selected remedy(ies). Additionally, the public has the opportunity to

comment on these and the proposed selected remedy(ies). The selected remedy(ies) could be modified based on comments received.

- e. Once the SB has been finalized and incorporated into this Permit pursuant to 6 NYCRR 621.13 and **Condition D.6** of this Module, the Permittee must submit a Corrective Measures Implementation (CMI) Work Plan that provides for the development and implementation of final plans and specifications for implementing the remedial alternative set forth in this Permit (i.e., in the SB). This CMI Work Plan must, unless otherwise provided in writing by the DEC, be submitted in accordance with the schedule specified in **Table II-3** of this Module. The Permittee must commence implementation of the CMI Work Plan, in accordance with the schedule specified in **Table II-3** of this Module.
- f. Once the selected remedy(ies) has been implemented, the Permittee must oversee the remedy effectiveness and performance in accordance with the schedule specified in **Table II-3** of this Module.

6. Permit Modification for Corrective Measures:

- a. Based on the CMS, the DEC will select the corrective measure(s), prepare the draft SB, and initiate a permit modification to this Permit, pursuant to 6 NYCRR 373-1.7(b) and 6 NYCRR 621.14, which includes a forty-five (45) calendar day public comment period for the SB and the permit modification. The permit modification will specify the selected corrective measure(s) and include, at a minimum the following:
 - i. Description of all technical features of the corrective measure(s) that are necessary for achieving the standards for corrective measures established under **Condition D.5.a** of this Module, including length of time or which compliance must be demonstrated at specified points of compliance.
 - ii. All media cleanup standards for hazardous constituents, selected by the DEC, that the corrective measure(s) must achieve to be protective of human health and the environment.
 - iii. All requirements for achieving compliance with these cleanup standards.
 - iv. All requirements for complying with the standards for management of wastes.
 - v. Requirements for removal, decontamination, closure or post-closure of units, equipment, devices or structures that will be used to implement the corrective measure(s).
 - vi. A schedule for initiating and completing all major technical features and milestones of the corrective measure(s); and

vii. Requirements for submission of reports and other information.

- b. Once the final SB has been issued, it is automatically incorporated in its entirety into this Permit.

7. Modification of Compliance Schedules

- a. If at any time the Permittee determines that modification of any Compliance Schedule of this Permit Module is necessary because such schedules cannot be met, the Permittee must:
- i. Notify the DEC in writing within fifteen (15) calendar days of such determination;
 - ii. Provide an explanation why the current schedule cannot be met; and
 - iii. Propose the date by which the Compliance Schedule can be met.
- b. The DEC shall notify the Permittee in writing of the final decision regarding the Permittee's proposed modification to the Compliance Schedule.
- c. Modification(s) to the Compliance Schedule pursuant to this procedure does not constitute a reissuance of this Permit.
- d. All other modifications to this Permit Module must be made in accordance with **Module I** of this Permit.

8. Reporting Requirements

- a. The Permittee shall submit to the DEC, when applicable, written progress reports of all activities conducted after the effective date of the approved CMS. The Permittee shall submit the first progress report in accordance with the schedule specified in **Table II-3** of this Module.
- b. The progress reports shall contain:
- i. A description of the work completed;
 - ii. Summaries of all the finding and all raw data;
 - iii. Summaries of all problems encountered during the reporting period and actions taken or to be taken to rectify problems; and
 - iv. Projected work for the next period.
- c. The Permittee shall maintain copies of the reports, drilling logs and data at the facility or in another approved location (i.e. electronic repository) during the effective period of this Permit.

E. INACCESSIBLE SWMUS

If, based on, the RCRA Facility Assessment/RCRA Facility Investigation and subsequent documentation, the DEC has determined that there is a potential for release of hazardous waste and/or constituents from any inaccessible SWMU(s)/AOC(s) at the Facility, they will be identified in **Table 1 of the SWMU/AOC Current Conditions Report** in **Attachment C** as requiring further action.

For the above area(s), the Permittee shall submit to the DEC for approval a schedule for the preparation of an RFI Work Plan, no later than one-hundred and eighty (180) calendar days prior to the date when the SWMU(s) is anticipated to become accessible for such an investigation. Accessibility to the SWMU(s) shall be considered achievable when the impediment (e.g., buildings, structures, utilities) is demolished, abandoned, or is altered in a manner that would allow access to the SWMU(s). All such work shall proceed in accordance with the approved schedule.

Following submission of the RFI Work Plan set forth in this condition, subsequent activities for the Plan shall proceed in accordance with schedule specified in **Table II-2** of this Module.

F. OTHER REQUIREMENTS

1. Groundwater Requirements. Any Groundwater Monitoring Program that is required as part of this permit, shall be submitted as part of the Groundwater Monitoring Requirement in accordance with **Condition C of Module XI** of this Permit.
2. Environmental Easement
 - a. If a SB, or other approved work plan, for the Facility relies upon one or more institutional and/or engineering controls, the Permittee (or the owner of the Facility) must submit to the DEC for approval an environmental easement and/or restrictive covenant to run with the land in favor of the State which must be:
 - i. created and recorded pursuant to ECL Article 71, Title 36;
 - ii. in a form and manner as prescribed by the DEC;
 - iii. in compliance with General Obligations Law (GOL) § 5-703(1) and ECL § 71-3605(2); and,
 - iv. recordable pursuant to Real Property Law § 291.
 - b. Upon acceptance of the environmental easement and/or restrictive covenant by the State, the Permittee must comply with the requirements of **Condition F.2** of this Module.

- c. Agents, employees or other representatives of the State may enter and inspect the property burdened by an environmental easement with reasonable prior notice to the property owner, to assure compliance with the restrictions identified by the environmental easement.
- d. If the SB provides for no action other than implementation of one or more institutional controls, the Permittee must cause an environmental easement to be recorded under the provisions of **Condition F.2.a** of this Module.
- e. If the Permittee does not cause such environmental easement to be recorded in accordance with **Condition F.2.a** of this Module, the DEC may file an Environmental Notice on the Facility.

3. Dispute Resolution

- a. The Permittee may submit a written Notice of Dispute to the DEC related to the DEC's action on any of the Permittee's corrective action submittals required by or related to this Permit Module. Any such notices must be made within fifteen (15) calendar days of receiving the DEC correspondence which is the basis of the dispute and must be directed to the designated individual as defined in **Condition F.3.a.iii** of this Module. Such a notice must contain specific information describing the Permittee's position and including any relevant supporting documentation. The designated individual shall render a written decision and furnish a copy thereof to the Permittee. This written decision shall be the final DEC determination, unless the Permittee files a written appeal of that decision with the designated appeal individual within twenty (20) calendar days of receipt of that decision.
 - i. Upon receipt of the written appeal pursuant to **Condition F.3.a** of this Module, the designated appeal individual will review the record and decision. The designated appeal individual will take one of the following actions, with written notice to the Permittee:
 - (1) remand the matter to the program staff for further negotiation or information if it is determined that the matter is not ripe for review;
 - (2) determine that there is no need for further action, and that the determination of the designated individual is confirmed; or
 - (3) make a determination on the records as it exists.
 - ii. The decision of the designated appeal individual shall be the final DEC decision and represent the DEC's determination to proceed in accordance with **Condition F.3.b** of this Module.
 - iii. The designated individual to:

- (1) hear disputes is a bureau director in the DEC's Division of Materials Management; and,
- (2) to review dispute decisions is the assistant director of the DEC's Division of Materials Management.

- b. In the event that the DEC issues a final decision in accordance with **Condition F.3.a.ii** of this Module, the DEC shall, pursuant to 6 NYCRR 621.13, send to the Permittee a notice of intent to modify this Permit with regard to the DEC's final decision in order to safeguard human health and the environment.
- c. Upon receipt of a notice of intent from the DEC, the Permittee must act in accordance with 6 NYCRR 621.13(d) or the DEC's action will become effective on the date specified in the notice of intent. In the event that the Permittee acts in accordance with 6 NYCRR 621.13(d) within the specified timeframe, the procedure for permit modification will continue in accordance with 6 NYCRR 621.13.

4. Required Authorizations

- a. The Permittee must use best efforts to obtain all Facility access, permits, easements, approvals, institutional controls, and/or authorizations necessary to perform the Permittee's obligations under this Permit, including all DEC-approved work plans and the schedules contained therein. If, despite the Permittee's best efforts, any access, permits, easements, approvals, institutional controls, or authorizations cannot be obtained, the Permittee must promptly notify the DEC and include a summary of the steps taken. The DEC may, as it deems appropriate and within its authority, assist the Permittee in obtaining the same.
- b. If an interest in property is needed to implement an institutional control required by a work plan and such interest cannot be obtained, the DEC may require the Permittee to modify the work plan to reflect changes necessitated by the Permittee's inability to obtain such interest. Within fifteen (15) calendar days of receipt of such notice, the Permittee must elect in writing to either: a) modify the work plan as requested by the DEC within forty-five (45) calendar days, or b) invoke dispute resolution in accordance with **Condition F.3** of this Module.

5. Green Remediation

- a. As part of the DEC's initiative, the Permittee must make best efforts to implement green remediation practices in the performance of the requirements of the Work, including but not limited to performance of a RCRA Facility Investigation, Corrective Measures Study, Interim Corrective Measure, Corrective Measures Implementation and Post-Closure/Effectiveness Evaluations to maximize to the extent practicable, sustainability, reduce energy and water usage, promote carbon neutrality,

promote materials reuse and recycling, and protect and preserve land resources.

- b. The Permittee must make best efforts to utilize concepts and techniques presented in the New York State Department of Environmental Conservation - DEC Program Policy DER-31/Green Remediation, most recent edition.

6. Institutional Measures

In order to minimize the impacts of the soil and groundwater contamination on the surrounding community the Permittee must:

- a. Restrict public access to the facility.
- b. Place a formal notification on approval of an environmental easement and/or restrictive covenant, or on some other instrument which is normally examined during title search, that will in perpetuity notify any potential purchaser of the property that:
 - i. the land has been used to manage hazardous waste; and
 - ii. its use is restricted under 6 NYCRR 373-2.7, as if it were a "hazardous waste disposal facility."

7. System Down Time

If a remedial system is installed it shall be operated on a continuous basis. If any part of the system is inoperable (down) for a period of more than three (3) calendar days consecutively or for five (5) calendar days in a rolling thirty (30) calendar day period, the Permittee shall notify the DEC. The notification shall include a plan for restoring system operation as soon as possible.

8. Modifications of Remedial Systems

If, after review of the performance monitoring data, the DEC determines that the design or operation of the Remedial System is not sufficient to achieve the remedial criteria, the DEC may require Permittee to modify the design or operation of the system so as to achieve the remedial criteria. Alternatively, the DEC may require, in accordance with **Condition D.5.f** of this Module, that the Permittee investigate and evaluate the use of a different corrective measure for remediation. If necessary, the DEC or the Permittee may seek modification of this Permit pursuant to 40 CFR 270.41 or 270.42 and 124.5 to implement modification to the existing Corrective Measure Remedy.

Table II-1: Newly Discovered SWMUs and AOCs Assessment Schedule

Activity	Due Date¹
Notification of Assessment	Fifteen (15) days of discovery
SWMU/AOC Assessment Report	Within thirty (30) days of notifying the DEC
SWMU/AOC Sampling and Analysis Plan Submittal, if necessary	Within sixty (60) days from submission of SWMU/AOC Assessment Report
SWMU/AOC Sampling and Analysis Plan Subsequent Assessment Actions, if necessary	• Meeting with the DEC • Submission of a revised Plan within thirty (30) days after the above-described meeting
SWMU/AOC Sampling and Analysis Plan Implementation	Initiate within thirty (30) days of SWMU/AOC Sampling and Analysis Plan approval
SWMU/AOC Sampling and Analysis Report	Within thirty (30) days of receipt by the Permittee of validated analytical data
Assessment Conclusions	If DEC determines that such investigations are needed, DEC shall, by written notification, require the Permittee to prepare and submit for approval a RCRA Facility Investigation Work Plan.

Footnotes:

1. Due Date changes may be made with written approval from the Department.

Table II-2: RCRA Facility Investigation Schedule

Activity	Due Date¹
Submit Draft RFI work plan and schedule	Within ninety (90) days from submission of the <u>SWMU/AOC Sampling and Analysis Report</u>
Subsequent Assessment Actions, if necessary	• Meeting with the DEC • Submission of a revised Plan within thirty (30) after the above-described meeting
Begin RCRA Facility Investigation according to the approved RFI work plan and schedule	Within fifteen (15) days following written approval by the DEC
Submit RFI Report	Within thirty (30) days of receipt by the Permittee of validated analytical data
Assessment Conclusions	If the DEC determines that remedies are needed, the DEC shall, by written notification, require the Permittee to prepare and submit for approval a CMS Work Plan.

Footnotes:

1. Due Date changes may be made with written approval from the Department.

Table II-3: RCRA Corrective Measure Study Schedule

Activity	Due Date¹
Submittal of CMS	Within one hundred and eighty (180) days after receiving the written notification from DEC of the requirement for a CMS. Following completion of the CMS, the DEC will select the corrective measure(s) from the corrective measure alternatives evaluated in the CMS.
Subsequent Assessment Actions, if necessary	• Meeting with the DEC. • Submission of a revised CMS within thirty (30) days after the above-described meeting.
Submit CMS Final Report	Within ninety (90) days of the DEC's approval of any draft/revised draft CMS.
Statement of Basis and Permit Modification – Public Participation	Forty-five (45) days for public notice. The public will have forty-five (45) days to review the selected remedy(ies) and submit comments
Responsiveness Summary	Within sixty (60) days of the close of the public comment period, the DEC shall provide a response for all the public comments received on the selected remedy(ies).
Permit Modification Approval	The final SB and permit modification shall become effective thirty (30) days after service of notice of the approval, unless another date is specified.
Submittal of the Corrective Measures Implementation (CMI) Work Plan	Within one hundred twenty (120) days of the effective date of the Permit modification.
Implementation of CMI Work Plan	The Permittee must commence implementation of the CMI Work Plan within thirty (30) days of the DEC's approval of such work plan.
CMI Construction	As specified in approved CMI Work Plan
CMI Construction Report	Within ninety (90) days following completion of construction
Progress Reports	As required, but the first shall be submitted within ninety (90) days after the CMI Work Plan is approved
Corrective Measures (Progress) Effectiveness and Performance Reports	Triennially, three (3) years after its construction/implementation.

Footnotes:

1. Due Date changes may be made with written approval from the Department.

MODULE III

RESERVED

MODULE IV

RESERVED

MODULE V

Land Disposal Unit(s)

Post-Closure Care

MODULE V
LAND DISPOSAL UNIT(S) POST CLOSURE REQUIREMENTS

A. AUTHORIZED ACTIVITY

1. The Permittee is authorized for the Post-Closure of the former land disposal unit(s) used for the final disposal of hazardous wastes subject to the terms herein. Additionally, the land disposal unit(s) are also subject to Corrective Action as described in **Module II** of this Permit. **Table V-1** provides information regarding the closed land disposal unit(s) for this facility. **Figure 3** in the **Executive Summary** shows the location of these units.
2. In the event that the Facility has multiple land disposal units, the provisions of this Module apply individually to each unit.

Table V-1
Post Closure Units

Unit Designation⁽¹⁾	Post Closure Activities Completed	Remaining Activities
SWMU-1: Closed Hazardous Waste Landfill	The hazardous waste landfill is a regulated unit and was closed in 1990 in accordance with the Department-approved closure plan.	Groundwater monitoring continues under the Groundwater Monitoring Program. All maintenance, inspection, and post closure requirements will continue under the Post-Closure Plan.

Footnotes:

1. Applicable sections of this Module are denoted for each specific unit listed herein.

B. POST CLOSURE MONITORING AND INSPECTION FOR SURFACE IMPOUNDMENTS [6 NYCRR 373-2.2(g) and 6 NYCRR 373-2.11(d) and (f)]

1. The Permittee must perform monitoring and inspection of each surface impoundment authorized by this Permit in accordance with the requirements of 6 NYCRR 373-2.2(g)(2), 6 NYCRR 373-2.11(d)(4) and this Permit, including the Post Closure Plan (**Attachment E**) and the Groundwater Monitoring Plan (**Attachment D**) in this Permit.
2. For each inspection the Permittee must record the inspection as part of the facility record. As required by 6 NYCRR 373-2.2(g)(4), the facility's operating record must include information of any deficiency listed in 6 NYCRR 373-2.11(f)(2) is identified in any surface impoundment.

3. The Permittee must take action in response to any of the aforementioned deficiencies in accordance with 6 NYCRR 373-2.2(g)(3) and **Condition C** of this Module.
4. For any identified deterioration or malfunction of equipment or structures associated with a hazardous waste management unit that do not result in a release or create the potential for a release of hazardous waste from the unit's primary containment or for situations where the waste has been removed from the unit in accordance with **Condition C** of this Module, except for specific defects where other Permit conditions or the regulations require repairs within other specified time periods, the Permittee must either:
 - a. Schedule and complete repairs to the defect within thirty (30) calendar days from the date the deficiency was first identified;
 - b. Submit a proposed schedule for Department approval within seven (7) calendar days from the date the deficiency was first identified, if it is anticipated that it will take longer than thirty (30) calendar days to complete repairs. The proposed schedule must include the date for completing the repairs which must be within six (6) months from the date when the deficiency was identified; or
 - c. The Permittee may request, and the Department may approve, extensions to the schedule provided the Permittee has adequately demonstrated that the extension is needed due to unforeseen circumstances or circumstances beyond the Permittee's control and that the delay will not lead to an environmental or human health hazard.

C. CLOSURE AND POST CLOSURE FOR SURFACE IMPOUNDMENTS [6 NYCRR 373-2.11(f)]

1. The Permittee has performed closure for each surface impoundment authorized by this Permit in accordance with the requirements of 6 NYCRR 373-2.11(f), 6 NYCRR 373-2.7 and the Department-approved Closure Plan and/or Post Closure Plan provided as **Attachment E** of this Permit.
2. For surface impoundments closed with waste residues or contaminated materials left in place, the Permittee must comply with the post closure requirements of 6 NYCRR 373-2.11(f)(2). The Permittee must also comply with the requirements post closure of 6 NYCRR 373-2.7(g), 6 NYCRR 373-2.8, and this Permit.

D. ACTION LEAKAGE RATE FOR SURFACE IMPOUNDMENTS [6 NYCRR 373-2.11(j)]

The Permittee must comply with the action leak rate for each landfill authorized by this Permit that is subject to 6 NYCRR 373-2.11(b)(3) and (4) in accordance with the requirements of 6 NYCRR 373-2.11(j) and this Permit.

E. RESPONSE ACTIONS FOR SURFACE IMPOUNDMENTS [6 NYCRR 373-2.11(k)]

The Permittee must perform the response actions for each landfill authorized by this Permit that is subject to 6 NYCRR 373-2.11(b)(3) and (4) in accordance with the requirements of 6 NYCRR 373-2.11(k), this Permit, and the Department-approved Response Action Plan.

F. POST CLOSURE MONITORING AND INSPECTION FOR WASTE PILES [6 NYCRR 373-2.2(g) and 6 NYCRR 373-2.12(e) and (h)]

The Permittee must perform monitoring and inspection of each waste pile authorized by this Permit in accordance with the requirements of 6 NYCRR 373-2.2(g)(2), 6 NYCRR 373-2.14(e)(2) and this Permit, including the Post Closure Plan (**Attachment E**) and the Groundwater Monitoring Plan (**Attachment D**) in this Permit.

G. CLOSURE AND POST CLOSURE FOR WASTE PILES [6 NYCRR 373-2.12(h)]

After making a reasonable effort, the Permittee was unable to feasibly remove or decontaminate all contaminated soils and perform closure for each waste pile authorized by this Permit in accordance with the requirements of 6 NYCRR 373 2.12(h), 6 NYCRR 373 2.7 and the Department-approved Closure Plan and/or Post Closure Plan provided as **Attachment E** of this Permit. Therefore, the Permittee must comply in accordance with the closure and post closure requirements that apply to landfills (**Conditions J through L** of this Module).

H. POST CLOSURE MONITORING AND INSPECTION FOR LAND TREATMENT [6 NYCRR 373-2.2(g) and 6 NYCRR 373-2.13(f) and (h)]

1. The Permittee must perform monitoring and inspection of each landfill authorized by this Permit in accordance with the requirements of 6 NYCRR 373-2.2(g)(2), 6 NYCRR 373-2.13(f)(2), 6 NYCRR 373-2.13(h)(3) and this Permit, including the Post Closure Plan (**Attachment E**) and the unsaturated zone monitoring program (**Attachment D**) in this Permit.
2. For each inspection the Permittee must record the inspection as part of the facility record. As required by 6 NYCRR 373-2.2(g)(4), the facility's operating record must include information of any deficiency listed in 6 NYCRR 373-2.13(h)(3) is identified in any landfill.

3. The Permittee must take action in response to any of the aforementioned deficiencies in accordance with 6 NYCRR 373-2.2(g)(3).
4. For any identified deterioration or malfunction of equipment or structures associated with a hazardous waste management unit that do not result in a release or create the potential for a release of hazardous waste from the unit's primary containment or for situations where the waste has been removed from the unit in accordance with **Condition L** of this Module, except for specific defects where other Permit conditions or the regulations require repairs within other specified time periods, the Permittee must either:
 - a. Schedule and complete repairs to the defect within thirty (30) calendar days from the date the deficiency was first identified;
 - b. Submit a proposed schedule for Department approval within seven (7) calendar days from the date the deficiency was first identified, if it is anticipated that it will take longer than thirty (30) calendar days to complete repairs. The proposed schedule must include the date for completing the repairs which must be within six (6) months from the date when the deficiency was identified; or
 - c. The Permittee may request, and the Department may approve, extensions to the schedule provided the Permittee has adequately demonstrated that the extension is needed due to unforeseen circumstances or circumstances beyond the Permittee's control and that the delay will not lead to an environmental or human health hazard.

I. RECORDKEEPING FOR LAND TREATMENT [6 NYCRR 373-2.13(g)]

The Permittee must keep a record of hazardous waste application dates and rates in the operating record in accordance with 6 NYCRR 373-2.13(g).

J. CLOSURE AND POST CLOSURE FOR LAND TREATMENT [6 NYCRR 373-2.13(h)]

1. The Permittee has performed closure for each land treatment unit authorized by this Permit in accordance with the requirements of 6 NYCRR 373-2.13(h), 6 NYCRR 373-2.7 and the Department-approved Closure Plan and/or Post Closure Plan provided as **Attachment E** of this Permit.
2. The Permittee must comply with the Post Closure requirements of 6 NYCRR 373-2.13(h)(3). The Permittee must also comply with the requirements of 6 NYCRR 373-2.7(g), 6 NYCRR 373-2.8, and this Permit.

K. POST CLOSURE MONITORING AND INSPECTION FOR SECURED LANDBURIAL FACILITIES (HAZARDOUS WASTE LANDFILLS) [6 NYCRR 373-2.2(g), 6 NYCRR 373-2.14(e) and 2.14(g)]

1. The Permittee must perform monitoring and inspection of each landfill authorized by this Permit in accordance with the requirements of 6 NYCRR 373-2.2(g)(2), 6 NYCRR 373-2.14(e)(2) and this Permit, including the Department-approved Post-Closure Plan (**Attachment E**) and the Department-approved Groundwater Monitoring Plan (**Attachment D**) in this Permit.
2. For each inspection the Permittee must record the inspection as part of the facility record. As required by 6 NYCRR 373-2.2(g)(4), the facility's operating record must include information of any deficiency listed in 373-2.14(g)(2) when identified in any landfill.
3. The Permittee must take action in response to any of the aforementioned deficiencies in accordance with 6 NYCRR 373-2.2(g)(3).
4. For any identified deterioration or malfunction of equipment or structures associated with a hazardous waste management unit that do not result in a release or create the potential for a release of hazardous waste from the unit's primary containment or for situations where the waste has been removed from the unit in accordance with **Condition L** of this Module, except for specific defects where other Permit conditions or the regulations require repairs within other specified time periods, the Permittee must either:
 - a. Schedule and complete repairs to the defect within thirty (30) calendar days from the date the deficiency was first identified;
 - b. Submit a proposed schedule for Department approval within fourteen (14) calendar days from the date the deficiency was first identified, if it is anticipated that it will take longer than 30 calendar days to complete repairs. The proposed schedule must include the date for completing the repairs which must be within six (6) months from the date when the deficiency was identified; or
 - c. The Permittee may request, and the Department may approve, extensions to the schedule provided the Permittee has adequately demonstrated that the extension is needed due to unforeseen circumstances or circumstances beyond the Permittee's control and that the delay will not lead to an environmental or human health hazard.

L. SURVEYING AND RECORDKEEPING FOR SECURED LANDBURIAL FACILITIES (HAZARDOUS WASTE LANDFILLS) [6 NYCRR 373-2.14(f)]

The Permittee must perform surveying and recordkeeping for each landfill authorized by this Permit in accordance with the requirements of 6 NYCRR 373-2.14(f) and this Permit.

M. CLOSURE AND POST CLOSURE FOR SECURED LANDBURIAL FACILITIES (HAZARDOUS WASTE LANDFILLS) [6 NYCRR 373-2.14(g)]

1. The Permittee has performed closure for each landfill authorized by this Permit in accordance with the requirements of 6 NYCRR 373-2.14(g), 6 NYCRR 373-2.7 and the Department-approved Closure Plan and/or Post Closure Plan provided as **Attachment E** of this Permit.
2. The Permittee must comply with the post closure requirements of 6 NYCRR 373-2.14(g)(2). The Permittee must also comply with the requirements of 6 NYCRR 373-2.7(g), 6 NYCRR 373-2.8, and this Permit.
3. During the post closure period, if liquid leaks into a leak detection system, the Permittee must notify the Department of the leak, in writing, within seven (7) calendar days of detecting the leak. The Department may require modifying the Groundwater Monitoring Plan to require compliance with the requirements of 6 NYCRR 373-2.6 in the event of a leak detection.

N. ACTION LEAKAGE RATE FOR SECURED LANDBURIAL FACILITIES (HAZARDOUS WASTE LANDFILLS) [6 NYCRR 373-2.14(n)]

The Permittee must comply with the action leak rate for each landfill authorized by this Permit that is subject to 6 NYCRR 373-2.14(c)(3) and (4) in accordance with the requirements of 6 NYCRR 373-2.14(n) and this Permit.

O. RESPONSE ACTIONS FOR SECURED LANDBURIAL FACILITIES (HAZARDOUS WASTE LANDFILLS) [6 NYCRR 373-2.14(o)]

The Permittee must perform the response actions for each landfill authorized by this Permit that is subject to 6 NYCRR 373-2.14(c)(3) and (4) in accordance with the requirements of 6 NYCRR 373-2.14(o), this Permit, and the Department-approved Response Action Plan.

MODULE VI

RESERVED

MODULE VII

RESERVED

MODULE VIII

RESERVED

MODULE IX

RESERVED

MODULE X

RESERVED

MODULE XI

Groundwater Monitoring

MODULE XI GROUNDWATER MONITORING

A. APPLICABILITY

1. Statute and Regulations: Article 27, Title 9, Section 27-0913, 6 NYCRR Sections 373-1.5(a), 373-2.6(a), 373-2.6(c), 373-2.6(h) and 373-3.6(b), as well as unit specific regulations requiring groundwater monitoring, including all measures beyond the Facility boundary where necessary to protect human health and the environment, for all releases of hazardous wastes, including hazardous constituents listed in Appendix 23 of 6 NYCRR Part 371 or Appendix 33 of 6 NYCRR 373-2 as well as any newly added hazardous substances (i.e., emerging contaminants) in 6 NYCRR Part 597 (defined together as constituents), from any land-based unit under post-closure care or any solid waste management unit (SWMU) regardless of the time at which waste was managed or placed in such unit. Pursuant to 6 NYCRR 373-1.6(c)(2) and **Condition F.1 of Module II**, the Department may impose Permit conditions as the Department determines necessary to protect human health and the environment (such as Areas of Concern (AOCs)). The conditions of this Module are applicable to all groundwater monitoring programs required pursuant to this Permit.
2. **All documents and reports required by this Permit must be certified pursuant to conditions established in 6 NYCRR 373-1.4(a)(5)(iv) and Condition O.4 of Module I and submitted in accordance with requirements set forward in Conditions O and W of Module I. Additionally, unless specifically exempted in this Permit, all information (e.g., documents and reports) required to be submitted by the Permittee must be approved by DEC. DEC does not require certain plans, documents or reports to be certified. The Permittee should verify if certification is required prior to submittal to the DEC.**

B. STANDARD CONDITIONS

1. Other regulatory programs: Sites and activities potentially impactful to the Facility's Groundwater Monitoring Program (GWMP) will be subject to this Module when the nature and extent of contamination and/or complexity of the issues warrant this determination.
2. Policies and Guidance Documents: The Permittee shall consider applicable Policies and Guidance Documents listed in **Conditions A.3 and A.4 of Module I** when conducting activities required by this Permit.
3. Groundwater Contamination: Groundwater notifications must be followed pursuant to **Condition B.11 of Module II**.
4. Groundwater Monitoring Period: When groundwater monitoring is required, the Permittee shall plan for a perpetual thirty (30)-year monitoring period for post closure or corrective action.

5. Groundwater Protection Standard: The Permittee must ensure that Groundwater Protection Standards are being met throughout the Site and, specifically, at any Point of Compliance or that remedial actions are taken to reduce contaminant levels to meet standards. The Facility's full listing of Constituents of Concerns (COCs) and their corresponding concentration limits are listed in **Table XI-1**. The COCs for which the Facility is required to perform groundwater monitoring sampling as well as their frequency may be found in the Facility's Groundwater Monitoring Program (GWMP).
6. Point of Compliance: The Permittee must ensure any Point(s) of Compliance (POC) is described in the Corrective Measures Study (CMS) as well as clearly delineated and represented in a Facility GWMP well map. Additionally, POCs must be listed in the GWMP as well as shown in a figure attached thereto.
7. Nothing in this Module shall be construed to require the Permittee to proceed in a manner which is in violation of any Permit conditions. The Permittee shall comply with all applicable requirements of this Permit as well as **Conditions A.5, P.1, and R.1 of Module I and B.10 of Module II**.
8. The Permittee is responsible to comply with all federal, state and local regulations in reference to Primary, Principal and Sole-Source Aquifer designations.
9. The Permittee is required to maintain and/or submit records in accordance with 6 NYCRR 373-1.4 and as described in either **Condition N of Module I** or in this Module.
10. A permit modification(s) is required when specific changes to groundwater monitoring plans, programs and wells, as listed in 6 NYCRR 373-1.7, 40 CFR 270.42 or as determined by the Department, are made. Permit modifications must be made in accordance with the regulations and **Condition E of Module I** of this Permit.

C. GROUNDWATER MONITORING PLAN(S) AND PROGRAM

A facility may have an overall Groundwater Monitoring Program (GWMP) for a sitewide GWM system or may have GWM Plans for multiple areas. When combined these GWM Plans provide the sitewide GWMP.

1. The Permittee must design, implement, and maintain a groundwater monitoring program/plan as required under this Permit and the applicable regulations. The program/plan shall discuss, at a minimum, the following:
 - a. Proper identification and management of contaminated groundwater.
 - b. Identification and description of the uppermost aquifer and aquifers hydraulically interconnected as established in 6 NYCRR 373-1.5(3)(iii) and (3)(v).

- c. A description of Facility activities.
- d. A description of other well types found on the premises of the facility (e.g., extraction, artesian, emergency use).
- e. A list of adjacent properties and/or roadways to north, south, east and west and adjacent property types (e.g., residential, agricultural, commercial); nearby wetlands/water bodies, private drinking water wells on adjacent properties, and existing wells on the Facility (e.g. irrigation, agricultural, potable, industrial use, monitoring) and location; an aerial site map to demonstrate site layout (additional site maps may be necessary to show water bodies and existing well locations, utilities, etc.); and a written description of site layout (location of entrance, mulch piles, etc.)
- f. A history of the Facility, prior uses specifically any land-based RCRA units and their capacity, known spills or activities that may impact water quality or indicate a potential presence of specific contaminants known point source.
- g. A description of the surface and subsurface characteristics of the Facility, including geology, hydrogeology, and depth to groundwater. Identify any sources of contamination, possible migration pathways, and actual or potential receptors of contaminants on or through air, soil, bedrock, sediment, groundwater, surface water, utilities, and structures at the contaminated Facility, without regard to property boundaries.
- h. Aquifer characteristics and hydrogeologic units to identify groundwater flow paths and rates including hydraulic conductivity, hydraulic gradient, effective porosity, aquifer thickness, degree of saturation, stratigraphy, degree of fracturing and secondary porosity of soils and bedrock, aquifer heterogeneity, groundwater discharge, and groundwater recharge areas.
- i. A combined use of direct and indirect techniques to produce an efficient and complete characterization to define the hydrogeological conditions at the Facility including an identification of the following:
 - i. The seasonal/temporal naturally and artificially induced (e.g., off-site production well pumping, agricultural use) variation in groundwater flow. The Permittee should take into consideration atypical seasonal changes with potential groundwater direction shift. The GWMP and reports must include a minimum discussion on hydraulic gradient, sustained well yield, hydraulic conductivity, permeability and an estimate of the rate of groundwater and contaminant flow in the aquifer with formulas.
 - ii. Potential effluent zones to surface water and public drinking water supply intake infrastructure.

- iii. Engineering controls including trenches, liners, cover systems, and aquifer controls (e.g., lowering the water table). These shall be evaluated under design and failure conditions to estimate their long-term residual performance.
 - iv. Assessment and estimation of microbiological or chemical degradation which may attenuate target compounds or cause transformation of compounds potentially forming harmful chemical species.
2. The Permittee must include the following items for site characterization, including but not limited to:
- a. An inventory of their monitoring well network for both off-site and on-site wells. This inventory must also include the laboratory analyses of subsurface samples.
 - b. Geophysical techniques.
 - c. Structure contour maps.
 - d. Cross-sections.
 - e. Groundwater modeling.
 - f. Topographic maps (1":200' scale) that show all features required by 6 NYCRR 373-1.5(a)(2)(xix), including:
 - i. Map scale.
 - ii. Aerial photography.
 - iii. Location of the operational units within the hazardous waste facility as well as any area where hazardous waste is treated, stored, or disposed including equipment clean up areas.

D. GROUNDWATER MONITORING SYSTEMS

- 1. The Permittee must observe requirements as established, but not limited to, those found in 6 NYCRR 373-2.6 and 373-3.6.
- 2. Groundwater Level Measurements: The Permittee must measure and report the elevation of the potentiometric surface in all monitoring wells and/or piezometers within the off-site and on-site monitoring well network identified in the GWMP or the appropriate Groundwater Monitoring Report (GWMR).
 - a. Water level measurements must have been collected within a 24-hour period. Within thirty (30) calendar days of completing these measurements, the Permittee shall use the water level data to evaluate the direction and

rate of groundwater flow. The facility must specify any other situations in which all measurements need to be taken within a short time interval as is the case of tidally influenced aquifers, impacts from impoundments, pumping charges and dischargers (including artesian wells if existing), stressed aquifers by production wells, recharge due to sudden precipitation, etc.

- b. Piezometers must be re-surveyed as required in the Facility's GWMP to determine the extent of subsidence or rise in the ground surface.
- c. In cases where immiscible contamination is found during the characterization, water level should be adjusted to reflect true elevation.
- d. Information gaps such as unidentified extraction wells in the vicinity, changes in seasonal precipitation causing groundwater plume shifting, formerly inaccessible areas, etc.
- e. Assess off-site or on-site well pumping as it may affect both the rate and direction of groundwater flow.

Additionally, the Permittee must provide, and keep current, a Facility map showing the locations of the GWM wells as discussed in **Conditions B.5 and D.6** of this Module.

- 3. Description of Wells: The Permittee must maintain an inventory of their monitoring well network for both off-site and on-site wells. This inventory must also include the status (i.e., active/inactive), purpose (e.g., corrective action, post-closure, unit-specific), type (e.g., upgradient/downgradient, compliance, monitoring, piezometers, replacement wells), depth and location of these wells. The Permittee may coordinate efforts to obtain this information with local authorities and/or DEC. The Permittee is responsible for notifying DEC on all changes in the well network, including but not limited to, decommissioning, abandonment, and unreported wells. The Permittee is responsible for updating this inventory every five (5) years, or within sixty (60) calendar days of addition of a new well, well decommissioning or replacement.
- 4. Monitoring Well Designations: The Permittee must ensure adequate placement of monitoring wells. This placement must include upgradient and downgradient monitoring wells relative to active and closed hazardous waste management units, solid waste management units and areas of concern at the Facility. Additionally, this placement must include screening of detection monitoring wells for the interception of predicted pathways of migration. The number of wells that shall be required shall be determined by DEC as the number necessary to achieve the performance objectives.
- 5. Plume Assessment Wells: The appropriately designated monitoring wells listed in the GWMP or GWMR shall be used to monitor the contaminant plume movement and to assess the effectiveness of the Post Closure Care or Corrective Action Program.

6. Documentation of Monitoring Wells: The Permittee must maintain an updated inventory of groundwater monitoring well information including but not limited to:
- a. Date/time of original construction. Additionally, the inventory must include any well redevelopment or replacement information.
 - b. Well identification number. Wells must be properly identified in the administrative record as well as physically on the well protective casing, cover or flush mount.
 - c. Well type (e.g., upgradient/downgradient, compliance, monitoring, piezometers, replacement wells).
 - d. Well location (± 0.5 ft).
 - i. Coordinates must be submitted in latitude/longitude coordinate system with a precision as required by DEC guidance.
 - ii. The Permittee must include a conversion factor or system whenever using Easting and Northing.
 - e. Well development method and date.
 - f. Unit(s) monitored.
 - g. Bore hole diameter and well casing diameter.
 - h. Casing materials.
 - i. Well depth (± 0.1 ft, must be the well bottom).
 - j. Ground elevation (± 0.01 ft relative to mean sea level (MSL)).
 - k. Top-of-Riser elevation (± 0.01 ft).
 - l. Screened interval (ft. relative MSL).
 - m. Drilling and lithological logs.
 - n. Detailed drawing of well (include dimensions).

All depth or elevations may be reported in ft below ground surface (BGS), ft above mean sea level (AMSL) or ft below top of casing (BTOC). Whatever system is used must be consistent across all GWM systems/plans/program for the Facility. All documentation must include the necessary definitions, units or acronyms used therein.

If requested by DEC, the Permittee must provide a copy of the Monitoring Well documentation within five (5) business days.

E. WELL LOCATION, INSTALLATION AND CONSTRUCTION

The Permittee must submit a written proposal to install and maintain a groundwater monitoring system a minimum of forty-five (45) calendar days prior to planned installation. The Permittee must design all groundwater monitoring system(s) such that they comply with all applicable regulations and requirements. The Permittee may not install any wells without DEC approval, including any proposed replacement well(s).

1. The Permittee shall ensure that all wells are designed, installed, and maintained such that groundwater samples are representative of the true water quality. Additionally, the wells shall be designed, installed and monitored in such a manner to prevent interconnection between different hydrologic units.
2. The Permittee must ensure the use of adequate construction materials that are durable enough to resist chemical and physical degradation and do not interfere with the quality of groundwater samples. Specific well components that are of concern include well casings, well screens, filter packs, and annular seals or backfills. Emerging contaminants, chemicals or materials characterized by a perceived, potential, or real threat to human health or the environment or by a lack of published health standards, should be considered when selecting these materials.
3. The Permittee must ensure the drilling method used minimizes disturbance of the surface and subsurface materials. Any method used should not contaminate these materials as well as groundwater or surface water. Emerging contaminants, chemicals or materials characterized by a perceived, potential, or real threat to human health or the environment or by a lack of published health standards, should be considered when selecting these materials.
4. The Permittee must maintain documentation on the design and construction of the wells. Otherwise, a placement of a monitoring well will be considered inadequate for groundwater monitoring if no documentation is provided to the DEC.
5. The Permittee shall measure total well depth annually and redevelop any monitoring well when sediment has entered the well and accumulated to a depth of one foot; or the accumulated sediment blocks ten percent of the screen length, whichever is less. The Permittee must notify DEC within fifteen (15) calendar days of any need to redevelop a well or any sediment accumulation above ten (10) percent.
6. The Permittee must submit a written plan for any well abandonment or decommissioning prior to implementation. The Permittee may not abandon or

decommission any wells without DEC approval. The Permittee must follow DEC's well decommissioning policy per **Condition A.4 of Module I**.

F. WELL MAINTENANCE

1. The Permittee is responsible for maintaining the GWM system and ensuring that all monitoring points yield representative samples of high integrity. During each sampling event the wells to be sampled shall be visually inspected for integrity. Any well found to be damaged beyond usability, blocked or broken, or that fails to recharge properly, shall be repaired, abandoned or replaced, if necessary, in accordance with the conditions of this Permit. Additionally, if the Permittee, or their contractor, observes any cracking or frost heaving of grout at any well, repairs shall be made and the top of the inner well casing will be resurveyed to ensure accurate definition of groundwater elevations. All repairs or replacements shall be completed prior to the next scheduled sampling event. Flush mounted wells shall be capped with a watertight seal. The integrity of this seal shall be inspected each time the wells are sampled.
2. The Permittee shall perform inspection activities within one hundred eighty (180) calendar days of the effective date of this Permit, and every three (3) years after the initial inspection. These inspections shall evaluate the exterior conditions and accessible parts of GWM wells as mentioned in **Condition F.1** above as well as assessing well performance and effectiveness in the GWMP (e.g., well screen depth versus plume locations). The Permittee shall report observations and maintenance actions in both an initial report and the Triennial Well Inspection Report as listed in **Table B and C of Module XIII**.
3. The Permittee shall maintain an inventory of all existing and historical wells throughout the facility and at off-site locations associated with the GWMP.

G. SAMPLING AND ANALYSIS PROCEDURES

1. The Permittee must ensure that the frequency of sample collection and the wells to be sampled are in accordance with the Groundwater Monitoring Schedule established in the GWMP or GWMR. These wells shall adequately characterize the nature and extent, both horizontal and vertical of groundwater contamination. The Permittee shall monitor groundwater quality throughout the compliance period to demonstrate conformance with the GWMP.
 - a. The Permittee must prepare and submit a Sampling and Analysis Plan (SAP) and its corresponding Sampling and Analysis Report (SAR) to DEC pursuant to **Conditions C.3 and C.5 of Module II**, as may be necessary. Any new groundwater monitoring requirements necessary based on any new SAP or SAR would subsequently be incorporated into the GWMP.
 - b. Any required SAP must include provisions for measurement of static water elevations in each well prior to each sampling event. A change in hydrologic conditions may necessitate modification to the design of the groundwater monitoring system.

2. Proposed sampling frequencies shall be submitted by the Permittee as part of the Permit application. The sampling frequency is determined on a case-by-case scenario and should reflect site-specific hydrogeological conditions. The minimum sampling is determined by the Department as defined in the GWMP and per 6 NYCRR 373-2.6(h), (i) and (j).
3. Unless specified in the Permit and/or approved modifications to the GWMP, the Permittee must include all active wells in sampling activities. Monitoring wells can only be removed from sampling activities after the review and approval of DEC.
4. The Permittee shall report water level data with the groundwater quality analytical results as specified in **Conditions C and D** of this Module and with a collection time inside a twenty-four (24) hour time span for a given well, unless otherwise approved by the Department in the GWMP.
5. The Permittee must collect field data parameters (e.g., pH, temperature, redox potential, dissolved oxygen, specific conductance) during sampling activities. Other field measurements may be required yet not limited to such as purged water collected and screened with photoionization detectors (PID) or organic vapor meters.
6. The Permittee shall take into account other indicator parameters additional to established hazardous constituents as described in 6 NYCRR 373-2.6(i) or as may be determined by the Department on a case-by-case basis.
7. The Permittee must note and report the presence of immiscible layers: Non-Aqueous Phase Liquids (NAPLs), and Dense Non-Aqueous Phase Liquids (DNAPLs) not detected in the aqueous phase.
8. At a minimum, the Permittee must use the techniques and procedures outlined in **Conditions G.9 through G.12** of this Module when obtaining and analyzing samples from the groundwater monitoring wells. The specific elements to be used must be established and discussed in the GWMP and GWMR.
9. Presampling Procedures
 - a. Procurement, inspection, and calibration of equipment;
 - b. Procurement and preparation of sample bottles;
 - c. Storage and handling of sampling gear between uses;
 - d. Personal protective equipment needed for sampling;
 - e. Well purging techniques;
 - f. Water level measuring techniques; and
 - g. Laboratory notification/verification.

10. Sampling Procedures

- a. Use of sampling equipment;
- b. Field measurements and calibration techniques;
- c. Sampling parameters/sample handling techniques, including:
 - i. sample containers to be used,
 - ii. sample preservation techniques,
 - iii. sample filtration techniques,
 - iv. order of sample collection,
 - v. sample labels, and
 - vi. sample storage.
- d. Field QA/QC such as decontamination, blanks, duplicate measurements, etc;
- e. Sample shipping and chain of custody procedures;
- f. Health and safety/personal protection measures; and
- g. Provisions for adequate disposal of purge water.

11. Background Information for each Monitoring Well/Piezometer

- a. Well log;
- b. Water level recovery rate of wells;
- c. Measuring point elevation;
- d. Normal purge volume of wells;
- e. Background water quality values; and
- f. Development/redevelopment history of the wells.

12. Data Management

The Permittee is responsible to maintain and update data from each well or piezometer after each sampling or monitoring event. The well record must contain the following information:

- a. Well I.D. number and, if possible, designation as up or downgradient;
- b. Depth of wells as installed and as measured in the most recent well inventory
- c. Measuring point elevation;
- d. Depth of water;
- e. Purge volume;

- f. Purge time (start/stop)
 - g. Sampling time;
 - h. Field parameters (e.g., temp., pH, S.C., TDS);
 - i. Physical condition of the well;
 - j. Important field observation related to sample integrity;
 - k. Names of sampling personnel;
 - l. Weather conditions;
 - m. Purge/sample date;
 - n. Concentration of required monitoring parameters;
 - o. Concentration of any other parameters analyzed;
 - p. Pertinent laboratory information (e.g., QA/QC problems); and
 - q. Water Elevation (quarterly water level measurements only).
13. Sample Analysis: Samples shall be analyzed based on most current USEPA Hazardous Waste Test Methods SW-846, using the most recent and stringent procedure at the time of analysis, unless the Department approves a different methodology prior to sampling. These samples must be analyzed by a laboratory with a NYS Environmental Laboratory Approval Program (ELAP) certification.
14. The Permittee is responsible to sample any wastes or other materials that may be generated as part of the GWMP and to ensure it is disposed of in accordance with all applicable regulations.
15. The GWMP should include provisions for measurement of static water elevations in each well prior to each sampling event.
16. The Permittee must report the presence of hazardous waste constituents that are consistently present in the monitoring wells exceeding established groundwater protection standards. DEC may require the Permittee to perform additional sampling and install additional wells to determine the horizontal and vertical extent of any contamination.
17. Inability to Obtain Samples: If the Permittee knows that a well (or multiple wells during a sampling event) may not provide representative samples (e.g., siltation, damage, obstruction beyond the facility's control), the Permittee shall within seven (7) calendar days of such knowledge notify DEC, in writing, of the problem and proposed remedy. Within fourteen (14) calendar days of such knowledge, the Permittee shall attempt to remedy the problem and, when appropriate, sample or re-sample the well(s), including the information in the GWMR for the assessment and resolution. If the Permittee is unable to resolve the problem within twenty-one (21) calendar days of such knowledge, the Permittee shall, through written notice to the DEC, provide information which

describes the nature of the problem within seven (7) calendar days following the twenty-one (21) calendar day resolution period. Any instance of site safety hazards interfering with a sampling event shall be discussed with DEC.

18. The Permittee must include a section with detailed procedures for evacuating wells in their GWMP (e.g., low-flow vs high-flow techniques, use of dedicated equipment, purging times).
19. Insufficient Groundwater for Sampling: The Permittee must address, in their GWMP, wells with a history of pumping dry and discuss with DEC the order of sampling COCs. On wells in which the water table has lowered to consider the well dry and no longer adequate for sampling, DEC will make the determination on whether the well should be retained in the GWMP or replaced.
20. The Permittee is responsible for the characterization of all Investigation Derived Waste (IDW) generated during sampling activities. Characterization may include Toxicity Characteristics Leaching Procedure (TCLP) analysis. The Permittee shall treat, store and/or dispose of all IDW, including contaminated groundwater, in accordance with all applicable federal, state and local requirements.
21. At the request of the DEC, the Permittee shall allow the DEC and/or its authorized representatives to collect samples or splits of any samples collected by the Permittee pursuant to the requirements of this Permit. Similarly, at the request of the Permittee, the DEC will allow the Permittee or the Permittee's authorized representatives to take splits or duplicates of any samples collected by the DEC. The Permittee shall provide appropriate management of or disposal of purge water whenever samples are collected by the DEC.
22. Laboratory Reporting: As stated in **Condition G.9** above, all samples must be analyzed by an ELAP-certified laboratory. Additionally, the Permittee must provide DEC with ASP Category B deliverables for sample results in accordance with **Condition O.1 of Module I**. An associated Data Usability Summary Report (DUSR) must be prepared by a qualified and approved data validator and submitted along with all results.
23. Change in Analytical Laboratory: Whenever the Permittee changes analytical contractors, the Permittee shall submit to the Department, within thirty (30) calendar days of such a change, a copy of the new laboratory's New York State ELAP certification to be included in the permit application. This certification must state the expiration date, analytical test methods and parameters for which the laboratory is certified.
24. The Permittee is required to report the concentrations of any newly detected hazardous constituents found during analysis to the DEC in writing within seven (7) calendar days after receipt of analytical data. The Permittee must immediately incorporate these new constituents into the GWMP when the presence of new hazardous constituents is confirmed by resampling. If the

Permittee chooses not to resample, the original detections will be considered valid detections, and the hazardous constituents must be added to the GWMP.

25. The Permittee must use the appropriate statistical procedure to evaluate groundwater monitoring data for each hazardous constituent detected as established in 6 NYCRR 373-2.6(h)(8) and (h)(9) or otherwise approved by the Department.

H. GROUNDWATER MONITORING PROGRAM TERMINATION CRITERIA

1. Request for Termination: The Permittee may submit a request for Termination of the Groundwater Monitoring Program whenever the Permittee determines that the cleanup in all or part of the on-site area/aquifer is achieving the Termination Criteria. The termination request must provide information that the Permittee's GWMP has met all groundwater protection standards set forth in monitoring parameters in **Table XI-1** for an appropriate number of consecutive sampling episodes determined by the DEC.
2. Termination Monitoring: Following a request for termination of the Groundwater Monitoring Program, the Permittee shall conduct Termination Monitoring to demonstrate that Termination Criteria continue to be achieved. At least sixty (60) calendar days prior to commencing Termination Monitoring, the Permittee shall submit a Termination Monitoring Plan for DEC review. That plan will describe the area (or wells) for which Termination Monitoring is proposed, and the monitoring plan, including wells, which will be used to determine whether the Termination Criteria have been achieved. The Permittee may proceed with the Termination Monitoring Program, without DEC approval, at their own risk. Only those results which conform to a DEC-approved Termination Monitoring Plan shall be accepted by the Department.
3. Basis for Termination: The basis for the DEC's determination of whether the groundwater monitoring for a particular well or area can be terminated shall be if DEC concurs that the **Table XI-1** groundwater protection standards have been met for three (3) consecutive years of sampling for Termination Monitoring. Where the historical groundwater monitoring data indicates a relapse of contamination in the well at a frequency greater than three (3) years, the Department shall determine an alternative monitoring schedule for Termination Monitoring for that well or area.

I. GROUNDWATER WELL DECOMMISSIONING OR REPLACEMENT

1. The Permittee is responsible to submit a Permit modification request, in accordance with **Condition B.10** of this Module, including a well decommissioning plan for any plugging, capping and abandonment of a GWMP well at the Facility. Once approved by the DEC and implemented, the Permittee must submit a GWM well decommissioning report to DEC for review and approval. All wells in the GWMP shall be decommissioned in accordance with **Condition A.4 of Module I** of this Permit. Once a well is decommissioned, the

Permittee must update the GWMP and maintain changes in the GWMR to remove said well(s).

2. The Permittee must submit a Permit modification request, in accordance with **Condition B.10** of this Module, including a work plan for any well replacement proposal. The Permittee must receive DEC approval prior to a well replacement installation. The new well should retain the same vertical and horizontal characteristics as well as the original well as well as the screen depth should be at the same stratigraphic unit. DEC will review this on a case-by-case scenario.

TABLE XI-1
Groundwater Protection Standards⁽¹⁾
 Site Specific Parameters

Constituent	<u>Concentration Limit, µg/L (micrograms per liter)⁽³⁾</u>
Barium ⁽²⁾	1000
Cadmium ⁽²⁾	5
Chromium, Total ⁽²⁾	50
Hexavalent Chromium ⁽²⁾	50
Cyanide, Total ⁽²⁾	100
Lead, Total ⁽²⁾	25
Copper ⁽²⁾	200
1,4-Dioxane	0.35
Perfluorooctane Sulfonic acid (PFOS)	0.0027
Perfluorooctanoic acid (PFOA)	0.0067

Footnotes:

1. If the facility has surface water requirements, they are captured in a monitoring plan.
2. This list contains all known Constituents of Concern (COCs) for the Facility, however, the Facility is currently subject to groundwater monitoring requirements for these particular COCs. Additional information may be found in the GWMP or GWMR.
3. The total concentration of all organic constituents, excluding pesticides, herbicides, vinyl chloride, and trihalomethanes, shall not exceed 100.0 ug/l.

MODULE XII

RESERVED

MODULE XIII

Scheduled Dates

MODULE XIII SCHEDULED DATES

A. COMPLIANCE SCHEDULE

The Permittee must complete the following activities within the scheduled timeframes indicated in the following table in accordance with 6 NYCRR 373-1.6(d):

Item No.	Item	Requirement	Compliance Date ¹
1.	Not Applicable		

Footnotes:

1. The Permittee must comply with the reporting requirements of 6 NYCRR 373-1.6(d)(1)(iii) for each interim date and the final compliance date.

B. SCHEDULE OF DELIVERABLES

The Permittee must complete the activities indicated in the following table within the scheduled timeframes from the effective date of the Permit:

Item No.	Item	Requirement	Deliverable Date ¹
1.	Draft Site Management Plan (SMP) Update	Submit a draft SMP prepared in accordance with Modules I and II as well as DER-10 https://extapps.dec.ny.gov/fs/programs/der/templates/smptemplate1.docx . The SMP must be a comprehensive document, must consider and include all site management activities for the entire Facility, and must describe how the Permittee will manage the Facility to achieve remedial goals and objectives for the entire Facility as a whole.	Within one-hundred eighty (180) days of the effective date of this Permit.

Item No.	Item	Requirement	Deliverable Date ¹
2.	Final SMP	Submit a final SMP acceptable to the Department prepared in accordance with Modules I and II as well as DER-10.	Within forty-five (45) days of the NYSDEC approval of the draft SMP.
4.	Initial Well Inspection Report	Module XI, Condition F.2	Within one-hundred eighty (180) days of the effective date of this Permit.
6.	Groundwater Monitoring Plan/Program Update	Module XI, Conditions D.6 and G	Within one-hundred eighty (180) days of the effective date of this Permit.
7.	Environmental Easement (EE) Document Package Submittal	Module II, Condition F.2	Within one-hundred twenty (120) days of the effective date of this Permit.
8.	Environmental Easement Finalization	Module II, Condition F.2	Within sixty (60) days of the Department providing the draft EE for review and execution.

Footnotes:

1. Deliverable Date changes may be made with written approval from the Department.

C. ROUTINE REPORTING

The Permittee must submit the following routine reports to the Department by the indicated due date in accordance with the requirements of this Permit (Note: the

table below is intended to serve as a guide for certain routine reporting required by this Permit. However, the Permittee is still obligated to comply with all applicable regulations cited in this Permit and all conditions and requirements contained in the Modules, Attachments and documents incorporated by reference into this Permit, regardless of whether they are or are not listed in the table below.):

Item No.	Item	Frequency	Due Date ¹	Requirement
1.	Hazardous Waste Manifest Reporting	On-going	Ten (10) days of receipt	6 NYCRR 372.2 and 373-2.5(a)
2.	Annual Report	Annually, if required	March 1, if required	6 NYCRR 373-2.5(e)
3.	Hazardous Waste Reduction Plan Update/Report	Annually	July 1	ECL 27-0908 and Module I, Condition M
4.	SWMU/AOC Current Conditions Assessment Report	Five (5) years, unless requested by DEC	Five (5) years from the date of submittal of initial report or within thirty (30) days of request.	Module II, Condition B.13
5	Post Closure Care Cost Estimate Adjusted for Inflation	Annually	Sixty (60) days prior to anniversary date of establishment of financial instrument	6 NYCRR 373-2.8(c)(2), 6 NYCRR 373-2.8(e)(2) and Module I, Condition P.3
6.	Evidence that Financial Assurance Instruments have been maintained and not lapsed	Annually	Thirty (30) days prior to anniversary of initial approval	Module I, Condition P.11
7.	Well Inspection Report	Triennially	Three (3) years after submittal of the Initial Report	Module XI, Condition F.2

Item No.	Item	Frequency	Due Date ¹	Requirement
8.	Groundwater Monitoring Reports	Annually, or as per approved GWMPs	March 1, or as per approved GWMPs	Module XI, Conditions C and D
9.	Groundwater Monitoring Well Inventory	Every five (5) years, or within sixty (60) days of when wells are modified	Dependent on activity	Module XI, Condition D.3 and Condition I

Footnotes:

1. Routine Date changes may be made with written approval from the Department.

ATTACHMENT A

Permit Modification Log

ATTACHMENT A PERMIT MODIFICATION LOG

The permit may be modified for causes as allowed under 6 NYCRR 373-1.7 and 621.14. Modification shall be requested in writing as required by 6 NYCRR 621.13 and 621.14. Requests for modifications shall be submitted to designees as specified in **Condition W of Module I**.

An application for permit modification is processed pursuant to 6 NYCRR Part 621 and 373-1.7. Applications for minor modifications listed under 373-1.7(c) may be processed without being treated as a new application. For any other modification not explicitly listed as major under 373-1.7(d) or minor modification, the permittee may submit a request for permit modification and request that it be classified and administered as a modification under Part 373-1.7(c)(15). This request must include information supporting the requested classification. The Department shall determine whether the request qualifies to be administered as a modification or an application for a new permit in accordance with Part 621 – Uniform Procedures. In making this determination, the Department shall consider the degree to which the proposed changes are similar to those listed as minor modification under 373-1.7(c), the Federal Regulations under 40 CFR 270.42 and the following criteria:

Minor modifications apply to minor changes that keep the permit current with routine changes to the facility or its operation. These changes do not substantially alter the permit conditions or reduce the capacity of the facility to protect human health and the environment.

Revision #	Affected permit modules, attachments, and/or documents incorporated by reference	Modified page number(s)		Permit modification request date	Permit modification issuance date	The nature of the modifications
		Old	New			

ATTACHMENT B

**Permit Renewal Application,
exclusive of Attachments**

United States Environmental Protection Agency
RCRA SUBTITLE C SITE IDENTIFICATION FORM



1. Reason for Submittal (Select only one.)

☐	Obtaining or updating an EPA ID number for on-going regulated activities (Items 10-17 below) that will continue for a period of time.
☐	Submitting as a component of the Hazardous Waste Report for _____ (Reporting Year)
☐	Site was a TSD facility, a reverse distributor, and/or generator of $\geq 1,000$ kg of non-acute hazardous waste, > 1 kg of acute hazardous waste, or > 100 kg of acute hazardous waste spill cleanup in one or more months of the reporting year (or State equivalent LQG regulations)
☐	Notifying that regulated activity is no longer occurring at this Site
☐	Obtaining or updating an EPA ID number for conducting Electronic Manifest Broker activities
☒	Submitting a new or revised Part A (permit) Form

2. Site EPA ID Number

N	Y	D	0	0	0	8	1	8	4	1	9
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3. Site Name

BASF Queensbury Closed Landfill
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4. Site Location Address

Street Address 236 Jenkinsville Road		
City, Town, or Village Queensbury	County Warren	
State New York	Country USA	Zip Code 12804
Latitude 43.39	Longitude -73.622789	☐ Use Lat/Long as Primary Address

5. Site Mailing Address

☐ Same as Location Street Address

Street Address BASF Corporation, 227 Oak Ridge Parkway		
City, Town, or Village Toms River		
State New Jersey	Country USA	Zip Code 08755

6. Site Land Type

☐ Private	☐ County	☐ District	☐ Federal	☐ Tribal	☒ Municipal	☐ State	☐ Other
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7. North American Industry Classification System (NAICS) Code(s) for the Site (at least 5-digit codes)

A. (Primary) 562211	C.
B.	D.

8. Site Contact Person

Enter the primary site contact here and additional contacts in Appendix A.

First Name Stephen	MI	Last Name Havlik
Title Site Manager & Senior Remediation Specialist		
Email steve.havlik@basf.com		
Phone 914-557-6009	Ext	Fax
Preferred Language English		

A. Site Contact Address☐ Same as Location Address

Street Address 227 Oak Ridge Parkway		
City, Town, or Village Toms River		
State New Jersey	Country USA	Zip Code 08755

9. Legal Owner and Operator of the Site**A. Name of Site's Legal Owner**☐ Same as Location Address

Full Name Town of Queensbury	Date Became Owner (mm/dd/yyyy) Unknown
Owner Type ☐ Private ☐ County ☐ District ☐ Federal ☐ Tribal ☒ Municipal ☐ State ☐ Other	
Street Address 742 Bay Road	
City, Town, or Village Queensbury	
State New York	Country USA
Zip Code 12804	
Email johns@queensbury.net	
Phone 518-761-8229	Ext
Fax	
Comments	

B. Name of Site's Legal Operator☐ Same as Location Address

Full Name BASF Corporation	Date Became Operator (mm/dd/yyyy) 04/09/2009
Operator Type ☒ Private ☐ County ☐ District ☐ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other	
Street Address 227 Oak Ridge Parkway	
City, Town, or Village Toms River	
State New Jersey	Country USA
Zip Code 08755	
Email steve.havlik@basf.com	
Phone 914-557-6009	Ext
Fax	
Comments	

10. Type of Regulated Waste Activity (at your site)

Mark "Yes" or "No" for all current activities (as of the date submitting the form); complete any additional boxes as instructed.

A. Hazardous Waste Activities

☒ Y ☐ N	1. Generator of Hazardous Waste—If "Yes", mark only one of the following—a, b, c	
☐	a. LQG	-Generates, in any calendar month, 1,000 kg/mo (2,200 lb/mo) or more of non-acute hazardous waste (includes quantities imported by importer site); or - Generates, in any calendar month, or accumulates at any time, more than 1 kg/mo (2.2 lb/mo) of acute hazardous waste; or - Generates, in any calendar month or accumulates at any time, more than 100 kg/mo (220 lb/mo) of acute hazardous spill cleanup material.
☐	b. SQG	100 to 1,000 kg/mo (220-2,200 lb/mo) of non-acute hazardous waste and no more than 1 kg (2.2 lb) of acute hazardous waste and no more than 100 kg (220 lb) of any acute hazardous spill cleanup material.
☒	c. VSQG	Less than or equal to 100 kg/mo (220 lb/mo) of non-acute hazardous waste.
☐ Y ☒ N	Is State Generator of Hazardous Waste the same as Federal— If "No", indicate State Generator Category in the space provided.	
☐ Y ☒ N	2. Short-Term Generator (generates from a short-term or one-time event and not from on-going processes). If "Yes", provide an explanation in the Comments section. <i>Note: If "Yes", you MUST indicate that you are a Generator of Hazardous Waste in Item 10.A.1 above.</i>	
☐ Y ☒ N	3. Treater, Storer or Disposer of Hazardous Waste—Note: Part B of a hazardous waste permit is required for these activities.	
☐ Y ☒ N	4. Receives Hazardous Waste from Off-site	
☐ Y ☒ N	5. Recycler of Hazardous Waste	
☐	a. Recycler who stores prior to recycling	
☐	b. Recycler who does not store prior to recycling	
☐ Y ☒ N	6. Exempt Boiler and/or Industrial Furnace—If "Yes", mark all that apply.	
☐	a. Small Quantity On-site Burner Exemption	
☐	b. Smelting, Melting, and Refining Furnace Exemption	

B. Waste Codes for Federally Regulated Hazardous Wastes. Please list the waste codes of the Federal hazardous wastes handled at your site. List them in the order they are presented in the regulations (e.g. D001, D003, F007, U112). Use an additional page if more spaces are needed.

F039						

C. Waste Codes for State Regulated (non-Federal) Hazardous Wastes. Please list the waste codes of the State hazardous wastes handled at your site. List them in the order they are presented in the regulations. Use an additional page if more spaces are needed.

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11. Additional Regulated Waste Activities (NOTE: Refer to your State regulations to determine if a separate permit is required.)**A. Other Waste Activities**

☐ Y ☒ N	1. Transporter of Hazardous Waste—If “Yes”, mark all that apply.
☐	a. Transporter
☐	b. Transfer Facility (at your site)
☐ Y ☒ N	2. Underground Injection Control
☐ Y ☒ N	3. United States Importer of Hazardous Waste
☐ Y ☒ N	4. Recognized Trader—If “Yes”, mark all that apply.
☐	a. Importer
☐	b. Exporter
☐ Y ☒ N	5. Importer/Exporter of Spent Lead-Acid Batteries (SLABs) under 40 CFR 266 Subpart G—If “Yes”, mark all that apply.
☐	a. Importer
☐	b. Exporter

B. Universal Waste Activities

☐ Y ☒ N	1. Large Quantity Handler of Universal Waste (you accumulate 5,000 kg or more) - If “Yes” mark all that apply. Note: Refer to your State regulations to determine what is regulated.
☐	a. Batteries
☐	b. Pesticides
☐	c. Mercury containing equipment
☐	d. Lamps
☐	e. Aerosol Cans
☐	f. Other (specify) _____
☐	g. Other (specify) _____
☐ Y ☒ N	2. Destination Facility for Universal Waste Note: A hazardous waste permit may be required for this activity.

C. Used Oil Activities

☐ Y ☒ N	1. Used Oil Transporter—If “Yes”, mark all that apply.
☐	a. Transporter
☐	b. Transfer Facility (at your site)
☐ Y ☒ N	2. Used Oil Processor and/or Re-refiner—If “Yes”, mark all that apply.
☐	a. Processor
☐	b. Re-refiner
☐ Y ☒ N	3. Off-Specification Used Oil Burner
☐ Y ☒ N	4. Used Oil Fuel Marketer—If “Yes”, mark all that apply.
☐	a. Marketer Who Directs Shipment of Off-Specification Used Oil to Off-Specification Used Oil Burner
☐	b. Marketer Who First Claims the Used Oil Meets the Specifications

D. Pharmaceutical Activities

☐ Y ☒ N	1. Operating under 40 CFR Part 266, Subpart P for the management of hazardous waste pharmaceuticals—if "Yes", mark only one. Note: See the item-by-item instructions for definitions of healthcare facility and reverse distributor.
☐	a. Healthcare Facility
☐	b. Reverse Distributor
☐ Y ☒ N	2. Withdrawing from operating under 40 CFR Part 266, Subpart P for the management of hazardous waste pharmaceuticals. Note: You may only withdraw if you are a healthcare facility that is a VSQG for all of your hazardous waste, including hazardous waste pharmaceuticals.

12. Eligible Academic Entities with Laboratories—Notification for opting into or withdrawing from managing laboratory hazardous wastes pursuant to 40 CFR Part 262, Subpart K.

☐ Y ☒ N	A. Opting into or currently operating under 40 CFR Part 262, Subpart K for the management of hazardous wastes in laboratories— If "Yes", mark all that apply. Note: See the item-by-item instructions for definitions of types of eligible academic entities.
☐	1. College or University
☐	2. Teaching Hospital that is owned by or has a formal written affiliation with a college or university
☐	3. Non-profit Institute that is owned by or has a formal written affiliation with a college or university
☐ Y ☒ N	B. Withdrawing from 40 CFR Part 262, Subpart K for the management of hazardous wastes in laboratories.

13. Episodic Generation

☐ Y ☒ N	Are you an SQG or VSQG generating hazardous waste from a planned or unplanned episodic event, lasting no more than 60 days, that moves you to a higher generator category. If "Yes", you must fill out the Addendum for Episodic Generator.
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14. LQG Consolidation of VSQG Hazardous Waste

☐ Y ☒ N	Are you an LQG notifying of consolidating VSQG Hazardous Waste Under the Control of the Same Person pursuant to 40 CFR 262.17(f)? If "Yes", you must fill out the Addendum for LQG Consolidation of VSQG hazardous waste.
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15. Notification of LQG Site Closure for a Central Accumulation Area (CAA) (optional) OR Entire Facility (required)

☐ Y ☒ N	LQG Site Closure of a Central Accumulation Area (CAA) or Entire Facility.
A. ☐ Central Accumulation Area (CAA) or ☐ Entire Facility	
B. Expected closure date: _____ mm/dd/yyyy	
C. Requesting new closure date: _____ mm/dd/yyyy	
D. Date closed : _____ mm/dd/yyyy	
☐	1. In compliance with the closure performance standards 40 CFR 262.17(a)(8)
☐	2. Not in compliance with the closure performance standards 40 CFR 262.17(a)(8)

16. Notification of Hazardous Secondary Material (HSM) Activity

☐ Y ☒ N	Are you notifying under 40 CFR 260.42 that you will begin managing, are managing, or will stop managing hazardous secondary material under 40 CFR 260.30, 40 CFR 261.4(a)(23), (24), (25), or (27)? If "Yes", you must fill out the Addendum to the Site Identification Form for Managing Hazardous Secondary Material.
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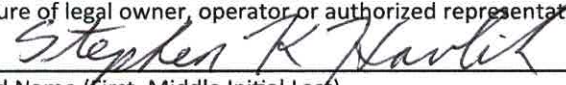
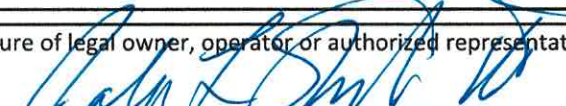
17. Electronic Manifest Broker

☐ Y ☒ N	Are you notifying as a person, as defined in 40 CFR 260.10, electing to use the EPA electronic manifest system to obtain, complete, and transmit an electronic manifest under a contractual relationship with a hazardous waste generator?
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18. Comments (include item number for each comment)

1. Updated application submitted in connection with the 2023 Renewal Application submitted on 3/29/2023.

19. Certification I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations. **Note: For the RCRA Hazardous Waste Part A permit Application, all owners and operators must sign (see 40 CFR 270.10(b) and 270.11).**

Signature of legal owner, operator or authorized representative 	Date (mm/dd/yyyy) 6/22/2026
Printed Name (First, Middle Initial Last) Stephen K. Havlik	Title Site Manager & Sr Remediation Specialist
Email steve.havlik@basf.com	
Signature of legal owner, operator or authorized representative 	Date (mm/dd/yyyy) 6/17/26
Printed Name (First, Middle Initial Last) John F. Strough, III	Title Town Supervisor
Email johns@queensbury.net	

Appendix A: Additional Contacts

1. Contact Name

Contact Type	Preferred Language	
First Name Stephen	MI K	Last Name Havlik
Title Site Manager & Senior Remediation Specialist		
Email steve.havlik@basf.com		
Phone 914-557-6009	Ext	Fax

A. Contact Address

☐ Same as Location Address

Street Address		
City, Town, or Village		
State	Country	Zip Code

2. Contact Name

Contact Type	Preferred Language	
First Name	MI	Last Name
Title		
Email		
Phone	Ext	Fax

A. Contact Address

☐ Same as Location Address

Street Address		
City, Town, or Village		
State	Country	Zip Code

3. Contact Name

Contact Type	Preferred Language	
First Name	MI	Last Name
Title		
Email		
Phone	Ext	Fax

A. Contact Address

☐ Same as Location Address

Street Address		
City, Town, or Village		
State	Country	Zip Code

ADDENDUM TO THE SITE IDENTIFICATION FORM: NOTIFICATION OF HAZARDOUS SECONDARY MATERIAL ACTIVITY

**ONLY fill out this form if:**

- You are located in a State that allows you to manage excluded hazardous secondary material (HSM) under 40 CFR 260.30, 261.4(a)(23), (24), (25), or (27) (or state equivalent; See <https://www.epa.gov/hw/where-2018-definition-solid-waste-rule-effect> for a list of eligible states; AND
- You are or will be managing excluded HSM in compliance with 40 CFR 260.30, 261.4(a)(23), (24), (25), or (27) (or state equivalent) or have stopped managing excluded HSM in compliance with the exclusion(s) and do not expect to manage any amount of excluded HSM under the exclusion(s) for at least one year. Do not include any information regarding your hazardous waste activities in this section. Note: If your facility was granted a solid waste variance under 40 CFR 260.30 prior to July 13, 2015, your management of HSM under 40 CFR 260.30 is grandfathered under the previous regulations and you are not required to notify for the HSM management activity excluded under 40 CFR 260.30.

1. Reason for Notification (Include dates where requested)

- ☐ Facility will begin managing excluded HSM as of _____ (mm/dd/yyyy).
- ☐ Facility is still managing excluded HSM/re-notifying as required by March 1 of each even-numbered year.
- ☐ Facility has stopped managing excluded HSM as of _____ (mm/dd/yyyy) and is notifying as required.

2. Description of Excluded HSM Activity. Please list the appropriate codes (see Code List section of the instructions) and quantities, in short tons, to describe your excluded HSM activity ONLY (do not include any information regarding your hazardous wastes). Use additional pages if more space is needed.

A. Facility Code	B. Waste Code(s) for HSM	C. Estimate Short Tons of excluded HSM to be managed annually	D. Actual Short Tons of excluded HSM that was managed during the most recent odd-numbered year	E. Land-based Unit Code

ADDENDUM TO THE SITE IDENTIFICATION FORM: EPISODIC GENERATOR

**ONLY fill out this form if:**

- You are an SQG or VSQG generating hazardous waste from a planned or unplanned episodic event, lasting no more than 60 days, that moves the generator to a higher generator category pursuant to 40 CFR 262 Subpart L. Note: Only one planned and one unplanned episodic event are allowed within one year; otherwise, you must follow the requirements of the higher generator category. Use additional pages if more space is needed.

Episodic Event	
1. Planned ☐ Excess chemical inventory removal ☐ Tank cleanouts ☐ Short-term construction or demolition ☐ Equipment maintenance during plant shutdowns ☐ Other _____	2. Unplanned ☐ Accidental spills ☐ Production process upsets ☐ Product recalls ☐ "Acts of nature" (Tornado, hurricane, flood, etc.) ☐ Other _____
3. Emergency Contact Phone _____	4. Emergency Contact Name _____
5. Beginning Date _____ (mm/dd/yyyy)	6. End Date _____ (mm/dd/yyyy)

Waste 1

7. Waste Description	8. Estimated Quantity (in pounds)
9. Federal and/or State Hazardous Waste Codes	

Waste 2

7. Waste Description	8. Estimated Quantity (in pounds)
9. Federal and/or State Hazardous Waste Codes	

Waste 3

7. Waste Description	8. Estimated Quantity (in pounds)
9. Federal and/or State Hazardous Waste Codes	

ADDENDUM TO THE SITE IDENTIFICATION FORM:
LQG CONSOLIDATION OF VSQG HAZARDOUS WASTE**ONLY fill out this form if:**

- You are an LQG receiving hazardous waste from VSQGs under the control of the same person. Use additional pages if more space is needed.

VSQG 1

1. EPA ID Number (if assigned)	2. Name	
3. Street Address		
4. City, Town, or Village	5. State	6. Zip Code
7. Contact Phone Number	8. Contact Name	
9. Email		

VSQG 2

1. EPA ID Number (if assigned)	2. Name	
3. Street Address		
4. City, Town, or Village	5. State	6. Zip Code
7. Contact Phone Number	8. Contact Name	
9. Email		

VSQG 3

1. EPA ID Number (if assigned)	2. Name	
3. Street Address		
4. City, Town, or Village	5. State	6. Zip Code
7. Contact Phone Number	8. Contact Name	
9. Email		

United States Environmental Protection Agency
HAZARDOUS WASTE REPORT _____ (reporting cycle)
WASTE GENERATION AND MANAGEMENT (GM) FORM



1. Waste Characteristics

A. Waste Description						
B. EPA Hazardous Waste Code(s)						
C. State Hazardous Waste Code(s)						
D. Source Code	Management Method (G25)			Country Code (G62)		
E. Form Code	F. Waste Minimization Code			G. Radioactive Mixed ☐ Y ☐ N		
H. Quantity	UOM	Density		☐ lbs/gal ☐ sg		

2. On-site Generation and Management of Hazardous Waste

☐ Y ☐ N	Was any of this waste that was generated at this facility treated, disposed, and/or recycled on-site? If yes, continue to On-site Process System 1.	
Process System 1	Management Method Code	Quantity
Process System 2	Management Method Code	Quantity

3. Off-site Shipment of Hazardous Waste

☐ Y ☐ N	A. Was any of this waste that was generated at this facility shipped off-site for storage, treatment, disposal, or recycling? If yes, continue to Site 1.		
Site 1			
B. EPA ID of facility to which waste was shipped	C. Management Method Code	D. Total Quantity Shipped	
Site 2			
B. EPA ID of facility to which waste was shipped	C. Management Method Code	D. Total Quantity Shipped	
Site 3			
B. EPA ID of facility to which waste was shipped	C. Management Method Code	D. Total Quantity Shipped	

4. Comments

--

United States Environmental Protection Agency
HAZARDOUS WASTE REPORT _____ (reporting year)
WASTE RECEIVED FROM OFF-SITE (WR) FORM

**1. Waste 1**

A. Waste Description						
B. EPA Hazardous Waste Code(s)						
C. State Hazardous Waste Code(s)						
D. EPA ID Number	E. Form Code		F. Management Code			
G. Quantity	UOM	Density		☐ lbs/gal ☐ sg		

2. Waste 2

A. Waste Description						
B. EPA Hazardous Waste Code(s)						
C. State Hazardous Waste Code(s)						
D. EPA ID Number	E. Form Code		F. Management Code			
G. Quantity	UOM	Density		☐ lbs/gal ☐ sg		

3. Waste 3

A. Waste Description						
B. EPA Hazardous Waste Code(s)						
C. State Hazardous Waste Code(s)						
D. EPA ID Number	E. Form Code		F. Management Code			
G. Quantity	UOM	Density		☐ lbs/gal ☐ sg		

4. Comments

--

United States Environmental Protection Agency
HAZARDOUS WASTE REPORT
OFF-SITE IDENTIFICATION (OI) FORM

**1. Site 1**

A. EPA ID Number of Off-site Installation or Transporter		
B. Name of Off-site Installation or Transporter		
C. Handler Type (mark all that apply) ☐ Generator ☐ Transporter ☐ Receiving Facility		
D. Address of Off-site Installation		
Street Address		
City, Town, or Village		
State	Zip Code	Country

2. Site 2

A. EPA ID Number of Off-site Installation or Transporter		
B. Name of Off-site Installation or Transporter		
C. Handler Type (mark all that apply) ☐ Generator ☐ Transporter ☐ Receiving Facility		
D. Address of Off-site Installation		
Street Address		
City, Town, or Village		
State	Zip Code	Country

3. Site 3

A. EPA ID Number of Off-site Installation or Transporter		
B. Name of Off-site Installation or Transporter		
C. Handler Type (mark all that apply) ☐ Generator ☐ Transporter ☐ Receiving Facility		
D. Address of Off-site Installation		
Street Address		
City, Town, or Village		
State	Zip Code	Country

4. Comments

--

United States Environmental Protection Agency
HAZARDOUS WASTE PERMIT PART A FORM

1. Facility Permit Contact

First Name	Stephen	MI	K	Last Name	Havlik
Title	Site Manager & Senior Remediation Specialist				
Email	steve.havlik@basf.com				
Phone	914-557-6009	Ext		Fax	

2. Facility Permit Contact Mailing Address

Street Address	227 Oak Ridge Parkway				
City, Town, or Village	Toms River				
State	New Jersey	Country	US	Zip Code	08755

3. Facility Existence Date (mm/dd/yyyy)

10/1/1976

4. Other Environmental Permits

A. Permit Type	B. Permit Number												C. Description

5. Nature of Business

Post-closure care, monitoring, and maintenance of a secured closed landfill.

6. Process Codes and Design Capacities

Line Number	A. Process Code			B. Process Design Capacity		C. Process Total Number of Units	D. Unit Name
				(1) Amount	(2) Unit of Measure		
1	D	8	0	4.6	B	001	Closed Landfill

7. Description of Hazardous Wastes (Enter codes for Items 7.A, 7.C and 7.D(1))

Line No.	A. EPA Hazardous Waste No.			B. Estimated Annual Qty of Waste	C. Unit of Measure	D. Processes									
						(1) Process Codes					(2) Process Description (if code is not entered in 7.D1))				
1	F	0	3	9	135	G	S	0	1						

8. Map

Attach to this application a topographical map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, and other surface water bodies in this map area. See instructions for precise requirements.

9. Facility Drawing

All existing facilities must include a scale drawing of the facility. See instructions for more detail.

10. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas. See instructions for more detail.

11. Comments

Updated application submitted in connection with the 2023 Renewal Application submitted on 3/29/2023.

ATTACHMENT C
SWMU/AOC Current
Conditions Report

BASF Queensbury Secure Landfill
Solid Waste Management Unit Current Conditions Report

The Facility consists of one active solid waste management unit (SWMU), consisting of the closed landfill. Detailed descriptions of the active SWMU along with historic SWMUs are included in the table below.

Table 1. Description of SWMUs

Name	Description and Recommended Action
Closed Landfill	Physical: The 4.6-acre hazardous waste landfill is a regulated unit. Operational: Closure activities of the hazardous waste landfill were performed during summer to fall of 1989 and were completed in spring to summer of 1990. Maintenance, monitoring, inspection and other post-closure care requirements are conducted in accordance with the Permit and Post-Closure Plan. Waste Type and Characteristics: Waste disposed of in the landfill includes wastewater treatment sludges from the production of inorganic pigments (Waste Codes K002, K003, K005, K006, K007, D005, D006, D007, D008, D009 and D010). Release Information: No spills or releases to the environment reported or observed. Recommended Action: Continue post-closure maintenance and monitoring activities.
Hazardous Leachate Surface Impoundment	Physical: A surface impoundment located adjacent to the closed landfill. Operational: The surface impoundment was closed in 1990 in accordance with the approved closure plan stating that Ciba would attempt to remove all waste and waste residues. The Department reviewed the closure certification for compliance with the approved closure plan and, by letters dated March 19, 1990, accepted Ciba's contention that all wastes and waste residue were removed. Waste Type and Characteristics: Used to collect leachate from the landfill and runoff from a truck washing station. Release Information: No spills or releases to the environment reported or observed. Recommended Action: No further action is recommended.

Table 1. Description of SWMUs

Name	Description and Recommended Action
Release from Hazardous Leachate Storage Container	Physical: Former leachate storage container was a 6,000-gallon single wall stainless steel tank, equipped with a remote monitoring system for continuous observation of system components and container leachate levels. The former tank was demolished and removed. Leachate is now collected in the landfill sump and pumped out to a drum on an as-needed basis for off-site disposal. Operational: Leachate storage container contained leachate generated from closed landfill. Waste Type and Characteristics: Leachate. Release Information: A release occurred from the Hazardous Leachate Storage Container during the first quarter of 2008. Leachate of an unknown amount (estimated at less than 300 gallons) was released to the surrounding soils. Sampling of the surrounding and underlying soils was performed in July 2008. Results from this sampling indicated there was no measurable impact from this release. Repairs to the container and support structures were completed and it was determined that no further actions were necessary. Recommended Action: No further action is recommended.

ATTACHMENT D

**Groundwater Monitoring
Plan**



500 North Franklin Turnpike, Suite 314
Ramsey, NJ 07446

T: 201.574.4700

Technical Memorandum

Prepared for: BASF Corporation

Project Title: Jenkinsville Road Closed Landfill, Queensbury NY

Project No.: 203516.426.008.1003

Technical Memorandum

Subject: Groundwater Monitoring Plan

Date: July 20, 2026

To: Stephen Havlik

From: Charles Meyn, Principal Geologist

Copy to: Scott Nelson, P.E., Chief Engineer

Prepared by:

A handwritten signature in black ink, appearing to read "Charles Meyn", written over a horizontal line.

Charles Meyn, Principal Geologist

Reviewed by:

A handwritten signature in black ink, appearing to read "Scott Nelson", written over a horizontal line.

Scott Nelson, P.E., Chief Engineer

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Table 1. Monitoring Well Details



Section 1: Introduction

1.1 Project Background

On September 26, 2018, the NYSDEC issued a five-year Hazardous Waste Management Permit renewal (DEC Permit No. 5-5234-00149/00002) (Permit) to BASF Corporation (formerly Ciba Corporation) for post-closure operation of the former Ciba-Geigy Jenkinsville Road Closed Landfill Facility, located in the Town of Queensbury, Warren County, New York (Figure 1). Figure 2 presents the Site location on the USGS 7.5 minute quadrangle maps (Digital Raster Graphics) circa 2000 on a 1":200' scale.

1.2 Facility Description

The Facility consists of a closed 4.6-acre landfill containing sludge from the former Ciba-Geigy owned wastewater treatment plant associated with the former Ciba-Geigy manufacturing facility in Glens Falls. The Facility is bordered to the north and east by the Town of Queensbury Closed Landfill, to the south by land owned by the Towns of Queensbury, and to the west by Jenkinsville Road, the closed McLaughlin Construction and Demolition Debris Landfill, and a sand and gravel quarry owned by Jenkinsville Sand & Gravel, LLC. In addition, the closed Finch Paper Landfill, is located further east beyond the Town of Queensbury Closed Landfill.

The landfill was constructed in 1976 in a former sand and gravel pit and subsequently acquired by CIBA-Geigy (along with the Glens Falls treatment plant) in 1979. The treatment plant generated approximately 100 to 125 cubic yards of dewatered sludge per week. The sludge material placed in the landfill consisted primarily of metal hydroxides and were classified as hazardous waste. An adjacent surface impoundment was used to collect leachate from the landfill and runoff from a truck washing station.

Closure activities began in the summer of 1989 and were completed in the summer of 1990. Closure certification was received on November 8, 1990, and was approved on March 26, 1991. A Site Plan is included as Figure 3. The extent of the SWMU is included in Figure 4.

Leachate from the landfill is collected in a leachate sump that is approximately 3.8 feet by 3.7 feet. The depth of leachate in the sump is measured during inspections. Once the depth of leachate approaches the maximum permitted depth of 30 centimeters (11.81 inches), the leachate is pumped to a new leachate collection system consisting of 55-gallon drums located on a drum spill containment platform. The drums are picked up by a licensed hauler for disposal.

1.3 Well Network

Twenty-five monitoring wells comprise the compliance monitoring network for the Facility as shown in Figure 3. Three of these wells, MW-1, MW-2 and MW-7 are installed within bedrock while the remainder are installed in the overburden unit. Two of the wells, Queensbury Monitoring Well 2 (QMW-2) and MW-9, are located outside of the Facility. Available well construction details are included in Table 1 and available boring logs are included as Attachment A.

1.4 Geology

The unconsolidated deposits are comprised primarily of Ice-contact stratified drifts consisting of interbedded layers of sand and gravel with cobbles and boulders. These deposits range between 105-191 feet in thickness at the Site. Underlying the drift deposits is a discontinuous lodgment till consisting of sands and gravels in a clayey silt matrix that ranges in thickness between 0 and 54 feet. The till is generally absent from the western edge of the site and thickest at the eastern property boundary. Underlying the unconsolidated

materials is the Glens Falls Formation consisting of dark gray fine-grained and thinly bedded limestone. Geologic cross-sections of the site are presented in Attachment B. The drift deposits and Glens Falls formations function as unconfined and confined aquifer, respectively, while the lower conductivity lodgment till functions as an aquitard and confining unit. Groundwater flow within the drift deposits at the landfill are generally to the southeast.

Section 2: Groundwater Monitoring Plan

Evaluation of groundwater quality at the facility is conducted on an annual basis in the second quarter of each calendar year. The evaluation includes the collection of groundwater elevation measurements and groundwater samples as detailed below.

2.1 Equipotential Gauging

Prior to the collection of groundwater samples, groundwater elevation measurements are conducted at all 25 of the monitoring wells shown in Figure 3. Measurements are collected by means of an electric measuring tape incremented to 0.01 feet increments. Measurements are made from the top of the inner casing. During the gauging event the field technicians will note the well condition and make recommendations for any maintenance needs for the continued use of the wells. Water levels will be collected within a 24-hour period.

2.2 Groundwater Sampling

Annual groundwater sampling will be conducted immediately following the collection of the equipotential measurements. The sampling will be performed on 5 point-of-compliance wells, specifically MW-2C, MW-4D, MW-8A, MW-15A and MW-17A. Samples will be collected by low-flow purging methodology utilizing the dedicated bladder pumps installed within each of these wells by the methods described below. Additional detail on sampling methodology is provided in the Standard Operating Procedures (SOPs) included in Attachment C.

2.2.1 Equipment Calibration

Prior to use all field instruments will be appropriately calibrated in line with manufacturer instructions. Calibration forms will be completed documenting the calibration and maintained in the project files. If an instrument is unable to be properly calibrated a replacement instrument will be used.

2.2.2 Low Flow Purge

The low-flow purge will be conducted using the dedicated bladder pumps installed at each of the wells. The air intake line will be connected to a compressor and control box and the water discharge line will be connected to the multi-parameter sonde (Horiba U-52). The purge will be conducted at between 100-300 mL/minute, with the rate adjusted to prevent drawdown in excess of 0.3 feet. During the purge, groundwater elevation, purge rates, and water quality parameters including pH, temperature, dissolved oxygen, oxidation-reduction potential, conductivity and turbidity will be monitored and recorded at three-minute intervals. The purge will continue for a minimum of 30 minutes. Sampling will be conducted once the three consecutive readings have been recorded with readings within the specified ranges required to assess Stability (see below).

Parameter	Stability Range
Water Level Drawdown	<0.3 ft from Static
pH	± 0.1
Specific Conductance	± 3%
Temperature	± 3%
Dissolved Oxygen	± 10%
Turbidity	± 10% for values greater than 1 NTU
ORP/Eh	± 10 millivolts

2.2.3 Sample Collection

Once stabilization has been confirmed the multiparameter sonde will be disconnected from the water discharge tubing. The same pumping rate used during well purging will be maintained during sample collection. The sample will be collected directly from the water discharge line. Samples will be collected in pre-labeled containers provided by the analytical laboratory will pre-portioned preservatives as required. Samples are collected for analysis for sulfate by EPA method 300.0, total cyanide by SW-846 method 9012 and barium, cadmium, copper, chromium, iron, lead and zinc by SW-846 method 6010.

In addition to the primary samples quality assurance/quality control (QA/QC) samples will be collected. These will include blind duplicates, equipment/rinsate blanks, and triplicate volume samples for use by the laboratory as a matrix spike and matrix spike duplicate. QA/QC samples of the above analysis are collected on a one per 20 basis.

2.2.4 Sample Handling

Samples collected for laboratory analysis during the field investigation will be specifically designated for unique identification. Each sample will be designated by an alpha-numeric code which will identify the sampling location, type or depth (as necessary). The date the sample was taken should also be included, in the following format: YYYYMMDD. An example groundwater sample name is as follows: "MW-01-20130108", indicating that the groundwater sample was collected from MW-01 on January 8, 2013.

Sample custody must be strictly maintained and carefully documented each time the sample material is collected, transported, received, prepared, and analyzed. A COC form will be included with sample transfers/shipments to the analytical laboratory. The analytical laboratory will provide the COC forms to be completed for the analytical samples.

Shipment of samples to an analytical laboratory is typically required upon completion of sample collection, unless the laboratory can provide a courier. Packaging may be necessary in order to protect the sample containers, to maintain the samples at the proper temperature and to comply with applicable transportation regulations.

In general, samples are shipped using packaging that is supplied by the analytical laboratory. The packaging normally includes a shippable insulated box such as an ice cooler and contains protective internal packaging materials such as foam sleeves. Some laboratories use proprietary sample packaging with integral internal packaging. In either case, ice will be used to maintain the temperature of the samples.

2.2.5 Laboratory Analysis

Analysis of groundwater samples will be conducted by a laboratory certified under the NYSDOH Environmental Laboratory Approval Program (ELAP) to provide Analytical Services Protocol (ASP)/Contract Laboratory Program (CLP) deliverables.



Section 3: Data Analysis and Reporting

3.1 Data Verification and Validation

Following receipt of analytical data the Electronic Data Deliverable (EDD) will be loaded into the site EQUIS database. The data will be reviewed for completeness and accuracy. The methodology for data verification is included in Appendix B.

Laboratory results for the groundwater samples will be forwarded to a qualified data validator for preparation of a Data Usability Summary Report (DUSR) in accordance with DER-10 Appendix 2B, Guidance for Data Deliverables and the Development of Data Usability Summary Reports. The DUSR will present a summary of data usability, including a discussion of qualified and rejected data and provide recommendations for resampling/reanalysis, as applicable.

3.2 Reporting

A summary report will be prepared on an annual basis for submission to NYDEC that includes a summary of the required post-closure care and site monitoring activities, including:

- Groundwater monitoring analytical results and associated statistical evaluations (if needed)
- A summary of field parameter measurements recorded during the annual sampling event
- Groundwater elevation data in tabular form, with accompanying potentiometric contour map
- Results of the periodic landfill and monitoring well network inspections
- A schedule for pending repairs at the facility, and/or potential changes proposed to the groundwater monitoring plan, if needed

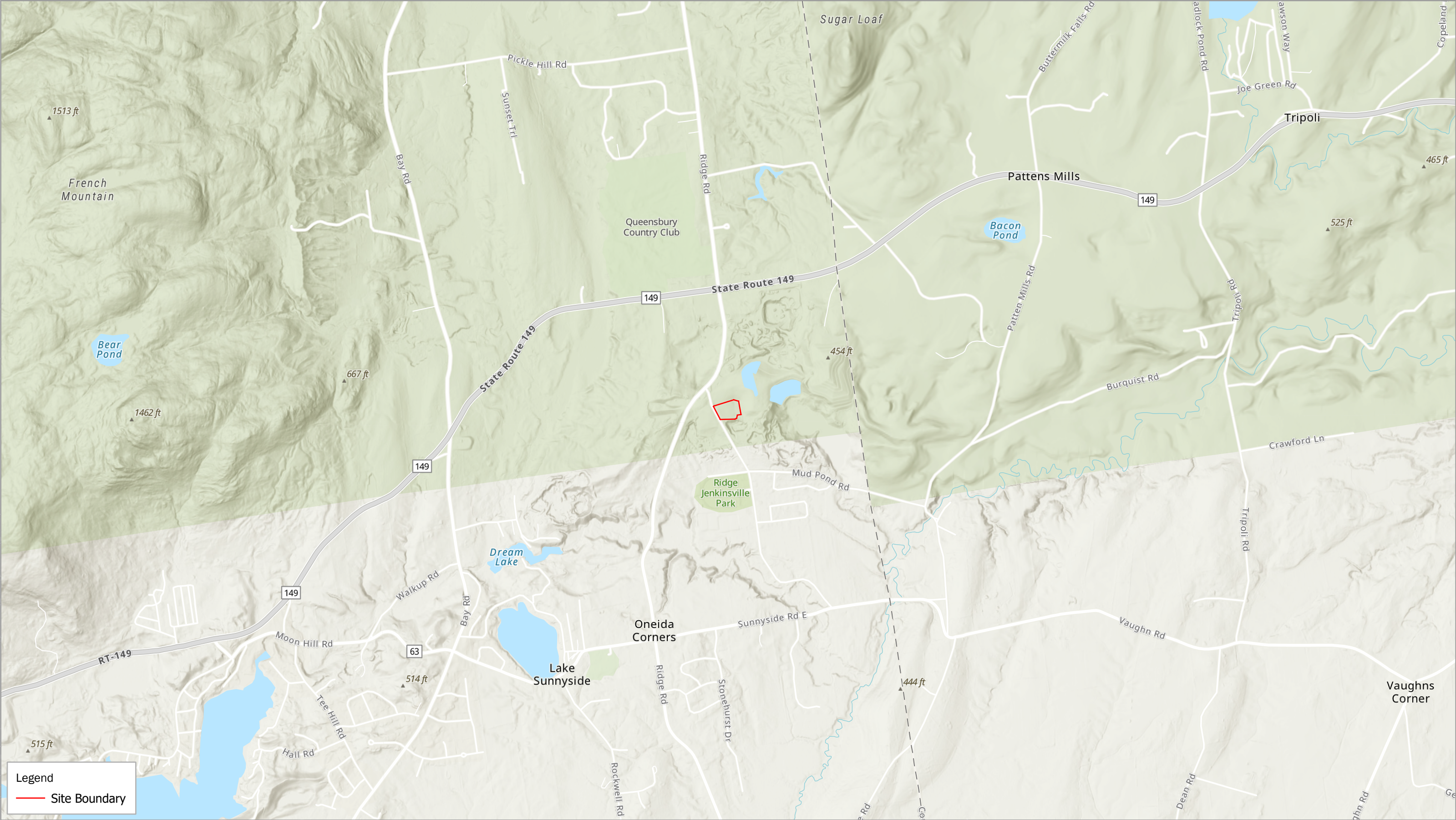
The analytical results will be provided to the NYSDEC as an Electronic Data Deliverable (EDD) formatted to the NYSDEC's data submission requirements that are detailed on the NYSDEC's website (<http://www.dec.ny.gov/chemical/62440.html>). This will include: 1) populating the NYSDEC EDD with the analytical data; 2) validating the EDD using the database software application EQUIS™ from EarthSoft®, Inc.; and 3) submitting the validated EDD to the NYSDEC.

Figures



FIG-1

Path: \\bcl.com\pw_ Exports\158606 - BASF OMM 2023\Queensbury_ 2023.aprx Accessed By: CMIEYN at 09/13/2023 07:21



Brown AND Caldwell BASF 158606 Queensbury Landfill 2025 O&M Date: 9/13/2023 7:18 AM	Notes: N/A Spatial Reference: Name: NAD 1983 StatePlane New York East FIPS 3101 Feet Esri, NASA, NGA, USGS, FEMA, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA Drawn By: Charles Meyn Checked By: 0 1,000 2,000 4,000 Feet N	FIGURE 1 SITE LOCATION MAP
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Path: Y:\Shared\Clients\BASF Corp\Toms River\120 Data-Ref\Info\02_Other Site_GIS\Queensbury_2023.aprx Accessed By: CMMEYN at 06/16/2026 16:05



Legend
— Property Line and SWMU Boundary

Brown AND Caldwell
BASF 158606
**Queensbury Landfill
2023 O&M**

Date: 6/15/2026 3:14 PM

Notes: N/A
Spatial Reference:
Name: NAD 1983 StatePlane New York East FIPS 3101 Feet
Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community, Copyright:© 2013 National Geographic Society, i-cubed

Drawn By: Charles Meyn
Checked By:
0 100 200 400 Feet

FIGURE 2
SITE TOPOGRAPHIC MAP

Path: Y:\Shared\Clients\BASF Corp\Toms River\120 Data-Ref-Info\02 Other Site GIS\Queensbury_2023.aprx
Accessed By: CMIEYN at 06/16/2026 16:06



Legend

- Monitoring Wells
- Sampled Compliance Monitoring Wells
- Property Line and SWMU Boundary



BASF 203516

Queensbury Landfill

2025 O&M

Date: 6/15/2026 3:14 PM

Notes: Aerial Imagery Source: Nearmap 3in Resolution taken May 12, 2025.

Spatial Reference:
Name: NAD 1983 StatePlane New York East FIPS 3101 Feet

Drawn By: Charles Meyn

Checked By:

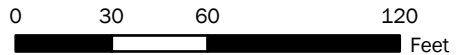


FIGURE 3
SITE PLAN

Path: Y:\Shared\Clients\BASF Corp\Toms River\120 Data-Ref\Info\02 Other Site GIS\Queensbury_2023.aprx Accessed By: CMIEYN at 07/20/2026 15:22



Legend

— Property Line and SWMU Boundary

Brown AND Caldwell BASF 203516
Queensbury Landfill
2025 O&M

Date: 7/10/2026 11:08 AM

Notes: Aerial Imagery Source: Nearmap 3in Resolution taken May 12, 2025.
Spatial Reference:
Name: NAD 1983 StatePlane New York East FIPS 3101 Feet

Drawn By: Charles Meyn
Checked By:

0 30 60 120 Feet

N

FIGURE 4
SWMU LOCATION MAP

Tables



TAB-1

Table 1 - Monitoring Well Details
Jenkinsville Road Closed Landfill
Queensbury, NY

Well	Sampled	Well Type	Top of Casing (ft MSL) ¹	Ground Elevation	TD	Screened Interval	Screen Material	Well Type	Easting	Northing	Notes
MW-1	Not Sampled	Piezometer	458.39	455.25	240	180-240	6" Open Borehole	Bedrock	725375.72	1661056.53	
MW-1A	Not Sampled	Piezometer	455.25	454.13	178	169-179	5" Stainless Steel	Overburden	725376.90	1661045.43	
MW-2	Not Sampled	Upgradient, Piezometer	474.68	473.34	240	192-240	6" Open Borehole	Bedrock	725080.67	1661310.33	
MW-2A	Not Sampled	Upgradient, Piezometer	474.90	472.39	190	185-190	6" Stainless Steel	Overburden	725070.13	1661335.00	
MW-2B	Not Sampled	Upgradient, Piezometer	474.38	472.84	163	148-158	5" Stainless Steel	Overburden	725081.57	1661323.70	
MW-2C	Annually	POC Well	473.88	471.95	NA	NA	NA	NA	725091.68	1661304.41	
MW-3	Not Sampled	Upgradient, Piezometer	442.10	441.28	140	132-142	6" Stainless Steel	Overburden	725525.75	1661419.14	
MW-4	Not Sampled	Piezometer	440.99	437.15	153	151-153	6" Open Borehole	Overburden	725586.19	1661130.33	
MW-4A	Not Sampled	Piezometer	441.64	439.02	158	117-158	Multilevel 6" Stainless Steel Screen	Overburden	725570.87	1661097.89	
MW-4B	Not Sampled	Piezometer	437.32	436.57	128	113-123	5" Stainless Steel	Overburden	725611.68	1661140.50	
MW-4C	Not Sampled	Piezometer	439.01	438.17	NA	NA	NA	NA	725561.79	1661115.97	
MW-4D	Annually	POC Well	438.71	436.66	NA	NA	NA	NA	725609.72	1661153.03	
MW-5	Not Sampled	Piezometer	437.13	435.64	150	150-160	6" Stainless Steel	Overburden	725646.05	1661279.80	
MW-6	Not Sampled	Upgradient, Piezometer	437.20	435.95	120	110-120	6" Stainless Steel	Overburden	725620.22	1661409.33	
MW-7	Not Sampled	Piezometer	436.95	436.25	194	165-194	6" Open Borehole	Bedrock	725656.07	1661222.29	
MW-7A	Not Sampled	Piezometer	437.79	436.34	120	111-121	6" Stainless Steel	Overburden	725657.81	1661213.91	
MW-8	Not Sampled	Upgradient, Piezometer	463.29	461.32	166	163-168	6" Stainless Steel	Overburden	725287.79	1661405.45	
MW-8A	Annually	POC Well	464.20	462.29	NA	NA	NA	NA	725279.02	1661398.00	
MW-9	Not Sampled	Piezometer	454.52	453.41	170	165-170	6" Stainless Steel	Overburden	725322.07	1660992.81	Outside SWMU Boundary
MW-15	Not Sampled	Piezometer	453.95	452.47	145	129-139	5" Stainless Steel	Overburden	725435.85	1661047.70	
MW-15A	Annually	POC Well	454.76	452.42	NA	NA	NA	NA	725421.93	1661052.10	
MW-16	Not Sampled	Piezometer	462.52	459.38	149	134-144	5" Stainless Steel	Overburden	725296.43	1661045.45	
MW-17	Not Sampled	Piezometer	471.11	469.01	157	142-152	5" Stainless Steel	Overburden	725195.40	1661115.62	
MW-17A	Annually	POC Well	471.39	469.89	NA	NA	NA	NA	725188.92	1661122.44	
QMW-2	Not Sampled	Piezometer	440.04	437.07	NA	NA	NA	NA	725638.62	1661466.00	Queensbury Landfill Monitoring Well

1) Top of Casing Measuring Point Elevations from October 8, 2024 survey performed by Van Dusen & Steves Land Surveyors, Queensbury, New York.

NA - Data not available

Attachment A: Boring Logs



WOODCOCK BROS.

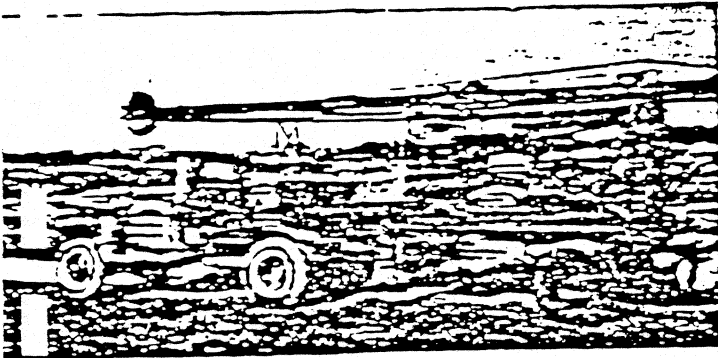
WATER WELL CONTRACTORS

Shaft Drilling

Commercial Installation

Test Pump Service

Water Systems



Hercules Inc.
Glens Falls, N.Y.
Attn: Mr. Burns

Dear Sir:

The following is well log on Hercules wells at landfill, from daily records.

Well #1

Surface to 40' - sand, boulders & hardpan
40 to 76 ft ---- sand & gravel
76 to 118 ft --- sand
118 ft to 160 ft-sand (course)
160 ft to 179 ft-sand & gravel
179 ft -bedrock- light line
179 ft to 240ft- light line

Well capacity 8 GPM,
Static level approx 75 ft.

Well #3

Surface to 20'-boulders, sand
20 to 61 ft---- sand
61 to 90 ft- -- sand & boulders
90 to 99 ft --- boulders
99 to 116 ft--- boulders & sand
116 to 132 ft-- gravel & boulders
132 to 146 ft-- gravel & boulders
146 to 158 ft-- boulders, and sand,
hardpan
158 ft to bedrock-light line
158 to 170 ft- light line

Static level approx 120 ft
Well capacity 3 to 5 gpm
Casing not tight at bedrock, rock
hole might fill with gravel, etc.

P. O. ADDRESS. FORT ANN, N. Y. 12827

7 Miles East of Hudson Falls on Hartford Road

Telephone: NF 2-3266

March 12, 1975

PRIVILEGED AND CONFIDENTIAL

Well #2

Surface to 20'-boulders, junk, and
20 to 70 ft-- boulders, sand
70 to 106 ft- sand
106 to 136 ft- sand & gravel
136 to 181 ft-sand
181 to 191 ft-gravel
191 ft -bedrock- darkline
191ft to 240 ft- darkline

Well capacity 10 gpm

Well #4

Surface to 13 ft- boulders
13 to 52 ft ----- boulder, sand
52 to 125 ft ---- sand & gravel
125 ft- gravel made 10 gpm
125 to 138 ft---- gravel
138 to 145 ft---- sand & gravel
145 to 153 ft --- gravel & fine
sand
153 ft. bedrock

Static level 113 ft.

If we can be of further help to you please call anytime.

Thank you,
W. B. Woodcock
W. B. WOODCOCK

WOODCOCK BROS.

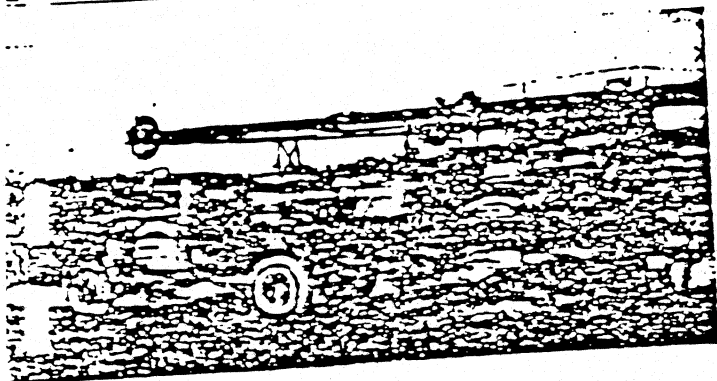
WATER WELL CONTRACTORS

or Shaft Drilling

Commercial Installation

Test Pump Service

Water Systems



P. O. ADDRESS, FORT ANN, N. Y. 12827

7 Miles East of Hudson Falls on Hartford Road

Telephone: 632-5266

May 21, 1982

Ciba Geigy Inc.
Glens Falls N.Y. 12801

Dear Sir:

The following is a well log at Landfill #5 well.

April 15, 1982- moved equipment to site, drilled and cased in sand to 60 feet (no water)

April 16, 1982- drilled and cased in sand to 103 feet (no water)

April 19, 1982- drilled and cased in sand to 105 feet. Drilled and cased in hard pan to 135 feet (no water).

April 20, 1982- drilled and cased in hard pan to 154 feet. Drilled in hard pan to 159 feet. Found bed rock at 161 feet. Left about 7 feet of hole uncased to check if possible water overnight.

April 22, 1982- Found some water in hole in morning. Static level of water was 130 feet. Cased well to bedrock and are ready to set screen.

April 23, 1982- Set 10 feet of Johnson stainless steel 10 slot screen, bottom of screen is at 159 feet. Pulled casing about 6 feet.

April 26, 1982- Welded casing, did some repair, casing pulled very hard.

April 27, 1982- casing is pulled 8 feet, ready to clean screen and develop well.

April 29, 1982- Cleaned and developed screen about 1 gallon per minute capacity. Static level 130 feet. Site vacated.

May 3, 1982- returned to well site and installed tamper proof well head.

May 17, 1982- Installed a 1/2 HP Sub pump with 155 feet of 1" black steel pipe and well seal. Pump is set about 1 1/2 feet off bottom. Ran pump to check and got some clay colored water. Site vacated.

Thank you,

W. F. Woodcock

WOODCOCK BROS.

WATER WELL CONTRACTORS

Elevator Shaft Drilling

Commercial Installation

Test Pump Service

Water Systems



P. O. ADDRESS, FORT ANN, N. Y. 12827

7 Miles East of Hudson Falls on Hartford Road

Telephone: 632-5266

Ciba Geigy Inc.
Glens Falls, N.Y. 12801

Dec. 17, 1982

Dear Sir:

The following is a log of work at Landfill #3 well.

12-6-82 - 8:30 workmen arrived to remove pump from #3 well.
9:30 pulled pump and cut off 5'5" casing due to lowered grade level. Total casing in well at this time 154 ft. less 3½ ft above grade or 150½ ft from grade to lower end.

Static water level at 113 ft 9 inch from grade.

11:30 Have measured well with steel take and found bottom to be 145½ ft from top of casing or 142½ ft from grade. Workmen began to clean out the 9' of fill and to check what this fill was.

11:45 This fill was found to be fine gray sand.

12:00 Well has been cleaned of fill (fine gray sand) to 161'7" from grade. Phone call to Mr. Burns. Discussion to set support leg of black steel pipe in to rock hole to hold screen.

1:00 Site vacated.

12-7-82 10:00 Work men arrived to set screen in #3 well.

10:30 Static water level was 114 ft. below grade.
LARGE No. amount of sand has come into well as the grade to bottom measurement was 160 ft.

12:00 Screen has been assembled with 8 ft 5 inch of 1½" black iron pipe below the bottom to fill rock hole.

Two section of 6 inch telescope stainless steel screens with a 5½ ft of 5 inch black iron pipe placed above the top seal, are now ready to place in hole.

2:00 Screen etc has been placed in hole and bottom of screen measures 150 ft 5 inch from grade.

2:30 One inch pipe has been placed on bottom of screen extending to top of casing to make sure

WOODCOCK BROS.

WATER WELL CONTRACTORS

Elevator Shaft Drilling

Commercial Installation

Test Pump Service

Water Systems



P. O. ADDRESS, FORT ANN, N. Y. 12827

7 Miles East of Hudson Falls on Hartford Road

Telephone: 632-3266

Ciba Geigy Inc

page 2

the screen does not move when casing is pulled.

3:00 Site vacated for today.

12-10-82 10:30 Men arrived with 200 ton jacks to pull casing back approx 10 feet.

12:00 Nonn-jacks are in place and ready to begin to pull casing.

4:00 Casing has been pulled approx 4 feet. Site vacated.

12-13-82 10:30 Pipe pulling continued and a break was made a few feet below grade. Excavating was done and rewelded. Excavating refilled and site vacated at 4:30.

12-14-82 9:30 Work men and equipment arrived to pull pipe from the bottom and expanding spear is used.
4:00 Have had problems to get spear to go down due to residue inside casing. Site vacated.

12-15-82 9:00 Work men arrived to begin to ream rust etc from pipe. Inside spear will not go to bottom due to rust etc build up. Have at hand a 6 inch reamer and will run this inside pipe.
12:00 Reamer has gone to bottom. Will attempt to get spear to bottom.
4:00 Spear did to to bottom and did grip pipe. Did pull an additional 6 feet of pipe or a total of 10 feet removed. Full length of screen is exposed. Work ceased for today.

12-16-82 9:00 Workmen arrived and began to remove pipe spear and clean hole.
12:00 Hole has been cleaned and flushed.
2:00 Cap and plate has been welded in place. Top of well pipe is 3 feet above grade.
3:00 Equipment dismantled and site vacated.

cont

WOODCOCK BROS.

WATER WELL CONTRACTORS

Elevator Shaft Drilling

Commercial Installation

Test Pump Service

Water Systems



P. O. ADDRESS, FORT ANN, N. Y. 12827

7 Miles East of Hudson Falls on Hartford Road

Telephone: 622-5266

Ciba Geigy Inc.

page 3

Well screening complete.

12-17-82	9:00	Work men arrived to set customers pump in well and check for operation.
	12:00	Pump set. Well pumped free of water several times. Ready for sampling.
		Site vacated.

WOODCOCK BROS.

WATER WELL CONTRACTORS

Shaft Drilling

Commercial Installation

Test Pump Service

Water Systems



P. O. ADDRESS, FORT ANN, N. Y. 12827

7 Miles East of Hudson Falls on Hartford Road

Telephone: 632-5266

Jan. 12, 1983

Ciba Geigy Inc.
Glens Falls, N.Y. 12801

Dear Sir:

The following is a well drilling log for #2A well at the Landfill.

Date	Formation & remarks	Depth
12-17-82	Boulders & sand	20'
12-20-82	Boulders & boulders	35'
12-21-82	Boulders & gravel	63'
12-22-82	Big boulders at 66' and smaller boulders	80'
12-23-82	Some boulders & some gravel and sand. Changed to sand at 90'	110'
12-27-82	Sand & gravel	155'
12-28-82	Sand & gravel	174'
12-29-82	Sand & gravel	190'

12-30-82 9:30 workman arrived to set 10 feet of #10 slot Johnson SS screen with a 5 foot top extension of 5 inch black steel pipe.

12:00- Screen is in place, bottom measurement from grade 190 feet.

2:30- set jacks strung inside spear and began to pull pipe back 10 feet to expose screen.

4:30- pipe has been pulled back one foot. Work ceased for today.

1-3-83- 9:30 Workman arrived to continue pulling pipe
12:00- Routine work, pipe is now pulled back 10 feet to expose 10 feet of screen
4:30- Have cleaned screen of some fine sand and did some developing with compressed air. Well has a capacity of about 10 gpm of almost clear water. Site vacated and machine set for well #1A work ceased.

Pump will be installed 1-5-83.

W. B. Woodcock

WOODCOCK BROS.

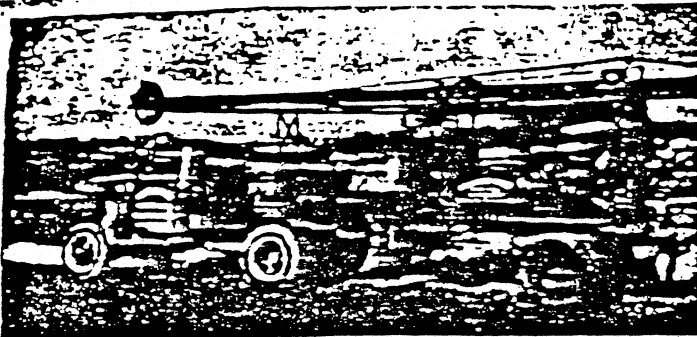
WATER WELL CONTRACTORS

Shale Drilling

Commercial Installation

Test Pump Service

Water Systems



P. O. ADDRESS, FORT ANN, N. Y. 12827

7 Miles East of Hudson Falls on Hartford Road

Telephone: 632-5266

Jan. 19, 1983

Ciba Geigy Inc.
Glens Falls, N.Y. 12801

Dear Sir:

The following is a well drilling log #1A well at
Landfill.

1-4-83	- sand & boulders -----	20'
1-5-83	- sand & some gravel -----	80'
1-6-83	- sand -----	134'
1-7-83	- sand to -----	165'
	gravel to -----	170'
	well produces approx 20 gpm open pipe	
1-10-83	- gravel -----	178'
	well produces approx 10 gpm open pipe Completed drilling at 11:00AM will begin to set screen	
1-11-83	-11:00 to 4:30 setting jacks and pulling casing. Have pulled 3'.	
1-12-83	- 9:00 to 4:30 pulling pipe and cleaning screen. Well makes a lot of water. Well completed. Will set pump soon.	

10' screen

Thank you,
W.R. Woodcock
W.R. Woodcock

cc: Mr. Burns

DUNN GEOSCIENCE CORP. LATHAM, NEW YORK (518) 783-8102					TEST BORING / WELL CONSTRUCTION LOG				
PROJECT Ciba-Geigy - Part B							BORING NO. DGC-6		
CLIENT Ciba Geigy							SHEET 1 OF 6		
DRILLING CONTRACTOR Woodcock Bros.							JOB NO. 164-6-3085		
PURPOSE							ELEV. ^{MP} 437.19 ^{GR} 435.3		
GROUNDWATER					CASING	SAMPLE	CORE	WELL	DATUM
DATE	TIME	DEPTH	CASING	TYPE	threaded Steel	S-S			STARTED: 11/29/84
				DIAMETER	6"	2"			COMPLETED: 12/7/84
				WEIGHT		140#		DRILLER J. Woodcock	
				FALL		30"		INSPECTOR M. Ianniello	

DEPTH FT.	SAMPLE NUMBER	BLOWS PER 6"	WELL CONSTRUCTION	IDENTIFICATION	REMARKS
5	S-1	6		Br c(+)mfS, t(+)\$, t mfG	Rec. = 1.3 Moist
		18			
		7			
		16			
10	S-2	27		Br c(+)mfS, t(+)\$, s(+)mfG	Rec. = 1.2 Moist
		31			
		35			
		41			
15	S-3	6		Br c(+)mfS, l\$, tfG	Rec. = 1.2 Moist
		16			
		17			
20					

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

DUNN GEOSCIENCE CORP.

LATHAM, NEW YORK (518) 783-8102

TEST BORING / WELL CONSTRUCTION LOG

PROJECT Ciba-Geigy Part B

BORING NO. 6

SHEET 2 OF 6

CLIENT Ciba Geigy

JOB NO. 164-6-3085

DEPTH FT.	SAMPLE NUMBER	BLOWS PER 6"	WELL CONSTRUCTION	IDENTIFICATION	REMARKS
20	S-4	39		Br cmfS, tS, tfG	Rec. = .2 Moist Rej. Boulder
25	S-5	25 32 52 73		Br cmG 1(+), cmfS	Rec. = .3 Moist probably cuttings
30	S-6	16 55 29 44		BrGr cmf(+)S, 1(+)S, t(+)mfG <u>Brown-Gray coarse to fine(+)</u> <u>SAND, little Silt, trace(+)</u> <u>medium fine Gravel (SM-SW)</u>	Rec. = 1.2 Moist
35	S-7	6 23 49		LtGr cm(+)fS, t(+)S, 1 mfG	Rec. = 1.0 Moist
40		11 27 36		BrGr c(+)mfS, t(-)S, 1(-)mfG	Rec. = .8 Moist
45					

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

DUNN GEOSCIENCE CORP.

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TEST BORING / WELL CONSTRUCTION LOG

PROJECT Ciba-Geigy Part B

BORING NO. 6

SHEET 3 OF 6

CLIENT Ciba Geigy

JOB NO. 164-6-3085

DEPTH FT.	SAMPLE NUMBER	BLOWS PER 6"	WELL CONSTRUCTION	IDENTIFICATION	REMARKS
45	S-9	23 25 31		Br cmfS, t\$ 1(-) mfG	Rec. = .8 Damp
50	S-10	20 30 40		Br cmfS, t\$, tfG	Rec. = 1.6 Dry
55	S-11	6 6 6 15		Br c(+) mfS, t(-)\$, 1(-) mfG <u>Brown coarse(+) to fine SAND,</u> <u>trace(-) Silt, little(-) medium</u> <u>fine Gravel (SW)</u>	Rec. = 1.2 Dry
60	S-12	6 6 15		Same	Rec. = 1.0 Dry Add H ₂ O to air rot. stream
65	S-13	5 37 63 81		BrGr c(+)mfS, 1\$, s(+)mfG	Rec. = 1.0 Moist
70					

LEGEND - Screen:  Sand:  Gravel:  Soil Backfill:  Bentonite:  Cement Grout: 

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TEST BORING / WELL CONSTRUCTION LOG

PROJECT Ciba-Geigy Part B

BORING NO. 6

SHEET 4 OF 6

CLIENT Ciba Geigy

JOB NO. 164-6-3085

DEPTH FT.	SAMPLE NUMBER	BLOWS PER 6"	WELL CONSTRUCTION	IDENTIFICATION	REMARKS
70	S-14	20		GrBr m(+)fGa, c(+)mfS, tS Coarse kamic Sand	Rec. = 1.3 Moist
		35			
		61			
75					
80	S-15	32		GrBr cmfS, lS, 1 mf(+)G	Rec. = 1.0 Moist
		65			
		78			
85					
90	S-16	41		GrBr Sa, fS, t(-)mG (fine-grained bottom set bed)	Rec. = 1.6 Moist
		110/.4			
95					

 LEGEND - Screen:  Sand:  Gravel:  Soil Backfill:  Bentonite:  Cement Grout: 

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PROJECT Ciba-Geigy Part B

BORING NO. 6

SHEET 5 OF 6

CLIENT Ciba Geigy

JOB NO. 164-6-3085

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

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TEST BORING / WELL CONSTRUCTION LOG

PROJECT Ciba-Geigy Part B

BORING NO. 6

SHEET 6 OF 6

CLIENT Ciba Geigy

JOB NO. 164-6-3085

DEPTH FT.	SAMPLE NUMBER	BLOWS PER 6"	WELL CONSTRUCTION	IDENTIFICATION	REMARKS
120	S-20			121.0 GrBr m(+)fGa, cmf(+)S, l(+)S	
			TILL		
125				Screen .006 slot 110 - 120 Riser 110 - 0	

 LEGEND - Screen:  Sand:  Gravel:  Soil Backfill:  Bentonite:  Cement Grout: 

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LATHAM, NEW YORK (518) 783-8102

TEST BORING / WELL CONSTRUCTION LOG

PROJECT Ciba-Geigy Part B						BORING NO. DGC-7A	
CLIENT Ciba Geigy						SHEET 1 OF 6	
DRILLING CONTRACTOR Woodcock Bros.						JOB NO. 164-6-3085	
PURPOSE						ELEV. ^{MP.} 436.81	^{GR.} 436
GROUNDWATER				CASING	SAMPLE	CORE	WELL
DATE	TIME	DEPTH	CASING	TYPE	Inthreaded Steel	S-S	
				DIAMETER	6"	2"	
				WEIGHT		140#	DRILLER Jim Woodcock
				FALL		30"	INSPECTOR M. Ianniello

DEPTH FT.	SAMPLE NUMBER	BLOWS PER 6"	WELL CONSTRUCTION	IDENTIFICATION	REMARKS
5				Brown Orange coarse to fine SAND, trace fine Gravel, little Silt (SM)	
10	S-1		BC	Brown coarse to fine SAND, little Silt, little(+) medium fine(+) Gravel (SW) (Kamic Sand & Gravel)	Rec. (est.) 1.2 Dry
15					
20					

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

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PROJECT Ciba-Geigy Part B

BORING NO. 7 A

SHEET 2 OF 6

LIENT Ciba Geigy

JOB NO. 164-6-3035

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

LATHAM, NEW YORK (518) 783-8102

TEST BORING / WELL CONSTRUCTION LOG

PROJECT Ciba Geigy Part B

BORING NO. 7 A

SHEET 3 OF 6

CLIENT Ciba Geigy

JOB NO. 164-6-3085

[illegible]

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

LATHAM, NEW YORK (518) 783-8102

PROJECT Ciba Geigy Part B

BORING NO. 7 A

SHEET 4 OF 6

CLIENT Ciba Geigy

JOB NO. 164-6-3085

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

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PROJECT

Ciba Geigy Part B

BORING NO. 7 A

SHEET 5 OF 6

CLIENT

Ciba Geigy

JOB NO. 164-6-3085

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

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TEST BORING / WELL CONSTRUCTION LOG

PROJECT Ciba Geigy Part B

BORING NO. 7 A

SHEET 6 OF 6

CLIENT Ciba Geigy

JOB NO. 164-6-3035

DEPTH FT.	SAMPLE NUMBER	BLOWS PER 6"	WELL CONSTRUCTION	IDENTIFICATION	REMARKS
120				Same Coarse GRAVEL	Change inferred from drilling rate, sound.
				122.0	
				Till	
				SCREEN 10-slot 110-115'	
				40-slot 115-120'	
				riser 110-0'	

LEGEND - Screen:  Sand:  Gravel:  Soil Backfill:  Bentonite:  Cement Grout: 

DUNN GEOSCIENCE CORP.
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TEST BORING / WELL CONSTRUCTION LOG

PROJECT		Ciba-Geigy - Part B		BORING NO. DGC-8	
CLIENT		Ciba-Geigy		SHEET 1 OF 8	
DRILLING CONTRACTOR		Woodcock Bros., Inc./D. Leise		JOB NO.	
PURPOSE		Monitoring Well/Test Boring		ELEV. ^{MP.} 463.37	^{GR.} 461.2
GROUNDWATER		CASING	SAMPLE	CORE	WELL
DATE	TIME	DEPTH	CASING	TYPE	THREADED STEEL
				DIAMETER	6"
				WEIGHT	140#
				FALL	30"
				STEEL MONIT.	STARTED: 12/26/84
				COMPLETED:	
				DRILLER	D. Leise
				INSPECTOR	M. L. Ianniello

DEPTH FT.	SAMPLE NUMBER	BLOWS PER 6"	WELL CONSTRUCTION	IDENTIFICATION	REMARKS
5				Brown Orange coarse to fine SAND, trace (+), Silt (SM-SW).	
10					
15					
20					

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

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PROJECT Ciba-Geigy - Part B

BORING NO. DGC-8 SHEET 2 OF 8

CLIENT

JOB NO.

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

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TEST BORING / WELL CONSTRUCTION LOG

PROJECT Ciba-Geigy - Part B

BORING NO.DGC-8 | SHEET 3 OF 8

CLIENT Ciba-Geigy

JOB NO.

[illegible]

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

LATHAM, NEW YORK (518) 783-8102

PROJECT Ciba-Geigy - Part B

BORING NO. DGC-8 SHEET 4 OF 8

CLIENT Ciba-Geigy

JOB NO.

DEPTH FT.	SAMPLE NUMBER	BLOWS PER 6"	WELL CONSTRUCTION	IDENTIFICATION	REMARKS
70	S-4	16 50 59 65		<u>Brown coarse to fine SAND, little silt (SM).</u>	Rec .8 dry
80		16 50 59 65		<u>Brown coarse to fine SAND, little silt (SW).</u>	Rec .8 dry
90					
95					

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

LATHAM, NEW YORK (518) 783-8102

TEST BORING / WELL CONSTRUCTION LOG

BORING NO. DGC-8

SHEET 5 OF 8

JOB NO.

[illegible]

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

LATHAM, NEW YORK (518) 783-8102

PROJECT Ciba-Geigy - Part B

SHEET 6 OF 8

CLIENT Ciba-Geigy

JOB NO. 164-6-3085

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

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TEST BORING / WELL CONSTRUCTION LOG

PROJECT Ciba-Geigy - Part B

BORING NO.DGC-8

SHEET 7 OF 8

LIENT Ciba-Geigy

JOB NO.

[illegible]

LEGEND - Screen:  Sand:  Gravel:  Soil Backfill:  Bentonite:  Cement Grout: 

LATHAM, NEW YORK (518) 783-8102

PROJECT Ciba-Geigy - Part B

BORING NODGC-8

SHEET 8 OF 8

LIENT Ciba-Geigy

JOB NO.

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

DUNN GEOSCIENCE CORP.
LATHAM, NEW YORK (518) 783-8102

TEST BORING / WELL CONSTRUCTION LOG

PROJECT Ciba Geigy Part B								BORING NO. DGC-9	
CLIENT Ciba Geigy								SHEET 1 OF 8	
DRILLING CONTRACTOR Woodcock Bros., Inc.								JOB NO. 164-6-3085	
PURPOSE Monit Well/Test Boring								ELEV. ^{MP} 454.55	^{GR} 453.3
GROUNDWATER					CASING	SAMPLE	CORE	WELL	DATUM
DATE	TIME	DEPTH	CASING	TYPE	Inread Steel	S-S		Monit Steel	STARTED: 12/26/84
				DIAMETER	6"	2"		6"	COMPLETED:
				WEIGHT		140#		DRILLER J. Woodcock	
				FALL		30"		INSPECTOR M. L. Ianniello	

DEPTH FT.	SAMPLE NUMBER	BLOWS PER 6"	WELL CONSTRUCTION	IDENTIFICATION	REMARKS
5				Brown Orange coarse to fine Sand, little Silt, trace medium fine Gravel (SM).	
10					
15					
20					

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

DUNN GEOSCIENCE CORP.

LATHAM, NEW YORK (518) 783-8102

TEST BORING / WELL CONSTRUCTION LOG

PROJECT Ciba Geigy / MP

BORING NO. DGG-9

SHEET 2 OF 8

CLIENT Ciba Geigy

JOB NO. 164-6-3035

DEPTH FT.	SAMPLE NUMBER	BLOWS PER 6"	WELL CONSTRUCTION	IDENTIFICATION	REMARKS
20	S-1	30 40 96		<u>Gray Brown coarse to fine SAND, little(+) Silt, little GRAVEL (SM).</u>	Rec. = .7 Moist
30					
40	S-2	10 19 34 71		GrBr cm ⁺ fS, t ⁺ \$, tmf ⁺ G	Rec. = 1.0 Moist

LEGEND - Screen:  Sand:  Gravel:  Soil Backfill:  Bentonite:  Cement Grout: 

LATHAM, NEW YORK (518) 783-8102

TEST BORING / WELL CONSTRUCTION LOG

PROJECT Ciba Geigy Part-B

BORING NO. DGC-9 SHEET 3 OF 8

LIENT Ciba Geigy

JOB NO. 164-6-3035

[illegible]

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

LATHAM, NEW YORK (518) 783-8102

TEST BORING / WELL CONSTRUCTION LOG

PROJECT Ciba Geigy Part B

BORING NO. DGC-9 SHEET 4 OF 8

LIENT Ciba Geigy

JOB NO. 164-6-3085

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

LATHAM, NEW YORK (518) 783-8102

TEST BORING / WELL CONSTRUCTION LOG

PROJECT Ciba Geigy Part B

BORING NO. DGC-9 | SHEET 5 OF 8

CLIENT Ciba Geigy

JOB NO. 164-6-3085

Brown coarse to fine SAND, little
Silt, trace medium fine Gravel (SM).

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

DUNN GEOSCIENCE CORP.

LATHAM, NEW YORK (518) 783-8102

TEST BORING / WELL CONSTRUCTION LOG

PROJECT Ciba Geigy Part B

BORING NO. DGC-9 SHEET 6 OF 8

CLIENT Ciba Geigy

JOB NO. 164-6-3085

DEPTH FT.	SAMPLE NUMBER	BLOWS PER 6"	WELL CONSTRUCTION	IDENTIFICATION	REMARKS
120	S-6	20 58 88		Brown coarse to fine SAND, trace(+) <u>Silt (SW-SM)</u>	Rec. = 1.0 Moist-WET
130	S-7	18 46 42 71		Brown Gray medium fine SAND, little(+) <u>Silt (SM).</u>	Rec. = 1.4 WET
140	S-7			Brown Gray medium fine SAND, little(+) <u>Silt (SM).</u>	Rec. = 1.2

LEGEND - Screen:  Sand:  Gravel:  Soil Backfill:  Bentonite:  Cement Grout: 

LATHAM, NEW YORK (518) 783-8102

TEST BORING / WELL CONSTRUCTION LOG

PROJECT Ciba Geigy Part B

BORING NO. DGC-9 | SHEET 7 OF 8

CLIENT Ciba Geigy

JOB NO. 164-6-3085

[illegible]

LEGEND - Screen: Sand: Gravel: Soil Backfill: Bentonite: Cement Grout:

DUNN GEOSCIENCE CORP.

LATHAM, NEW YORK (518) 783-8102

TEST BORING / WELL CONSTRUCTION LOG

PROJECT Ciba Geigy Part B

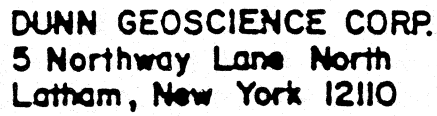
BORING NO. DGC-9 SHEET 8 OF 8

CLIENT Ciba Geigy

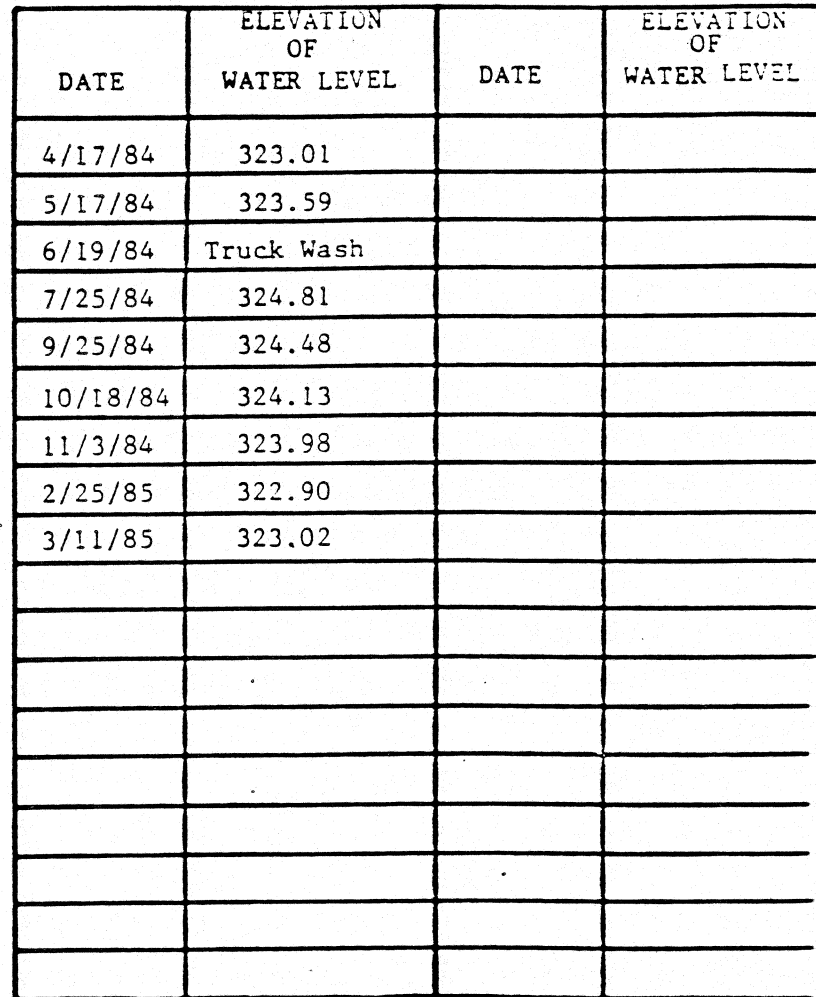
JOB NO. 164-6-3055

DEPTH FT.	SAMPLE NUMBER	BLOWS PER 6"	WELL CONSTRUCTION	IDENTIFICATION	REMARKS
165				<u>Brown Coarse (+) to fine SAND, trace Silt and (+) medium fine Gravel (SW).</u>	Cuttings Very high Q WET
170				<u>Brown coarse to fine SAND, little(+) Silt, trace fine Gravel (SM).</u>	Cuttings WET
				Bedrock 178' B.G. Cutting indicate Glens Falls FM	
				Screen 170-165 Riser 165-0	

LEGEND - Screen:  Sand:  Gravel:  Soil Backfill:  Bentonite:  Cement Grout: 



WELL DEPTH 240



Datum is mean sea level.

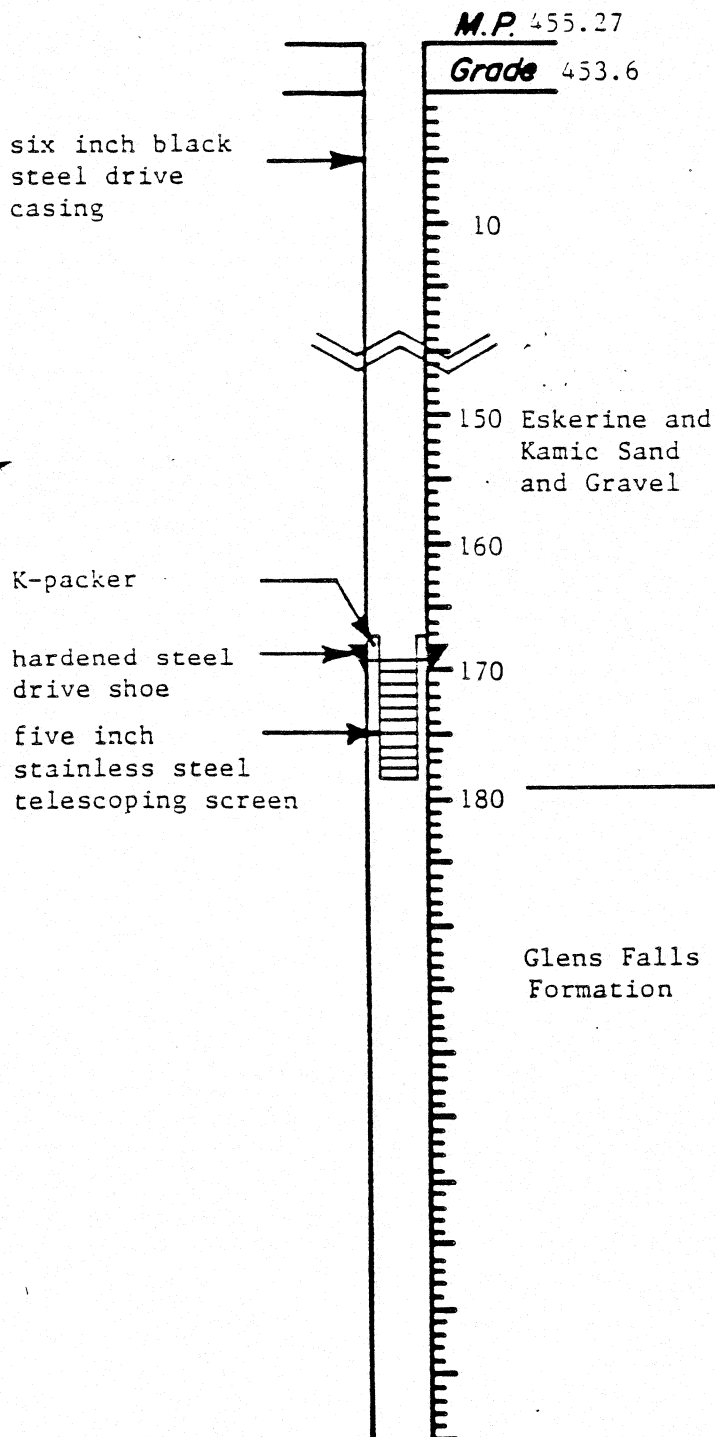


DUNN GEOSCIENCE CORP.
5 Northway Lane North
Latham, New York 12110

Well Number 1A

DATE DRILLED 1/12/83

WELL DEPTH 178



DATE	ELEVATION OF WATER LEVEL	DATE	ELEVATION OF WATER LEVEL
4/17/84	323.58		
5/17/84	324.17		
6/19/84	324.96		
7/25/84	325.35		
9/25/84	325.00		
10/18/84	324.77		
11/3/84	324.55		
1/5/85	323.78		
2/25/85	324.19		
3/11/85	323.44		

NOTE: Grade to measuring point (M.P.)
is not to scale.

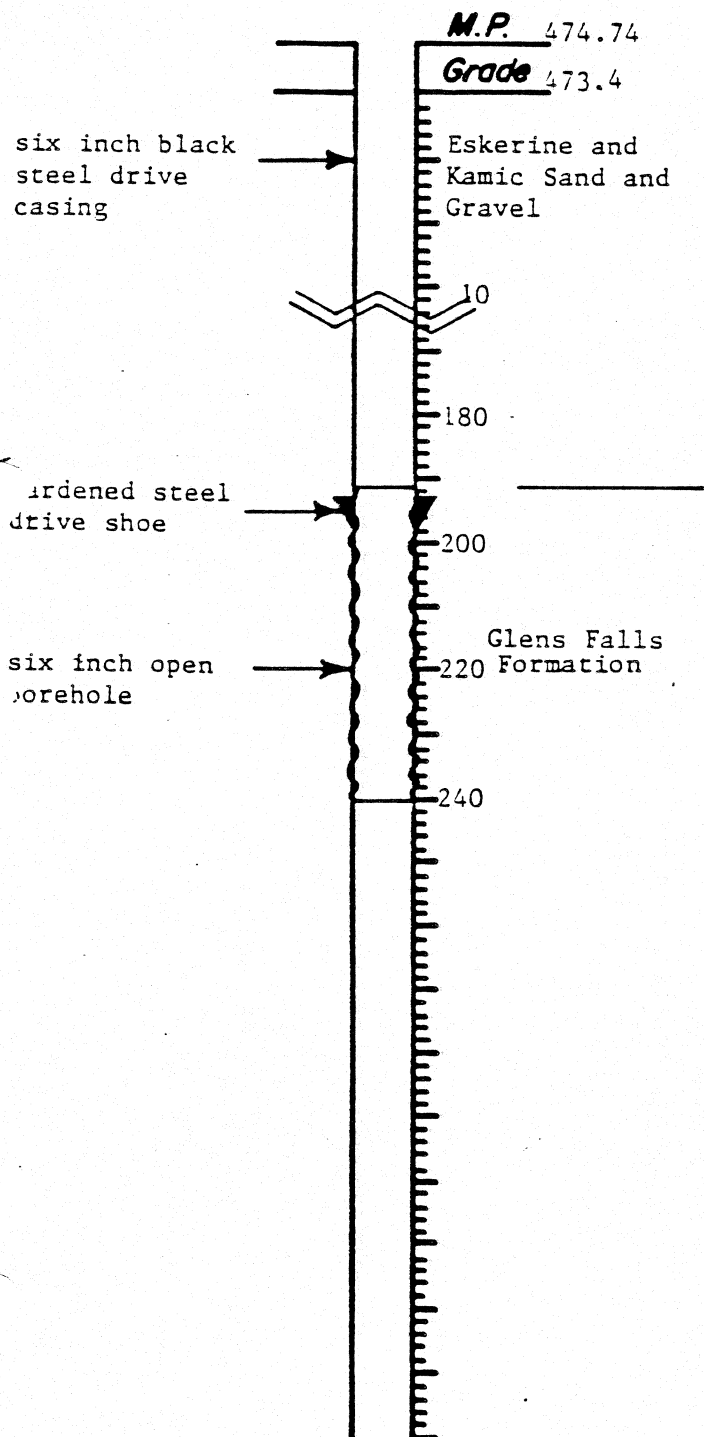
Datum is mean sea level.



DUNN GEOSCIENCE CORP.
5 Northway Lane North
Latham, New York 12110

Well Number 2

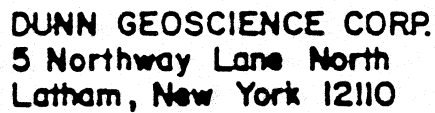
DATE DRILLED 1975
WELL DEPTH 240



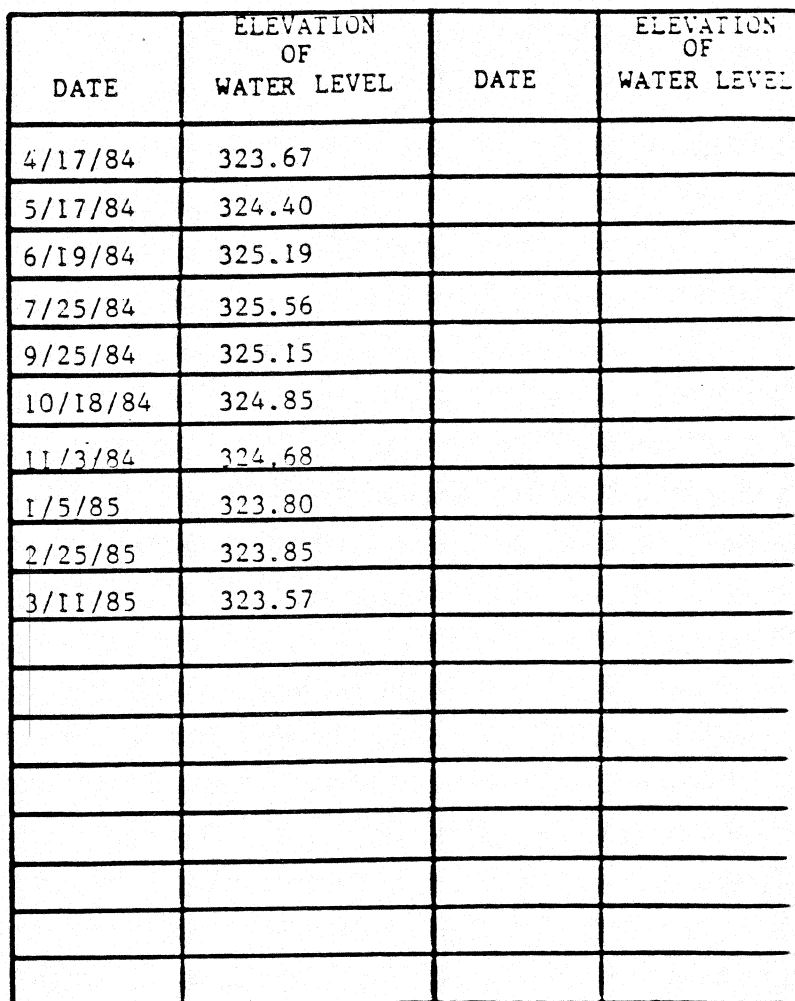
DATE	ELEVATION OF WATER LEVEL	DATE	ELEVATION OF WATER LEVEL
4/17/84	323.58		
5/17/84	324.23		
6/19/84	325.03		
7/25/84	325.32		
9/25/84	324.93		
10/18/84	324.64		
11/3/84	324.43		
1/5/85	324.10		
2/25/85	323.55		
3/11/85	323.01		

NOTE: Grade to measuring point (M.P.)
is not to scale.

Datum is mean sea level.



WELL DEPTH 190 _____



Datum is mean sea level.

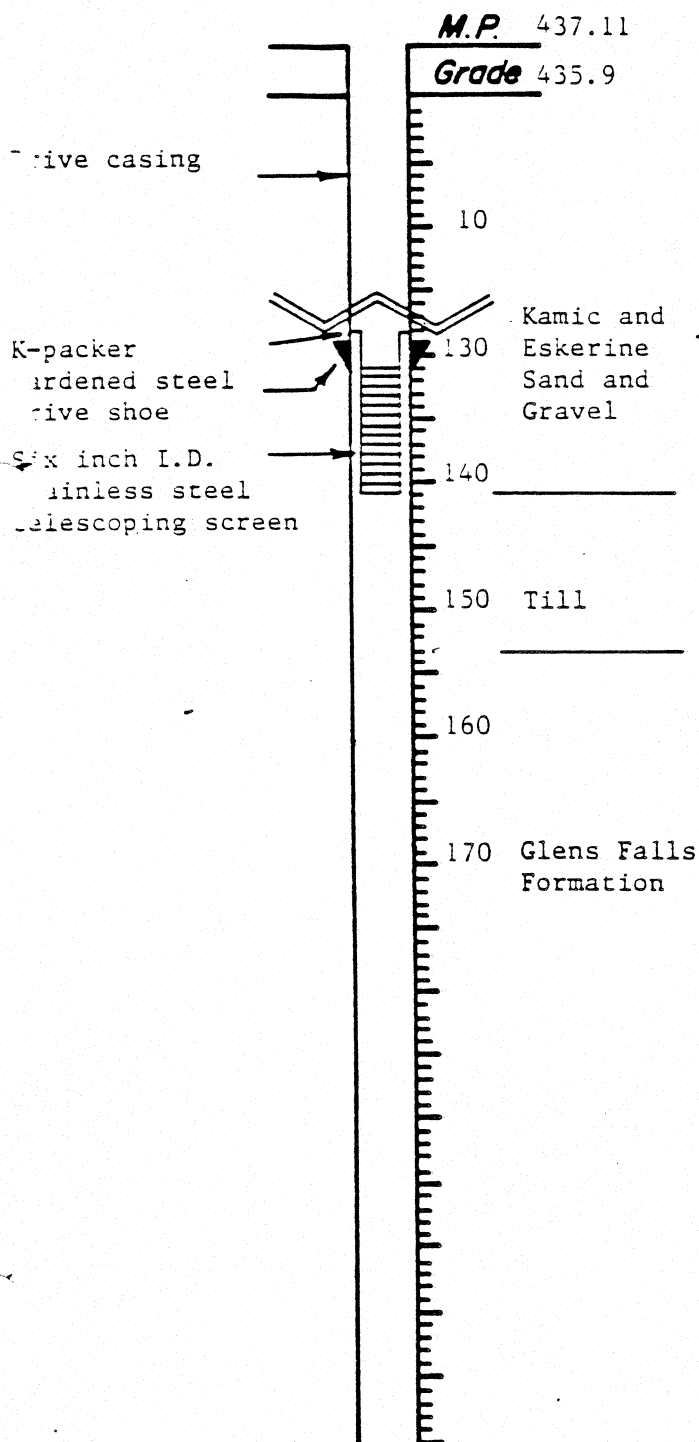


DUNN GEOSCIENCE CORP.
5 Northway Lane North
Latham, New York 12110

Well Number 3

DATE DRILLED 12/17/82 (modified)

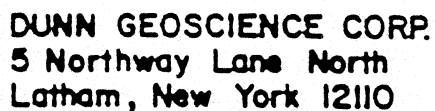
WELL DEPTH 141



DATE	ELEVATION OF WATER LEVEL	DATE	ELEVATION OF WATER LEVEL
4/17/84	323.30		
5/17/84	324.13		
6/19/84	324.90		
7/25/84	325.28		
9/25/84	324.92		
10/18/84	324.69		
11/3/84	324.42		
1/5/85	323.76		
2/25/85	323.36		
3/11/85	323.41		

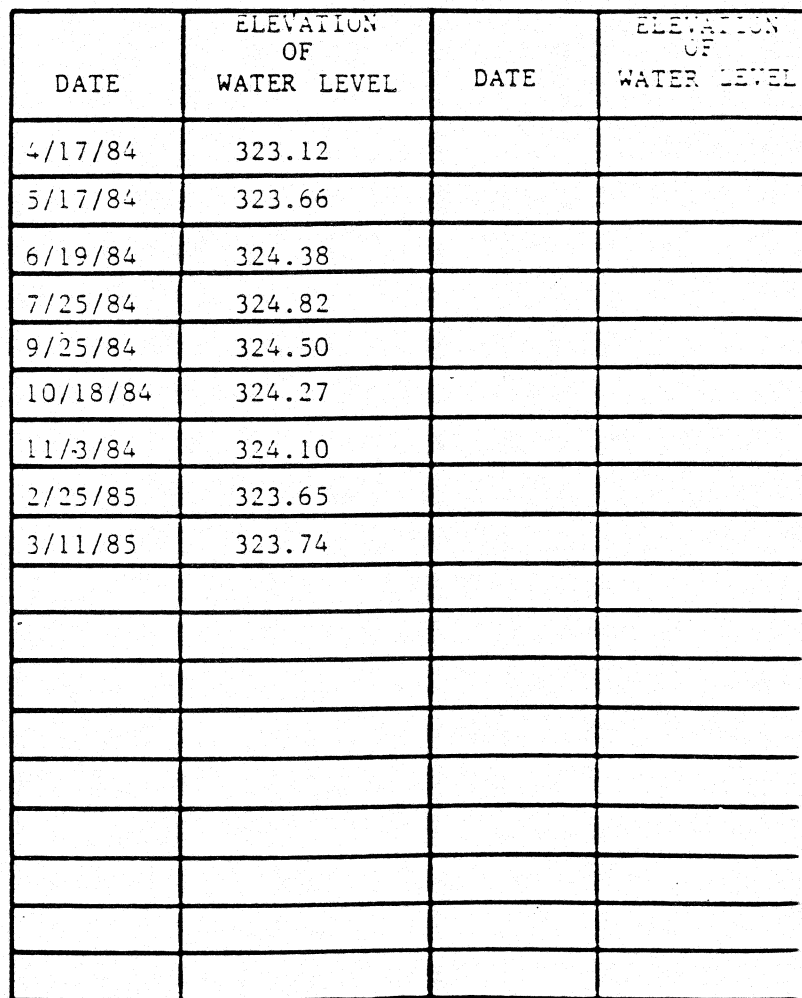
NOTE: Grade to measuring point
is not to scale.

Datum is mean sea level.



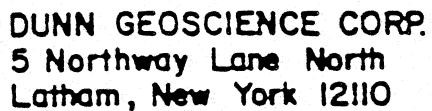
DATE DRILLED 1975

WELL DEPTH 153



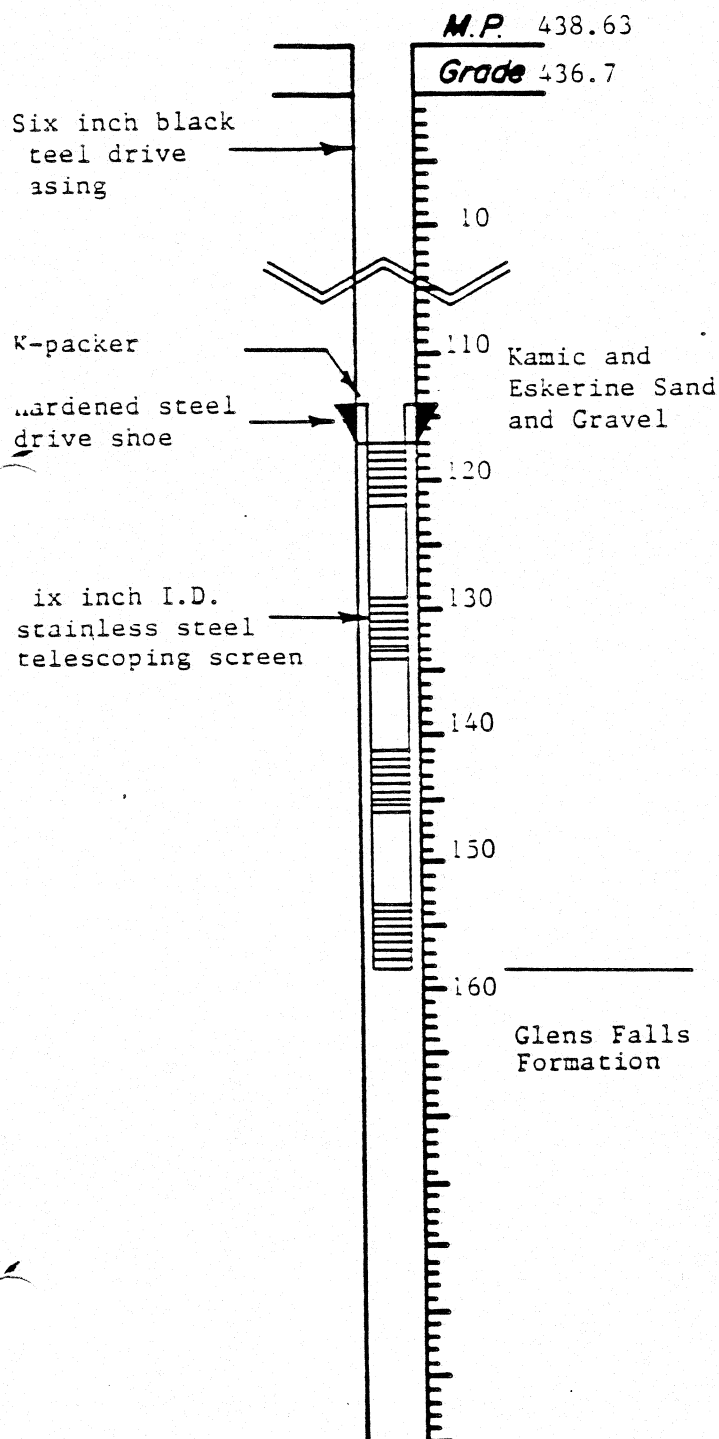
NOTE: Grade to measuring point (M.P.)
is not to scale.

Datum is mean sea level.


$$\begin{array}{r} 158 \\ 112 \\ \hline 46 \end{array}$$

Well Number 4A

DATE DRILLED	1983
WELL DEPTH	158

[illegible]

NOTE: Grade to measuring point (N.R.)
is not to scale.

Datum is mean sea level.



DUNN GEOSCIENCE CORP.
5 Northway Lane North
Latham, New York 12110

Well Number 5

DATE DRILLED 5/17/82
WELL DEPTH 159

M.P. 437.13

Grade 435.2

Kamic and
Eskerine
10 Sand & Gravel

100

Till

120

Six inch black
steel drive
using

K-packer

140

Hardened steel
drive shoe

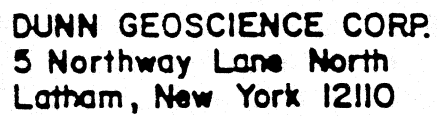
Six inch
stainless steel
screen

Glens Falls
Formation

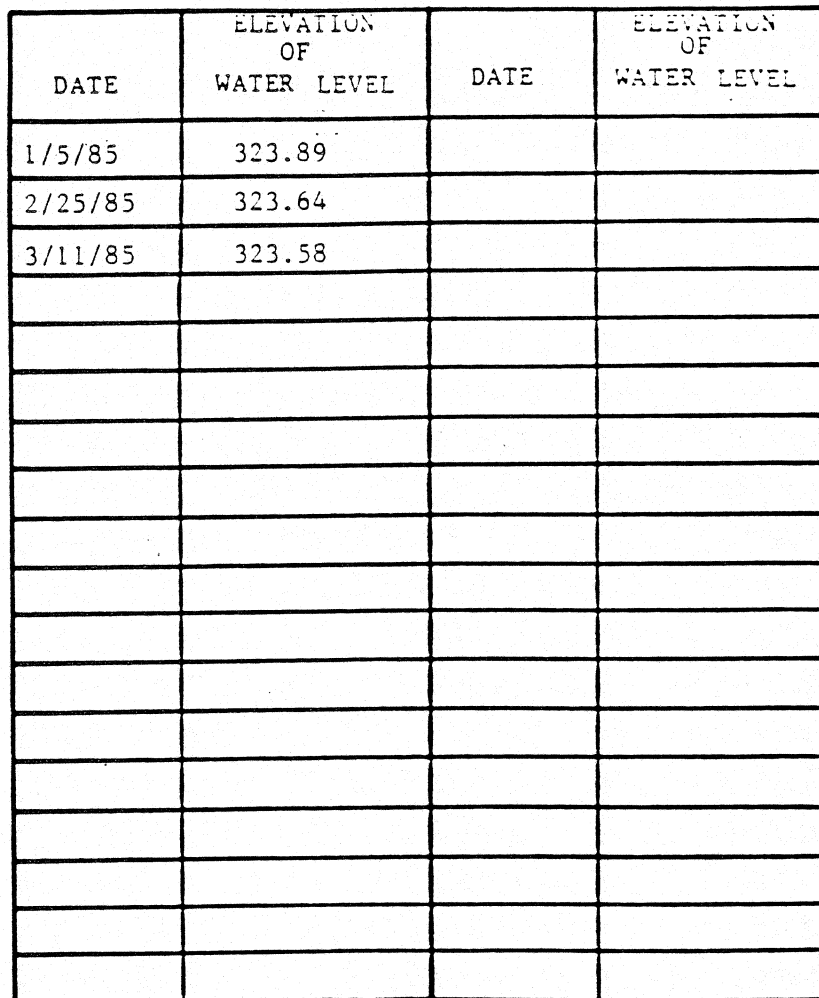
DATE	ELEVATION OF WATER LEVEL	DATE	ELEVATION OF WATER LEVEL
4/17/84	323.96		
5/17/84	323.43		
6/19/84	324.17		
7/25/84	324.59		
9/25/84	324.30		
10/18/84	324.05		
11/3/84	323.84		
1/5/85	322.98		
2/25/85	322.80		
3/11/85	322.73		

NOTE: Grade to measuring point (M.P.)
is not to scale.

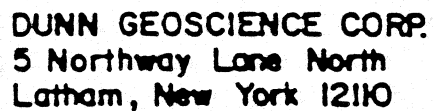
Datum is mean sea level.



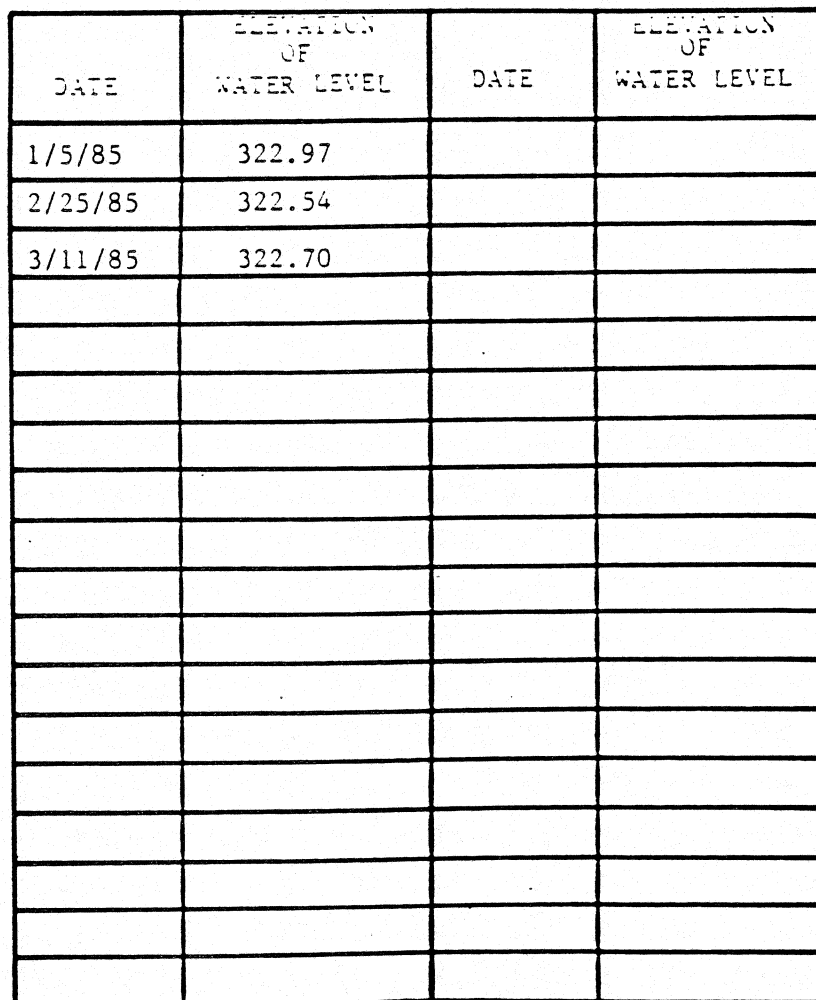
WELL DEPTH 120



Datum is mean sea level.

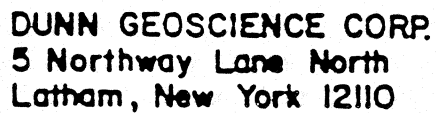


DATE DRILLED	12/19/84
WELL DEPTH	194

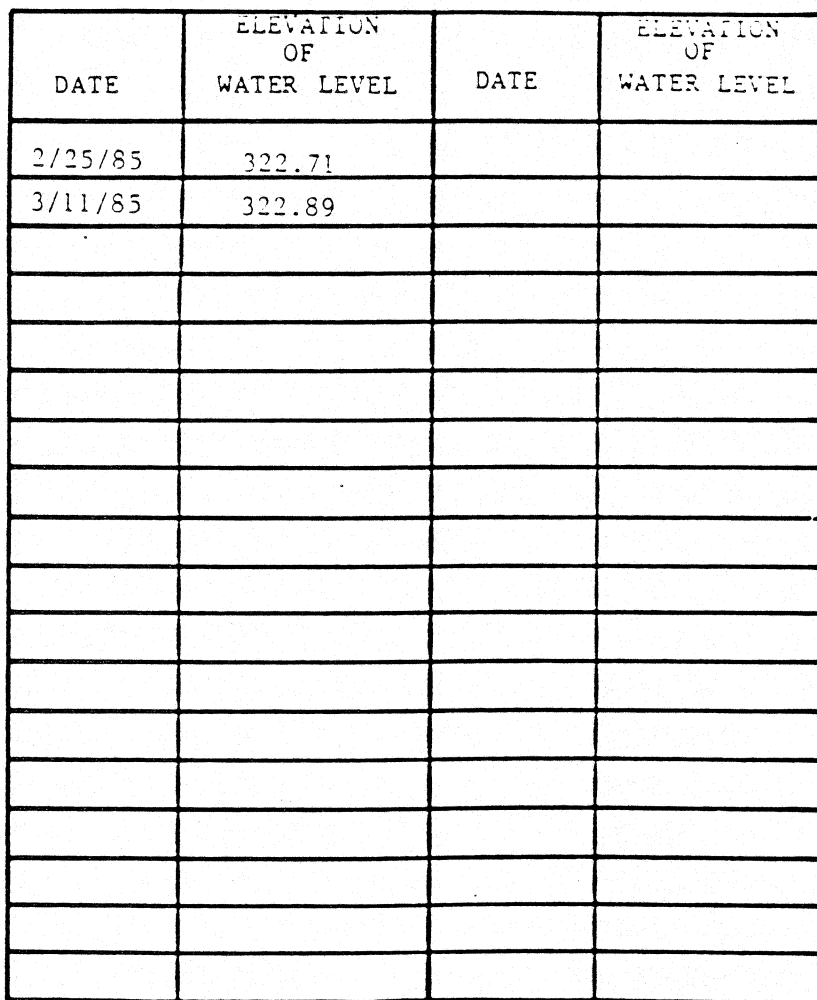


NOTE: Grade to measuring point (M.P.)
is not to scale.

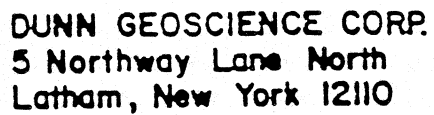
datum is mean sea level.



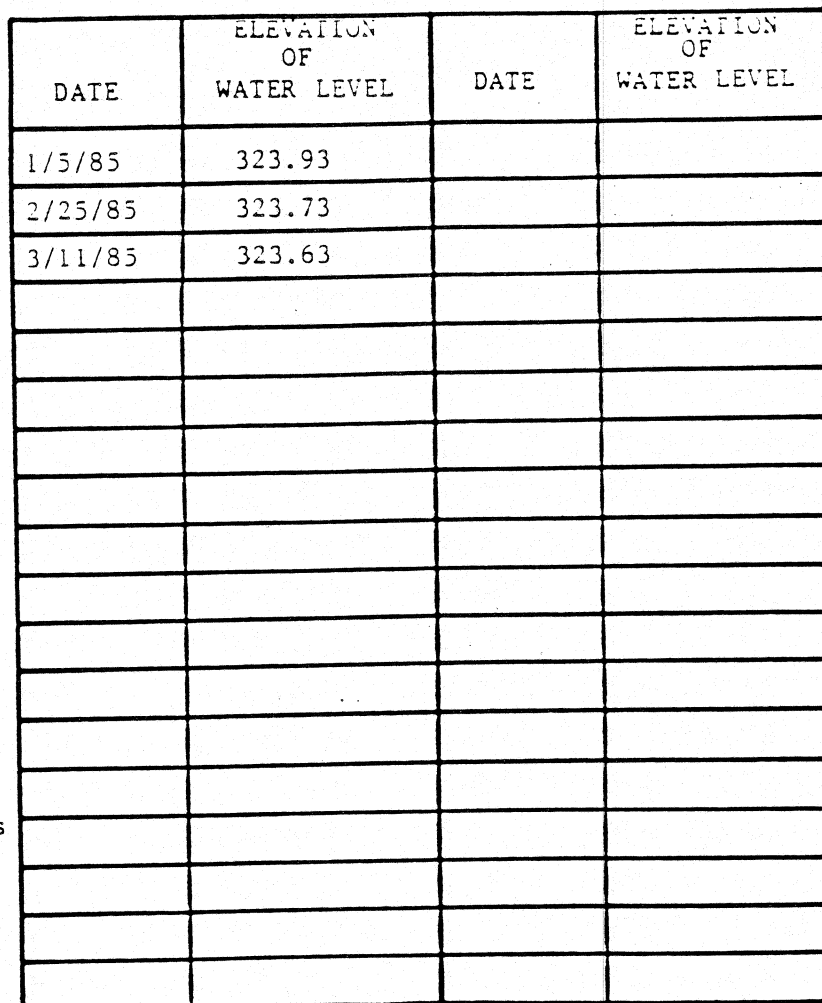
WELL DEPTH 120.0



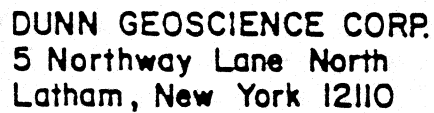
Datum is mean sea level.



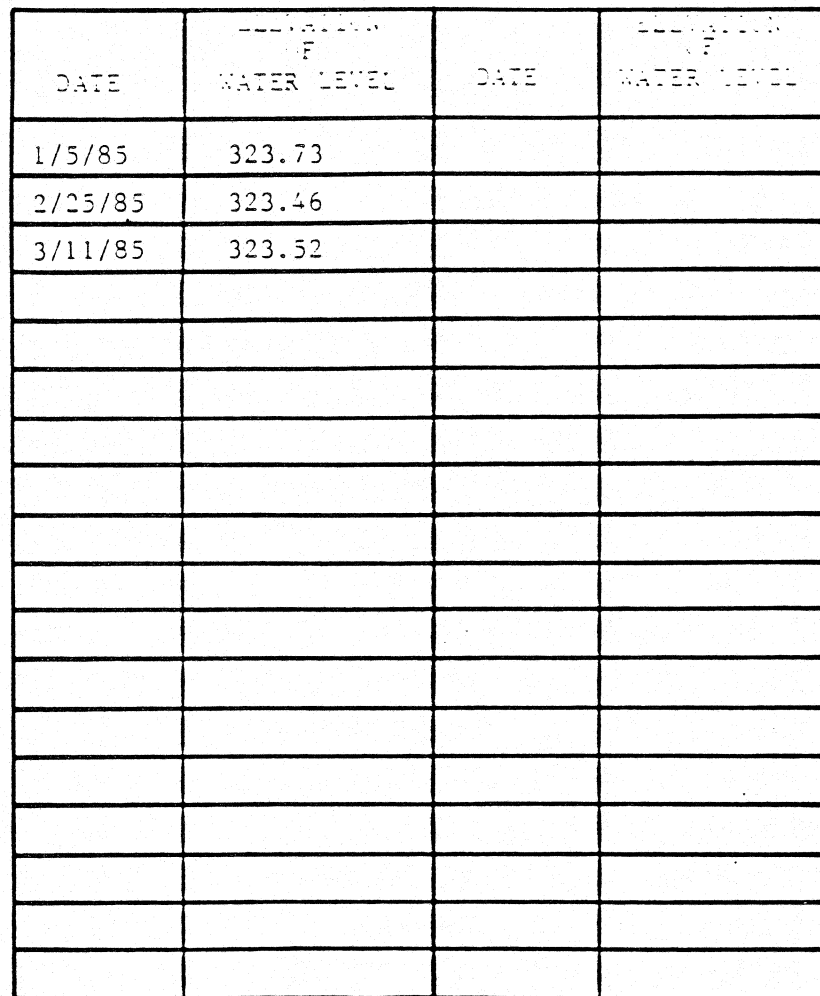
WELL DEPTH 166



Datum is mean sea level.



WELL DEPTH 170



Datum is mean sea level.

PROJECT: CIBA-GEIGY LANDFILL	PROJECT NO: Landfill No. 1
DATE: October 21, 1985 - October 26, 1985	LOCATION: Town of Queensbury
DRILLING CONTRACTOR: Woodcock Bros.	INSPECTOR: L.G. Klopman
DRILLING METHOD: Air Rotary	SAMPLING METHOD: Wash and Cuttings
ELEVATION: 473.0 +	DATUM: TMP 474.37

ELEVATION: 473.0 ±								
SAMPLE			DEPTH	STRATA	SOIL DESCRIPTION			REMARKS
no.	depth	density, color, SOIL, admixtures, moisture, other notes, OPIGIN						
		474.57						

NOTES:

PROJECT: CIBA-GEIGY LANDFILL				PROJECT NO: Landfill No. 1			
DATE: October 21, 1985 - October 26, 1985				LOCATION: Town of Queensbury			
ELEVATION: 473.0 ±				DATUM: TMP 474.37			
SAMPLE			DEPTH	STRATA	SOIL DESCRIPTION		REMARKS
no.	depth	density, color, SOIL, admixtures, moisture, other notes, ORIGIN					
			45				
			50			51.3	No air, water or cuttings returned surface
			55		Cobble Field		Sample recovered from inside of casing
			60		Grey and Brown Cuttings in Fine to Coarse Gravel Sizes		
1	58' - 61'		65				
			70				
			75			-75	Driller stopped using quick foam Strata Ch
2	75' - 78'				Grey Brown Fine Sand to Coarse Gravel - Trace Silt Well Graded		

NOTES:

PROJECT: CIBA-GEIGY LANDFILL					PROJECT NO: Landfill No. 1	
DATE: October 21, 1985 - October 26, 1985					LOCATION: Town of Queensbury	
ELEVATION: 473.0 ±					DATUM: TMP 474.37	
SAMPLE			DEPTH	STRATA	SOIL DESCRIPTION	REMARKS
no.	depth				density, color, SOIL, admixtures, moisture, other notes, ORIGIN	
			90			
3	95' - 97'		95		Grey Brown Fine to Coarse Sand, Some Coarse Gravel	97 Resumed us quick foa
			100			
			105		Encounter More Cobbles or Boulders	
			110			
			115		Cobbles or Boulders	
			120			
			125		Cobbles or Boulders	
NOTES: 6" Steel Casing						

PROJECT: CIBA-GEIGY LANDFILL					PROJECT NO: Landfill No. 1	
DATE: October 21, 1985 - October 26, 1985					LOCATION: Town of Queensbury	
ELEVATION: 473.0 +					DATUM: TMP 474.37	
SAMPLE		DEPTH	STRATA	SOIL DESCRIPTION		REMARKS
no.	depth			density, color, SOIL, admixtures, moisture, other notes, ORIGIN		
		6" Steel Casing	135	Grey Brown Fine Sand, Little Coarse Sand to Fine Gravel, Trace Silt	133.5	Stopped of quic foam
4	137' - 138'					
		7.5 L.F. Steel Extension	140	K-Packer Rubber Seal	139.9 Refusal Had to off cas and dri boulder	
		10 L.F. Slotted Stainless Steel Screen 5" Diameter	145	Grey Brown Fine to Medium Sand Little to Some Silt		
5	155'	5 L.F. Steel Blank	148	Grey Brown Fine Sand and Silt		
		Varied Brown Fine Silty Sand and Blue Clay	150			
	</					

NOTES:

PROJECT: CIBA-GEIGY LANDFILL	PROJECT NO: Landfill No. 1
DATE: October 28, 1985 - November 1, 1985	LOCATION: Town of Queensbury
DRILLING CONTRACTOR: Woodcock Bros.	INSPECTOR: L.G. Klopman
DRILLING METHOD: Air Rotary	SAMPLING METHOD: Wash and Cuttings
ELEVATION: 436.0 +	DATUM: TMP 437.28
SOIL DESCRIPTION	

[illegible]

NOTES:

Monitoring Well No.. 4B cont.

NOTES:

PROJECT: CIBA-GEIGY LANDFILL				PROJECT NO: Landfill No. 1		
DATE: October 28, 1985 - November 1, 1985				LOCATION: Town of Queensbury		
ELEVATION: 436.0 ±				DATUM: TMP 437.28		
SAMPLE		DEPTH	STRATA	SOIL DESCRIPTION		REMARKS
no.	depth			density, color, SOIL, admixtures, moisture, other notes, ORIGIN		
		90				
		95				
		100				
3	103' - 105'	105		Grey Fine Sand, Little Brown Silt		
				5 L.F. Steel Extension 5" Diameter		
		110		K-Packer Rubber Seal		
		113		Slotted S.S. Screen 5" Diameter		
4	116' - 118'	115		Grey Fine Sand, Little Brown Silt		
		120		5 L.F. Steel Blank - 5" Diameter		
		123				
5	123' - 128'	125		Grey Fine to Coarse Gravel, Little Brown Fine to Coarse Sand, Little Silt		
		128				

6" Steel Casing

5" Blank of 5" Pipe

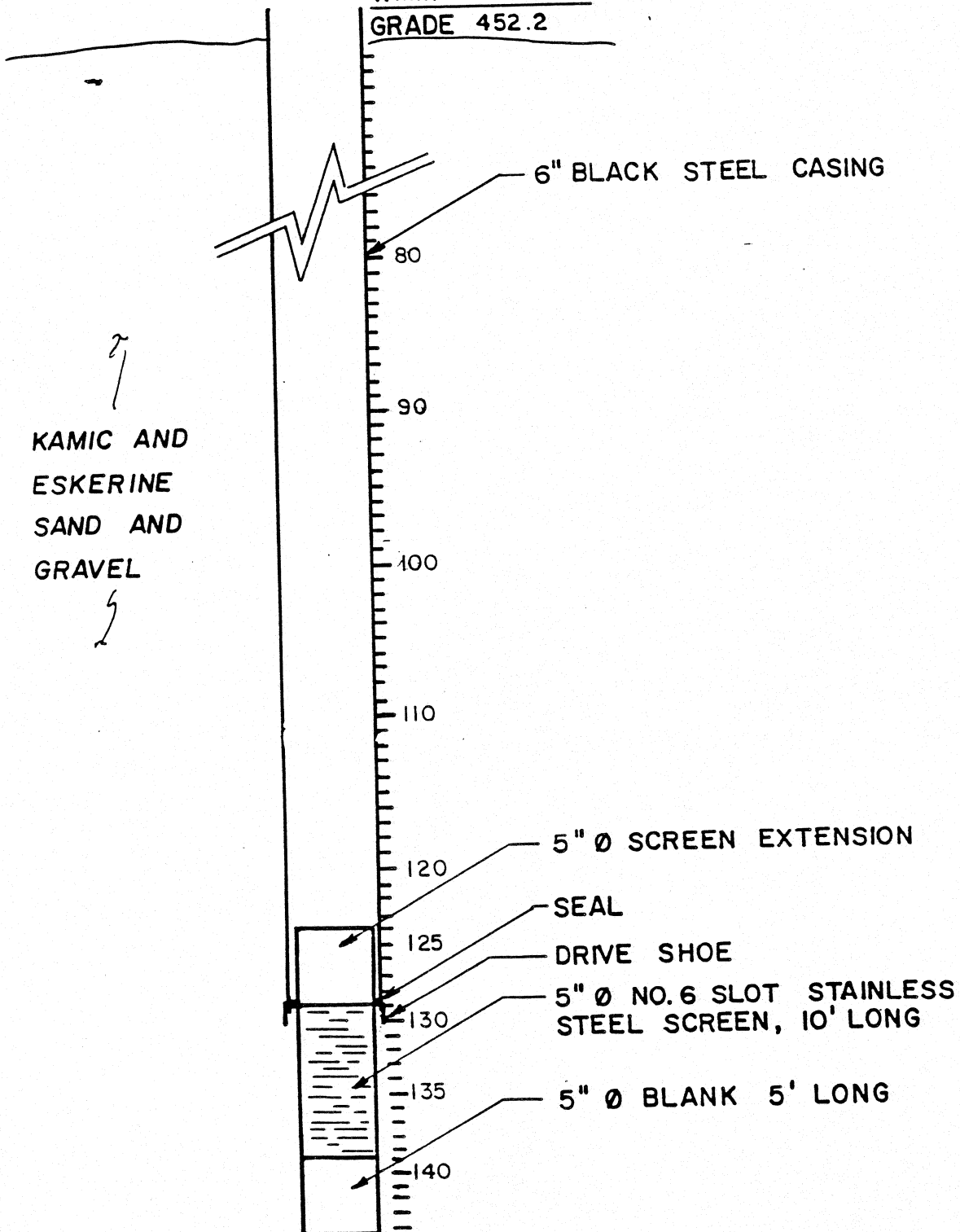
NOTES:

MONITORING WELL No. 15

DATE COMPLETED 5-2-86

T.M.P. 453.94

GRADE 452.2



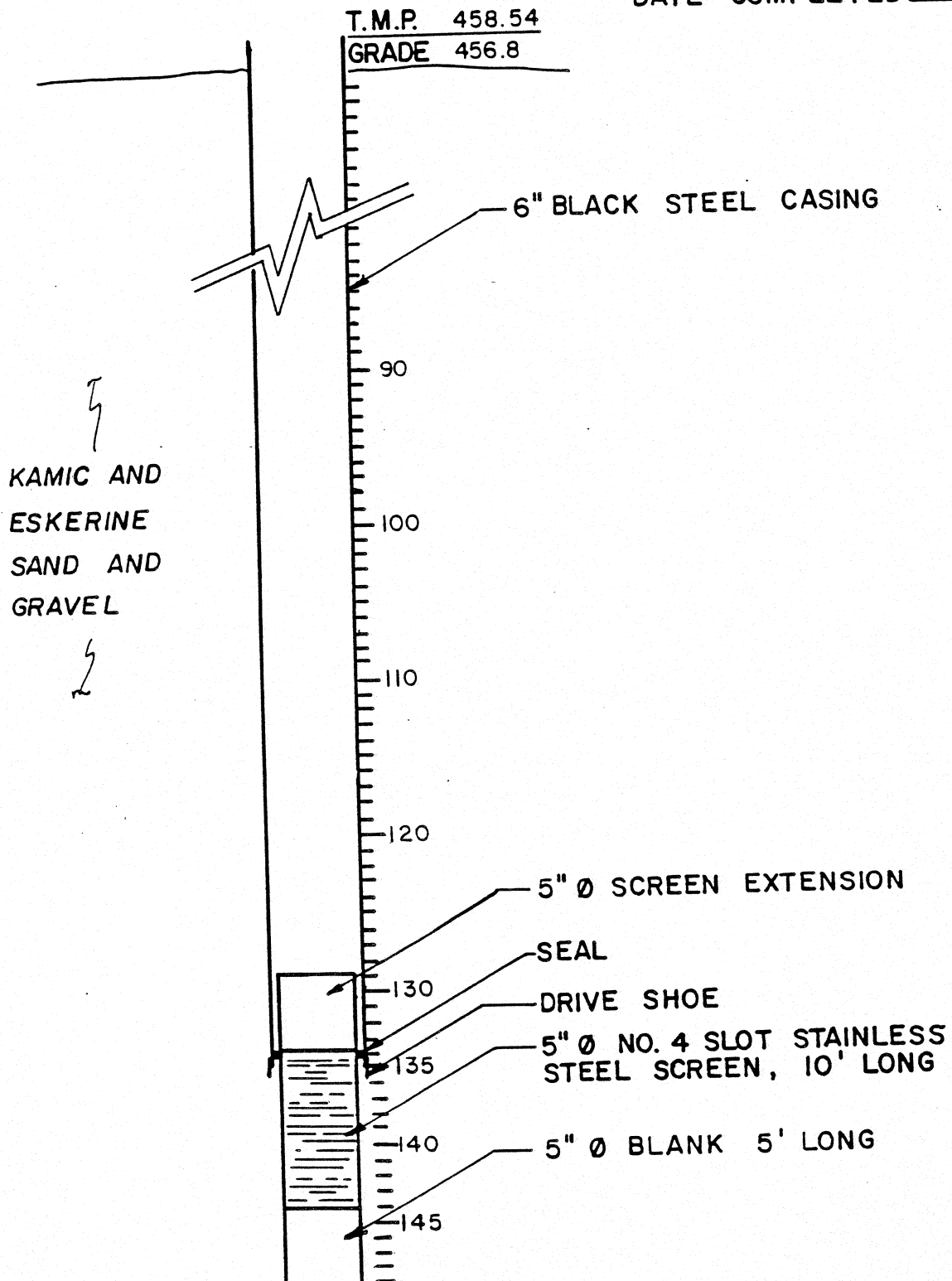
**MALCOLM
PIRNIE**

**CIBA GEIGY HAZARDOUS WASTE
LANDFILL SITE**

MONITORING WELL INSTALLATION DATA

MONITORING WELL No. 16

DATE COMPLETED 4-23-86



**MALCOLM
PIRNIE**

**CIBA GEIGY HAZARDOUS WASTE
LANDFILL SITE**

MONITORING WELL INSTALLATION DATA

MONITORING WELL No. 17

DATE COMPLETED 4-9-86

T.M.P. 466.78

GRADE 465.0

KAMIC AND
ESKERINE
SAND AND
GRAVEL

6" BLACK STEEL CASING

5" Ø SCREEN EXTENSION

SEAL

DRIVE SHOE

5" Ø NO. 6 SLOT STAINLESS
STEEL SCREEN, 10' LONG

5" Ø BLANK 5' LONG

**MALCOLM
PIRNIE**

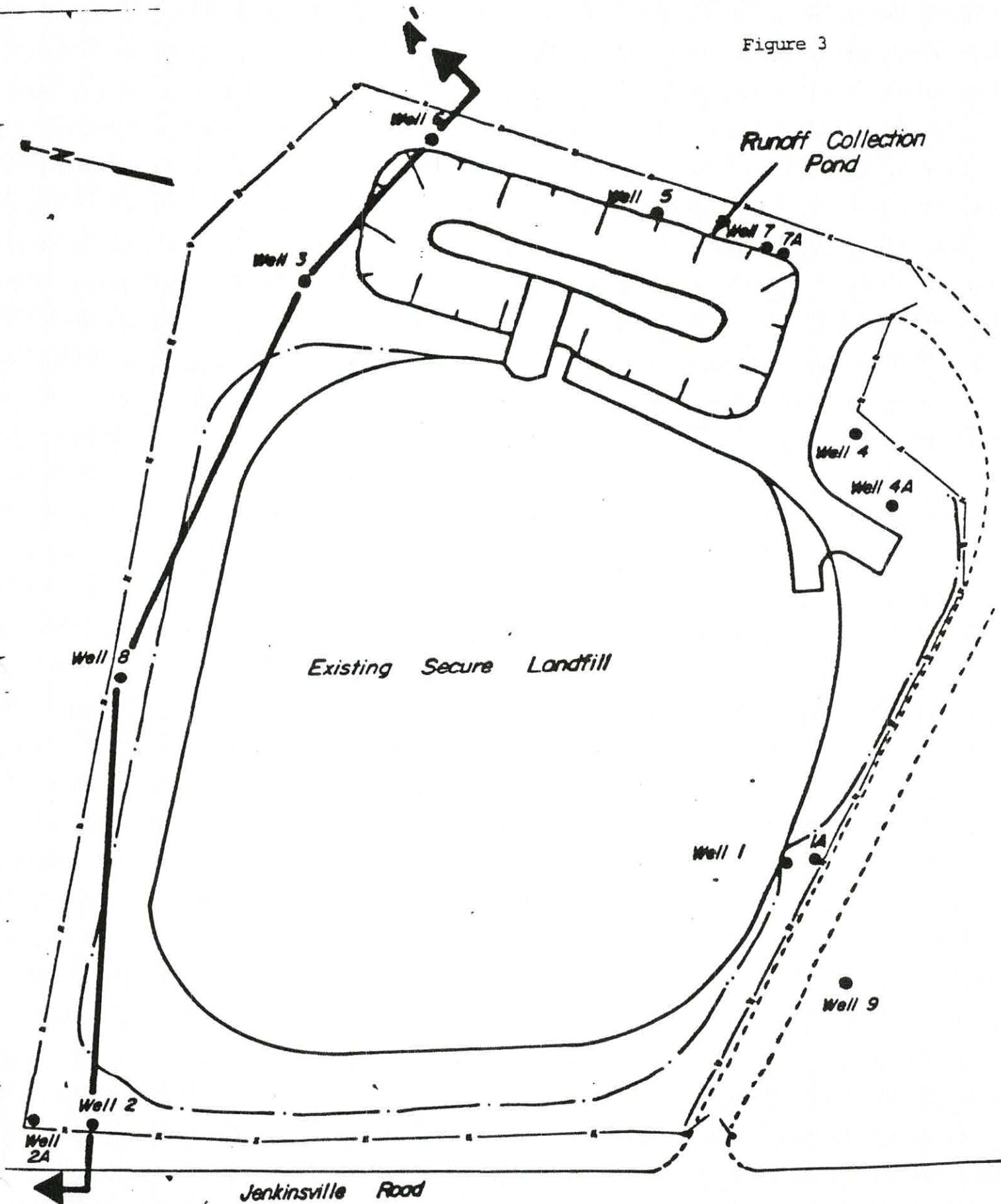
**CIBA GEIGY HAZARDOUS WASTE
LANDFILL SITE**

MONITORING WELL INSTALLATION DATA

Attachment B: Geologic Cross-Sections



Figure 3



LOCATION OF CROSS-SECTION A-A'

Scale: 1" = 67'

GENERALIZED CROSS-SECTION A-A'

Elevation

500'

Well No. 2

M.P. 474.74'
G.L. 473.4'

Well No. 8

M.P. 463.37'
G.L. 461.2'

Well No. 3

M.P. 437.11'
G.L. 435.9'

Well No. 6

M.P. 437.19'
G.L. 435.8'

420'

460'

380'

340'

300'

260'

Sand, Gravel

& Cobbles

Top of Bedrock

(from old grade)

Till

Scale:

Horizontal: 1" = 100'
Vertical: 1" = 40'

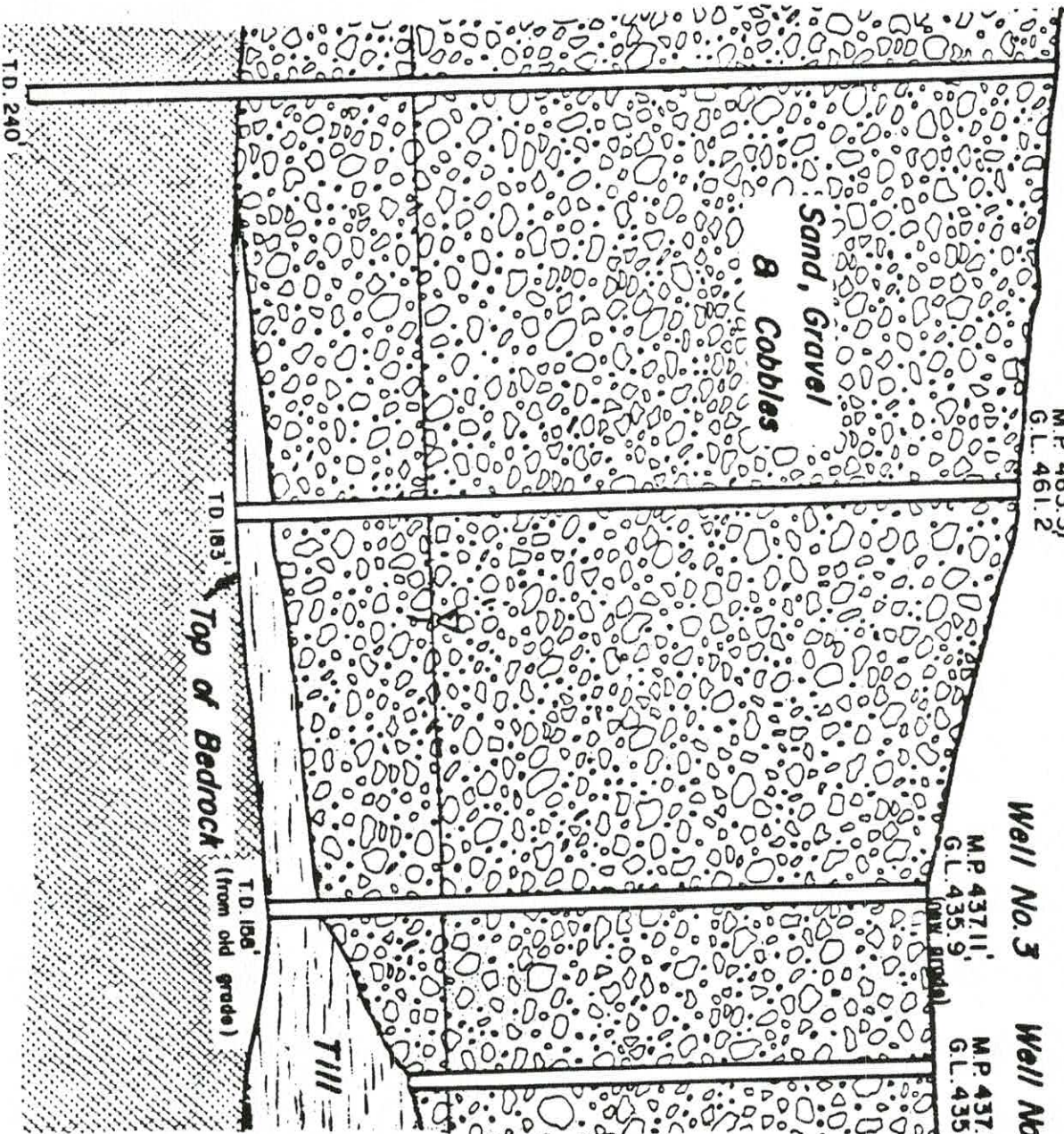
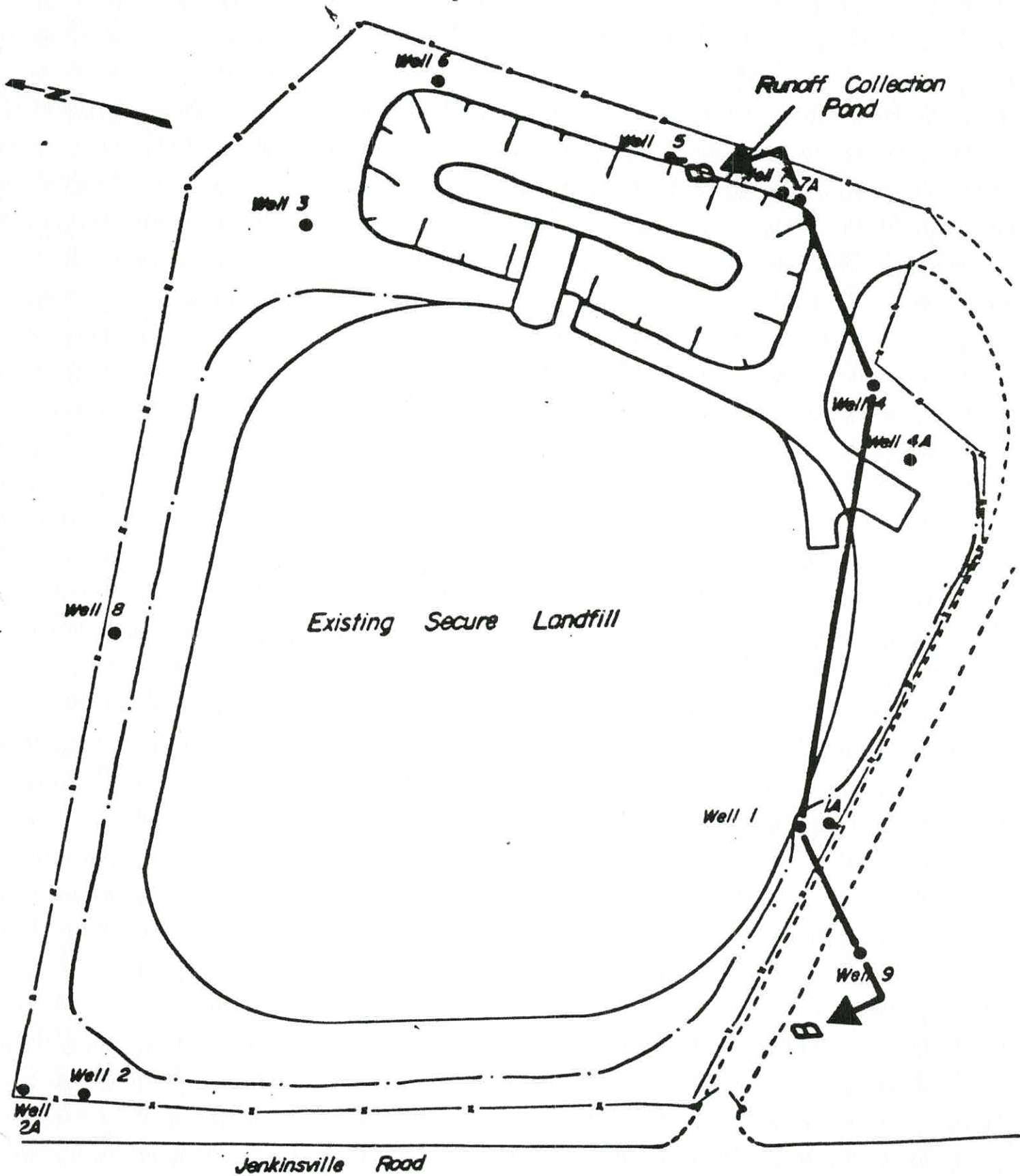


Figure 5



LOCATION OF CROSS-SECTION B - B'

Scale: 1" = 57' ±

Figure 6

GENERALIZED CROSS-SECTION B-B'

Scale:
Horizontal: 1" = 50'
Vertical: 1" = 40'

Well No. 9

Well No. 1

M.P. 454.55'
G.L. 453.3'

M.P. 454.69'
G.L. 453.3'

Well No. 4

Well No. 7A

M.P. 437.65'
G.L. 436.9'

M.P. 436.81'
G.L. 436.3'

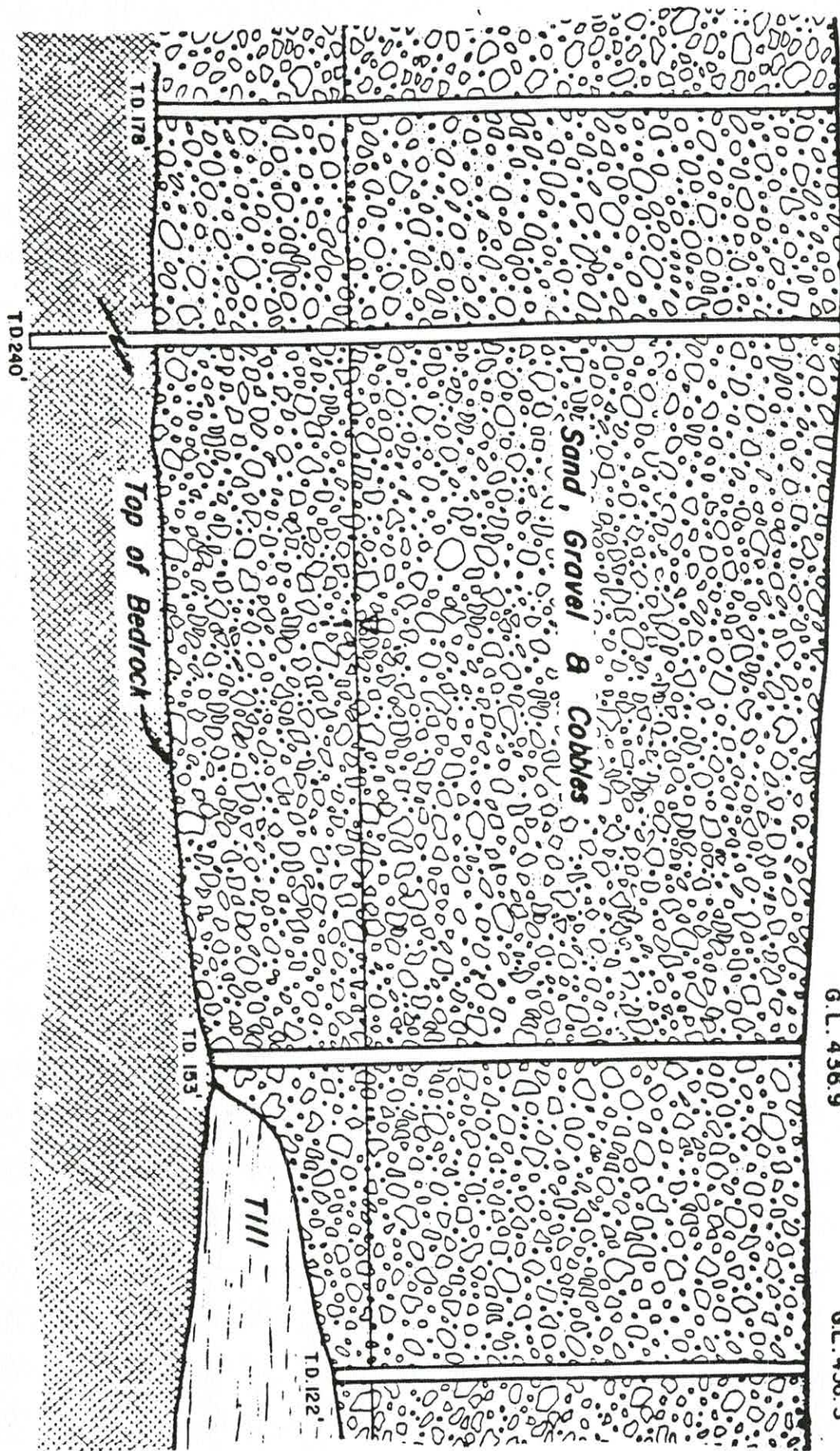
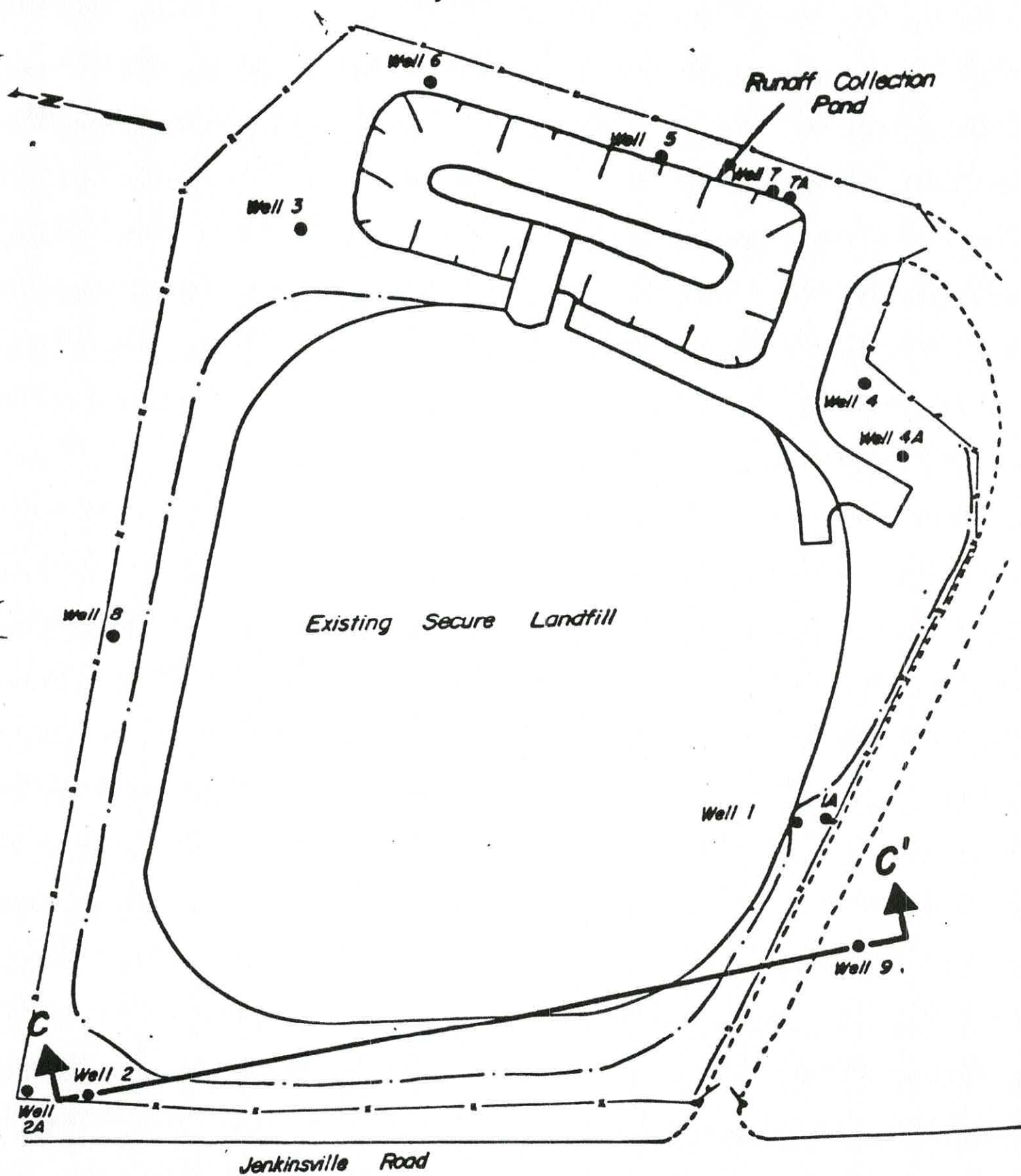


Figure 7



LOCATION OF CROSS - SECTION C - C'

Scale: 1" = 67'

Figure b

GENERALIZED CROSS-SECTION C-C'

Scale:

Horizontal: 1" = 50'

Vertical: 1" = 40'

Well No. 2

M.P. 474.74'

G.L. 473.4'

Well No. 9

M.P. 454.55'

G.L. 453.3'

Sand, Gravel & Cobbles

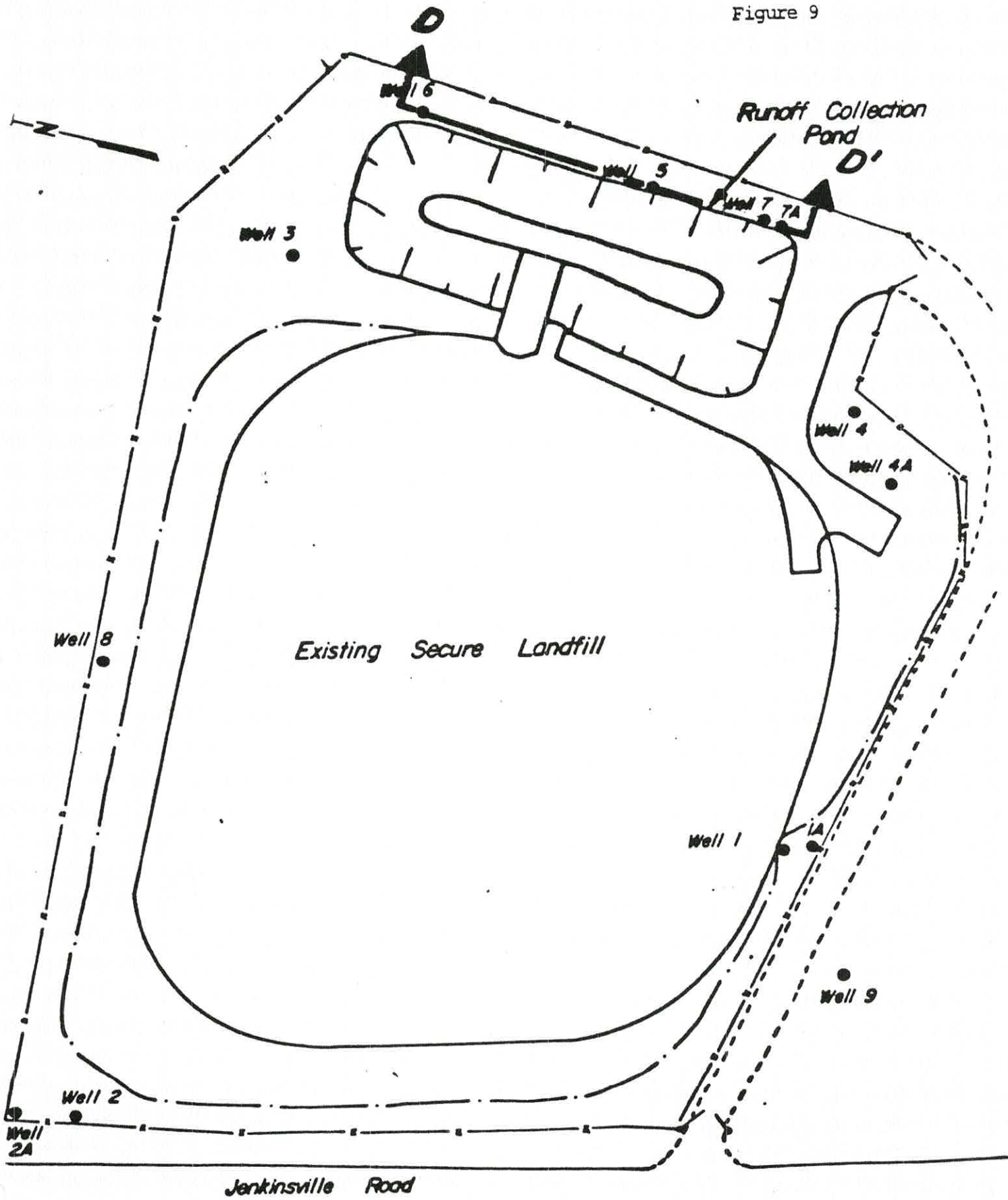
Top of Bedrock

T.D. 178'

T.D. 240'

0'
10'
20'
30'
40'
50'
60'

Figure 9



LOCATION OF CROSS-SECTION D-D'

Scale: 1" = 67'

GENERALIZED CROSS-SECTION D-D'

Elevation

460'

420'

380'

340'

300'

260'

220'

Well No. 6

6

M.P. 437.19'
G.L. 435.8'

Well No. 5

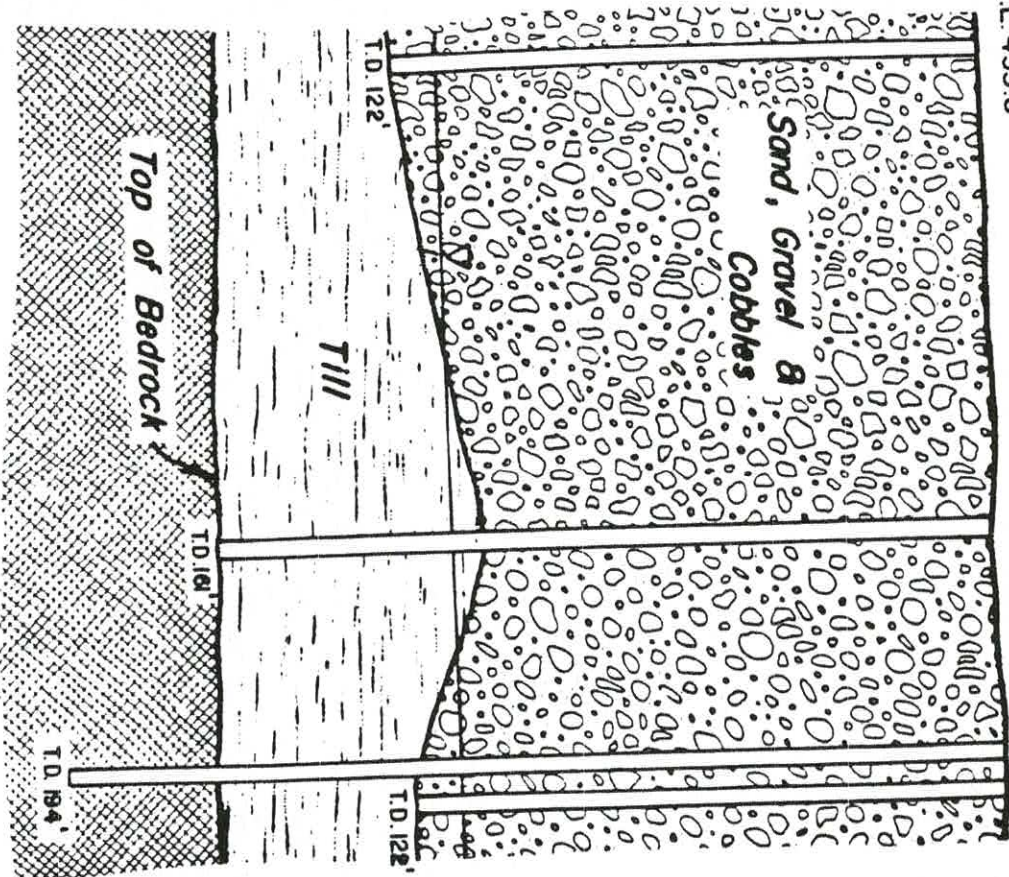
5

M.P. 437.13'
G.L. 435.2'

Well Nos. 7 & 7A

M.P. 436.92'
G.L. 436.4'

M.P. 436.91'
G.L. 436.3'



Scale:

Horizontal: 1" = 50'
Vertical: 1" = 40'

Attachment C: SOPs





Standard Operating Procedure

500 North Franklin Tpke, Suite 314
Ramsey, New Jersey 07446

T: 201.574.4700

Prepared by: Brown and Caldwell

Project Title: Standard Operating Procedures (BCNNJ-SOP-FIC4-0825)

SOP Version 4.0

Subject: Field Instrument Calibration

Date: August 18, 2025

Reviewed by:

A handwritten signature in black ink, appearing to read "Charles Meyn", written over a horizontal line.

Charles Meyn, P.G.
Principal Geologist/Hydrogeologist

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Attachments

Attachment 1 Example Field Calibration Form



Section 1: Objectives

The objective of this Standard Operating Procedure (SOP) is to provide general procedures for the calibration of field instruments used during field investigations. These instruments are used for field sample characterization and health and safety monitoring.

Section 2: Applicability

This general procedure will be used during field activities when field instruments are used for the collection of data. The general use and calibration of these instruments are discussed in this SOP and should be supplemented (or superseded, if necessary) with the manufacturer's calibration and maintenance instructions.

Section 3: Responsibilities

The Project Manager, or designee, is responsible for maintaining compliance with the requirements of the SOP.

The field sampling personnel are responsible for implementation of the requirements of this SOP, including record keeping.

Section 4: Definitions and Abbreviations

Calibration – Procedure used to check, adjust, and/or demonstrate by comparison to a standard, that an instrument is reading correctly.

CGI – Combustible Gas Indicator

DNAPL – Dense Non-aqueous Phase Liquid

LNAPL – Light Non-aqueous Phase Liquid

OVA – Organic Vapor Analyzer

OVM – Organic Vapor Meter

PID – Photo Ionization Detector

FID – Flame Ionization Detector

Section 5: Required Materials

The materials required for this SOP include the following:

- Bound field logbooks;
- Black or blue water proof and/or indelible ink pens;
- Instrument Calibration Form(s) – specific to each instrument;
- Calibration gases and standard solutions, and materials and secondary collection containers (Tedlar bags, tubing, etc.) – specific to each instrument; and

- Replacement batteries and parts (if applicable) – specific to each instrument.

Instruments used during field activities may include, but are not limited to, the following:

- Water Quality Instruments (e.g., pH, temperature, conductivity, dissolved oxygen, turbidity, oxidation reduction potential);
- Water level indicators;
- Oil/Water Interface probes (LNAPL and DNAPL);
- Organic vapor meters (OVMs);
- Organic vapor analyzers (OVAs);
- Photoionization Detectors (PIDs);
- Flame Ionization Detectors (FIDs);
- Combustible gas indicators (CGI); and
- Oxygen (O₂) Monitors.

Section 6: Procedure

This SOP includes the methods for field instrument calibration, calibration documentation and corrective action procedures that will be implemented during field activities. Prior to commencement of field activities, a determination will be made as to which instruments will be needed for the field activities. Some instruments may be available from an office equipment pool or from an equipment rental/supply company. Field personnel should procure the necessary instruments, calibration gases and/or standard solutions, and other necessary equipment and materials sufficiently in advance of the beginning of the field activities. Consideration should be made for specialty instruments (e.g., helium detectors) and materials that may take longer to obtain.

Prior to field mobilization, instruments that will be used during the field activities will be checked for proper operation, cleanliness, and calibration. Ideally, rented field equipment will be provided pre-calibrated accompanied by appropriate calibration records.

The calibration activities will be conducted in accordance with manufacturer's procedures, where applicable. In the event that manufacturer procedures are not available, standard, generally-accepted calibration procedures will be used. Calibration verification will be performed on field instruments prior to their initial use, at least once daily, or whenever indications of instrument malfunction or questionable readings are observed. Some field instruments, such as water quality meters, or gas chromatographs, may require more frequent calibration verification depending upon project quality objectives.

In general, field instrument identification and calibration will include the following steps:

- Determine which field instruments are needed for implementing the project scope of work;
- Obtain the necessary field instruments and associated calibration gases and/or standard solutions for calibration;
- Check expiration dates on calibration gases and/or standard solutions. Replace, if out of date;
- Obtain other equipment and materials that are needed for calibration and use;
- Assemble the instrument and turn it on, allowing the instrument to stabilize;
- Check battery charge and recharge or replace (if necessary);
- Check carrier gas volumes, and recharge if necessary [e.g. hydrogen carrier gas used for in a flame ionization detector (FID)];
- Clean the instrument (if necessary);



- Calibrate the instrument prior to field use in accordance with manufacturer's procedures, and if necessary adjust the instrument to meet calibration specifications (this step is sometimes referred to as the initial calibration);
- If instrument malfunctions cannot be corrected, obtain another instrument and have the other repaired (see Section 7 for Corrective Action Procedures);
- Clean and decontaminate the instrument after use, and before storage;
- Conduct calibration verifications at least once per day, or as needed;
- Conduct final calibration verification at the end of each day, or at completion of field measurement collection for the day;
- Document calibration activities and results; and
- Recharge batteries, add carrier gases (if applicable), and re-calibrate the instrument (if applicable) at the end of each day or as needed. This should be carried out in a non-hazardous area.

Some manufacturers recommend field calibration procedures that are inadequate for verifying instrument linearity and calibration range. For example, some commercially available water quality meters may have a stock calibration mixture that is used during an "easy to conduct" calibration which consists of pressing a "calibrate" button on the instrument while the probes are in stock solution. The problem with this calibration method is that it only provides a single point calibration. This is inadequate for the field measurements collected during water quality monitoring because of the wide range of conditions that may be encountered. Typically, more involved calibration of these instruments requires disassembling the instrument probe components, which is not recommended. Instrument calibration and accuracy should be checked by using at least two different commercially-available standard solutions over a range of values (e.g., pH buffers at 4 and 10) to confirm that the meter is capable of providing accurate readings over a range of conditions. These solutions should be separate from the solution provided by the manufacturer. These additional calibration steps are useful for applications requiring a high degree of accuracy but are not necessary for applications such as initial screening or evaluating relative change.

Important Note: *Equipment rental suppliers may supply applicable calibration standards. However, calibration gases are frequently not provided and may need to be procured separately. It should be noted that shipping restrictions may require calibration gases to be shipped by ground transport.*

A record will be maintained of the calibrations and calibration verification. The records will include the following information, where applicable:

- Date and time of activities;
- Project name and number;
- Personnel conducting the calibration;
- Serial and/or meter numbers;
- Instrument name and model number;
- Calibration gases or standard solutions used, concentration of the gases and solutions used, and the associated units (if applicable), and lot numbers of calibration intervals;
- Instrument readings before and after calibration; and
- Instrument readings of calibration verification data.

Personnel responsible for the use of these field instruments will read the manufacturer's instruction manual and will be adequately familiar with the use, calibration, and maintenance of the instrument prior to use in the field. The calibration, maintenance and use of these field instruments will be conducted in accordance with the manufacturer's specifications and procedures. If instrument calibration cannot be met or if the instrument is malfunctioning, obtain another instrument and repair the malfunctioning instrument immediately (see Section 7 Corrective Action).



Calibration activities will be recorded in the field logbooks and/or on pre-printed calibration logs. Calibration data may be recorded in the Instrument Calibration Record or within the field logbook. An example of this calibration record is included as Attachment 1. This record can be modified as necessary to accommodate specific instruments.

Section 7: Corrective Action Procedures

If an instrument cannot be successfully calibrated or if it is malfunctioning, the instrument will be immediately placed out of service. In the event that this occurs during the course of the field activities, it will be necessary to procure a replacement instrument and/or repair the instrument before continuation of field activities. Under no circumstances should field personnel continue with activities until a replacement is obtained or approval from the PM or their designee is obtained. Instances of instrument failure and corrective actions taken will be documented in the field logbook.

Field instruments can be affected by rainfall, changes in temperature, humidity, and barometric pressure and/or use in rugged environments. Instrument calibration should be checked when significant changes in ambient conditions occur. In addition, instrument calibration should be checked if maintenance activities (e.g., battery replacement, lamp replacement, etc.) are required, if instrument malfunctions occur, or when questionable readings are observed. Calibration verification and recalibration activities shall be conducted and documented as outlined in Section 6.

Section 8: Corrections and Reviews

Corrections and reviews of calibration records will be completed in accordance with the SOP for Field Notes and Documentation.

Section 9: Document Archive

At the completion of the project, the calibration records will be stored in the project files in accordance with Brown and Caldwell procedures. This will generally include scanning to PDF and saving in the project folder.



Attachment 1: Example Field Calibration Form



Water Quality Equipment Calibration Form



Project: _____

Date: _____

Water Quality Parameter Meter

Unit Name/ID: _____ Serial Number: _____

Calibrated By: _____ Assigned User: _____

Water Quality Parameter Meter Calibration Form							
	Cal Std. Expiration Date & Lot Number	Initial Calibration		Re-Calibration		Drift Check	
		Time:		Time:		Time:	
		Cal	Read	Cal	Read	Read	Acceptable Performance
pH (3-point)							±0.20
Buffer 2.0							
Buffer 4.0							
Buffer 7.0							
Buffer 10.0							
Conductivity							±10%
447 uS/cm							
1413 uS/cm							
8974 uS/cm							
15,000 uS/cm							
ORP							±10%
220 mv							
Dissolved Oxygen							±10%
Open Air (mg/L)							
Zero Oxy Std (mg/L)							
Barometer (mm Hg)							

Turbidity Meter

Unit Name/ID: _____ Serial Number: _____

Calibrated By: _____ Assigned User: _____

Turbidity Meter Calibration Form							
	Cal Std. Expiration Date	Initial Calibration		Re-Calibration		Drift Check	
		Time:		Time:		Time:	
		Cal	Read	Cal	Read	Read	Acceptable Performance
Turbidity							±10%
10 Standard							
20 Standard							
100 Standard							
800 Standard							



Standard Operating Procedure

500 North Franklin Tpke, Suite 314
Ramsey, New Jersey, 07446

T: 201.574.4700

Prepared by: Brown and Caldwell

Project Title: Standard Operating Procedures (BCNNJ-SOP-CUH4-0825)

SOP Version 4.0

Subject: Calibration and Use of the Horiba U-52 Multi-Parameter Meter

Date: August 18, 2025

Reviewed by:

A handwritten signature in black ink, appearing to read "Charles Meyn".

Charles Meyn, P.G.
Principal Geologist/Hydrogeologist

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Figure 1. Horiba U-52 Calibration Form

Attachments

- | | |
|----------------|---|
| Attachment F-1 | Manufacturer's Instructions - Horiba U-52 Multi-Parameter Meter |
| Attachment F-2 | Manufacturer's Instructions - Flow cell for U-50 series U-50FC Instruction Manual |

Section 1: Objective

The objective of this standard operating procedure (SOP) is to establish a standard set of procedures for the calibration, use and maintenance of the Horiba U-52 Multi-Parameter meter, for the analysis of pH, dissolved oxygen, temperature, specific conductance and turbidity. This procedure is consistent with Standard Methods 4500 H+B (pH), 4500-O G (dissolved oxygen [DO]), 2550 B (temperature), 2510 B (specific conductance) and 2130 B (turbidity) within the USEPA approved document entitled Standard Methods for the Examination of Water and Wastewater, 2022 (24th edition) and with the NJDEP document entitled Regulations Governing the Certification of Laboratories and Environmental Measures, (N.J.A.C. 7:18, November 22, 2006).

Section 2: Scope and Applicability

This SOP will be used during the field determination of pH, dissolved oxygen, temperature, specific conductance and turbidity for drinking, surface, ground, and saline waters, and domestic and industrial wastewater, when using the Horiba U-52 Multi-Parameter meter. This will be the default method for periodic measurements of purge water quality that are performed during low-flow purging and sampling.

Horiba U-52 multi-parameter meters will be rented for low-flow groundwater sampling. Current arrangements are for Brown and Caldwell (BC) to procure rental instruments from U.S. Environmental Rental Corporation (U.S. Environmental) of Hamilton, NJ. U.S. Environmental will own, maintain and perform routine instrument calibrations of a pool of Horiba U-52 instruments and will also provide certification documentation regarding calibration and Certificates of Analysis (COAs) for instrument reagents.

Section 3: Required Materials

The materials required for this SOP include the following:

- Horiba U-52 meter with a capability of automatic temperature compensation;
- Sensor probe with mounted pH, DO, temperature, specific conductance and turbidity sensors;
- Commercially available standard solutions for calibration of pH, DO, specific conductance and turbidity;
- Field calibration form for the Horiba U-52 meter; and
- Flow-through cell – for use during low-flow purging and sampling.

These materials will typically be provided when renting the Horiba U-52 from US Environmental.

Section 4: Meter Use

The rented Horiba U-52 meter will be delivered to BC fully calibrated and ready for field use. Therefore, only procedures for preparing the meter for use upon delivery are included herein. After carefully unpacking the meter's control unit and sensor probe, connect the control unit and the sensor probe (with power OFF) by aligning the red mark on the connector, and pressing the connector in until it clicks. Connect the cable's hook to the display to protect the cord from undue stress. Operation of the Horiba U-52 is as follows:

- Press and hold down the control unit's **POWER** key for approximately 3 seconds to turn the power **ON**.
- Press the right (►) key to switch the display to the "**SETTINGS**" screen.
- Press the down (▼) key to move the cursor to "**Measurement**", then press the **ENTER** key.
- Press the down (▼) key to move the cursor to the desired measurement mode. Press the **ENTER** key to save the setting. Set the measurement method to "**single measurement**" – in this mode, pressing the **MEAS** key acquires the 5-second average for the selected measurement parameter.

Section 5: Calibration

5.1 Introduction

The Horiba U-52 meter will be calibrated at least once each day of use in accordance with the manufacturer's calibrating procedures. This will include calibration with standard solutions provided with the meter by the rental company. Calibration procedures for each parameter are outlined below. For more in-depth description of calibration, refer to the Horiba U-52 User's Manual, provided as Attachment 1. The form for calibration of the Horiba U-52 meter must be used for recording calibration information, which includes the site name/location, project number, date/time of calibration, the serial number of the particular meter used and other information, as shown in Figure 1.

5.2 pH

The Horiba U-52 meter is equipped with automatic temperature compensation for the measurement of pH at changing temperatures. The Horiba U-52 has a resolution of 0.01 and precision of ± 0.1 pH units. Probes should be rinsed between calibration buffers with deionized (DI) water. The meter will be calibrated to 2 pH points and readings must be within ± 0.05 pH units of the buffer used. The pH will be checked with the pH 7 buffer immediately after calibration (displayed value must be within ± 0.1 units), and every 3 hours of sampling time. The buffer solution will be discarded after calibration. Calibration of the Horiba U-52, based on U.S. Environmental's SOP, "Calibration of pH sensors for Rental Water Quality Meters", Revision 7 (9/16/22) for pH is as follows:

- Press the **CAL** button and choose manual calibration. Then choose pH. Rinse the probe with DI water and fill the transparent calibration container to the "with turbidity" line with pH 4 solution.
- Place probe in the pH 4 solution and press **ENTER**. Wait for readings to stabilize. Adjust the value to 4 and press **ENTER**. Record before and after readings on the calibration form.
- Rinse the probe and transparent calibration container. Follow prompts for 2nd calibration point. Fill calibration container to the "with turbidity" line with pH 10 solution.
- Place the probe in pH 10 solution, press **ENTER** and wait for stabilization. Then adjust the value to 10 and press **ENTER**. Record before and after readings on the calibration form. Press **ESC** to exit calibration mode.



- Rinse the probe and calibration container with DI water. Fill with pH 7 solution. Enter measurement mode. Place probe in the pH 7 solution, press **ENTER** and wait for stabilization. If the unit differs from true pH readings by more than ± 0.1 units, the probe must be recalibrated. Record result on the calibration sheet.
- Record the temperature, initial readings, calibrated readings, the result of the pH 7 buffer check and the lot numbers of the buffers used on the calibration field form.

5.3 Dissolved Oxygen

The Horiba U-52 meter is equipped with automatic temperature compensation for the measurement of DO at changing temperatures. The Horiba U-52 will be tested against a Winkler titration method weekly by the rental company. The Horiba U-52 has a resolution of 0.01 mg/L and precision of ± 0.2 mg/L. Calibration of the Horiba U-52 for DO in the field, based on U.S. Environmental's SOP, "Calibration of Dissolved Oxygen sensors for Rental Water Quality Meters", Revision 7 (9/16/22), is as follows:

- Rinse the probe thoroughly and place the damp sponge into the bottom of the calibration storage container. Position unit so that air can circulate. Press the **CAL** button and choose manual calibration. Wait for readings to stabilize. Adjust the value to 100.0% and press **ENTER**. Record before and after readings on the calibration form.
- Remove damp sponge from sensor guard and rinse the probe with DI water. Re-attach the sensor guard and place the unit in the black calibration container. Ensure that the black calibration container is thoroughly rinsed with DI water.
- Change meter to measurement mode. Fill the black calibration container using the spout (while the unit is still inside) with a zero DO standard. Wait for readings to stabilize. Record reading.

5.4 Temperature

The Horiba U-52 meter will be calibrated quarterly against a National Institute of Standards and Technology (NIST) thermometer by U.S. Environmental, and will not be calibrated for temperature in the field. The Horiba U-52 has a resolution of 0.01 °C. Check U.S. Environmental's calibration records for a temperature correction factor. Temperature correction must be applied for values ≥ 0.1 °C.

5.5 Specific Conductance

The Horiba U-52 meter is equipped with 4-electrode cells with auto ranging function for the measurement of conductivity temperature compensated to 25 °C (specific conductance). The Horiba U-52 has a resolution of 0.001 mS/cm. Probes should be rinsed between calibration buffers with DI water. The calibration solution will be discarded after calibration. Cell constant calibration will be conducted by U.S. Environmental prior to shipment of the Horiba U-52 to BC; an updated tag with the cell constant recorded will be attached to the meter. Calibration of the Horiba U-52, based on U.S. Environmental's SOP, "Calibration of Specific Conductance sensors for Rental Water Quality Meters", Revision 6 (9/16/22) for specific conductance is as follows:

- Press the **CAL** button and choose manual calibration. Then choose **Cond**. Set the number of calibration points to 2.
- Keep the unit in the sensor guard and set the "Cond" value to 0.0 mS/cm. Wait for readings to stabilize and press **ENTER**.
- When the message "**Cal complete. Press ENT to Span Cal.**" appears, record the values and press **Enter** to start the span calibration.



- Rinse the probe with DI water and fill the transparent calibration container to the “with turbidity” line with 1413 $\mu\text{S}/\text{cm}$ (1.413 mS/cm) conductivity standard.
- Place probe in standard solution. Agitate probe to dislodge any air bubbles.
- Avoid placing probe against the sides or bottom of the container.
- Wait for stabilization and then calibrate unit.
- Calculate the percent recovery (%Rec) using the following equation: $\text{result}/\text{initial reading} \times 100 = \% \text{Rec}$
- Record the temperature, initial and calibrated readings, the percent recovery, and the lot numbers of the standards used on the calibration field form.
- Check calibration with meter in measurement mode, using known standard. Calculate Relative Percent Difference (RPD) between measured value and true value. Measured value should be within 1% of true value. Calculate RPD using the following equation:

$$(\text{Measured Value}/\text{True Value of Standard}) \times 100 = \text{RPD} (\%)$$
- If 1% accuracy criterion cannot be met, use a standard with a different (higher) conductivity value.

5.6 Turbidity

The Horiba U-52 meter is equipped with a nephelometer to measure turbidity, with a resolution of 0.1 NTU and a range of 0 to 800 NTU. Probes should be rinsed between calibration buffers with DI water. Calibration of the Horiba U-52, based on U.S. Environmental’s SOP, “Calibration of Turbidity sensors for Rental Water Quality Meters”, Revision 7 (9/16/22) for turbidity is as follows:

- Choose manual calibration from the menu. The scroll down to “**Turb:NTU**”.
- Choose a 2-point calibration.
- Rinse the turbidity sensor and clear calibration container with DI water.
- Fill the calibration container to the “with Turb” line with 0 NTU solution or Type II DI water and place into the black storage container (light will interfere with the proper calibration of this sensor).
- Place the sensor in the calibration container and wait for the “measurement value” to stabilize. Using the up/down arrows, set the Turb value to 0.0 NTU and press **ENTER**.
- Rinse the turbidity sensor with DI water. Fill clean calibration container to the fill line with 100 NTU solution and then place into the black storage container.
- Place the probe into the 100 NTU solution and wait for full stabilization. Now use the up (▲) and down (▼) keys to adjust the value to 100 NTU. Press **ENTER**.
- Check calibration with meter in measurement mode, using known standard. Calculate RPD between measured value and true value. Measured value should be within 10% of true value. Calculate RPD using the following equation:

$$(\text{Measured Value}/\text{True Value of Standard}) \times 100 = \text{RPD} (\%)$$
- Record all results on the calibration field form, including initial and calibrated readings, and lot numbers of standards.

Section 6: Sample Handling and Preservation

All samples should be analyzed immediately following sample collection whenever practicable. Under no circumstance will field analyses be made greater than 15 minutes after sample collection.

A flow-through cell will normally be employed for purge monitoring during low-flow sampling. The flow cell (series U-50FC) has a flow rate of 0.1 L/min to 0.5 L/min and is to be used with water or water solutions only



(cannot be used with organic solvents). The sensor guard on the Horiba U-52 must be removed prior to use of the flow cell. Care must be taken not to damage the sensors once the guard is removed. Instructions for use and maintenance of the flow cell are included as Attachment 2.

Section 7: Measurement and Meter Maintenance

- Calibrate the Horiba U-52 meter and electrode system as described in Section 5.0.
- After turning the power ON, check that the DO readout value has stabilized before starting measurement (takes approximately 20 minutes).
- When on the measurement screen, pressing ENTER enlarges the display and shows three measured values at a time. Pressing the up (▲) and down (▼) keys scrolls through the measured values one item at a time. Pressing the **ENTER** key again reverts to the normal measurement screen display.
- Refer to the SOPs for pH, DO, specific conductance, temperature and turbidity for procedure on recording measurement results.
- Following completion of measurements, press and hold down the control unit's **POWER** key for about 3 seconds to turn the power **OFF**.
- Remove the sensor guard and clean the sensor with tap water.
- Clean the turbidity sensor with the cleaning brush provided.
- Wipe off any dirt with a soft cloth. If parts are very dirty, clean them with neutral detergent, then rinse. If parts are contaminated with oil, wipe it off with a soft cloth soaked in alcohol.
- The instrument will be stored according to the manufacturer's instructions.

Figures

Field Calibration Record - Horiba U-52 Multimeter

Brown and Caldwell Field Lab (NJDEP OQA No. 02023)



Calibration Location: _____

Project No.: _____

Calibrated By (Print Name): _____

Signature: _____

Calibration Time: _____

Date:¹ _____

Meter Serial #: _____

Handheld Serial #: _____

Temperature Correction Factor _____ °C

Instrument Notes:

1. Calibration must be performed on the same day of field use.

☐ Calibrated by US Environmental on date of sampling (see attached calibration records).

pH ⁽²⁾:

Standard Solution	Time	Temp. °C	pH reading (initial)	pH reading (calibrated/check) ⁽³⁾	Lot No. of Standard
4.0 s.u.					
10.0 s.u.					
7.0 s.u. (initial check) ⁽³⁾					
7.0 s.u. (check) ⁽⁴⁾					
7.0 s.u. (check) ⁽⁴⁾					
7.0 s.u. (check) ⁽⁴⁾					

pH Notes:

2. SM 4500-H B-21

3. Calibrated pH reading must be ± 0.05 s.u. of standard value. Initial 7.0 check should be ± 0.10 s.u. of standard.

4. Perform pH checks once every three hours. 3-hour 7.0 checks should be ± 0.2 s.u. of standard.

Specific Conductance (SM 2510 B-21):

Meter Cell Constant: _____

Standard Solution	Initial Reading	Calibrated Reading	Calibration Check	Percent Recovery ⁽⁵⁾	Lot No. of Standard
Air $\mu\text{S}/\text{cm}$ ⁽⁶⁾					
1413 $\mu\text{S}/\text{cm}$ ⁽⁶⁾					

Specific Conductance Notes:

5. Calibration check reading must be within 1% of Standard value (Calibration Check Value/Standard Value) X 100

6. Confirm that units on meter match the units on this form.

Turbidity (SM 2130 B-20):

Standard Solution	Initial Reading	Calibrated Reading	Calibration Check ⁽⁷⁾	Percent Recovery ⁽⁷⁾	Lot No. of Standard
0 NTU					
100 NTU					

Turbidity Note: 7. Calibration check reading must be within 10% of Standard value (Calibration Check Value/Standard Value) X 100

D.O. (SM 4500-O G-21):

Standard Solution	Initial Reading	Calibrated Reading/Standard Value	Check Reading	Recovery ⁽⁹⁾ Check
Air % ⁽⁸⁾				
Zero D.O. (mg/L) Check		0		

D.O. Notes:

8. Calibrate first in air then follow by check with Zero DO Solution.

9. Calibrated/check reading must be within ± 0.3 mg/L (Zero DO Check)

Field Calibration Record - Horiba U-52 Multimeter

Brown and Caldwell Field Lab (NJDEP OQA No. 02023)



SUMMARY OF CALIBRATION REQUIREMENTS

Field calibrations must be performed using the methods and at the frequency specified in the BC Field Laboratory "Quality Assurance Manual," version 7. The calibration requirements are summarized below.

pH:

- Calibrate at the beginning of each day of use.
- Minimum of 2 standard pH buffers (4.01, 7.00, 10.01).
- Recalibrate if pH differs by more than ± 0.05 units of standard.
- Check with pH 7.00 buffer immediately after calibration – recalibrate if pH differs by more than ± 0.1 units.
- Check with pH 7.00 buffer every 3 hours of use – recalibrate if pH differs by more than ± 0.2 units from standard.
- Record pH to nearest 0.01 unit and temperature to nearest 0.1 °C.
- Reference pH buffer temperature chart provided by rental company when calibrating

Specific Conductance:

- Calibrate at the beginning of each day of use (make sure units on meter match units on form).
- Calibrate against air.
- Calibrate against 1413 $\mu\text{S}/\text{cm}$ conductivity standard in calibration mode.
- Check against 1413 $\mu\text{S}/\text{cm}$ conductivity standard in measurement mode.
- Calculate Percent Recovery as follows: (Value of Standard Check in Measurement Mode/True Value of Standard) x 100.
- Percent Recovery should be within $\pm 1\%$ of true value.

Turbidity:

- Calibrate at the beginning of each day of use.
- Use 2-point calibration (0 and 100 NTU). Use black outer calibration cup.
- Check with 100 NTU standard in measurement mode.
- Calculate Percent Recovery as follows: (Value of Standard Check in Measurement Mode/True Value of Standard) x 100.
- Percent Recovery should be within $\pm 10\%$ of true value.

DO:

- Calibrate at the beginning of each day of use.
- Calibrate against air or air saturated water.
- Calibrate at a temperature within $\pm 10^\circ\text{C}$ of the sample temperature.
- Check against zero DO standard in measurement mode.
- Recalibrate if calibrated/check reading is greater ± 0.3 mg/L (Zero DO) of the true value.
- Record DO to the nearest 0.1 mg/L and temperature to nearest 0.1 °C.
- Wash probe off well prior to using meter.

Temperature:

- Check U.S. Environmental calibration records for a Temperature Correction Factor, and record on form.
- Temperature correction must be applied for values $\geq \pm 0.1^\circ\text{C}$.

Attachment 1: Manufacturer's Instructions

Horiba U-52 Multi-Parameter Meter

Multi Water Quality Checker U-50 Series

Instruction Manual

CODE:GZ0000144342C

Preface

This manual describes the operation of the Multi Water Quality Checker, U-50 Series. Be sure to read this manual before using the product to ensure proper and safe operation of the instrument. Also safely store the manual so it is readily available whenever necessary.

Product specifications and appearance, as well as the contents of this manual are subject to change without notice.

■ Warranty and Responsibility

HORIBA warrants that the Product shall be free from defects in material and workmanship and agrees to repair or replace free of charge, at HORIBA's option, any malfunctioned or damaged Product attributable to HORIBA's responsibility for a period of one (1) year from the delivery unless otherwise agreed with a written agreement. In any one of the following cases, none of the warranties set forth herein shall be extended;

- Any malfunction or damage attributable to improper operation
- Any malfunction attributable to repair or modification by any person not authorized by HORIBA
- Any malfunction or damage attributable to the use in an environment not specified in this manual
- Any malfunction or damage attributable to violation of the instructions in this manual or operations in the manner not specified in this manual
- Any malfunction or damage attributable to any cause or causes beyond the reasonable control of HORIBA such as natural disasters
- Any deterioration in appearance attributable to corrosion, rust, and so on
- Replacement of consumables

HORIBA SHALL NOT BE LIABLE FOR ANY DAMAGES RESULTING FROM ANY MALFUNCTIONS OF THE PRODUCT, ANY ERASURE OF DATA, OR ANY OTHER USES OF THE PRODUCT.

■ Trademarks

Generally, company names and brand names are either registered trademarks or trademarks of the respective companies.

Conformable Directive

This equipment conforms to the following directives and standards:



Directives: the EMC Directive 2004/108/EC
Standards: [the EMC Directive]
EN61326-1:2006 Class B, Portable test and measurement equipment

■ Information on Disposal of Electrical and Electronic Equipment and Disposal of Batteries and Accumulators

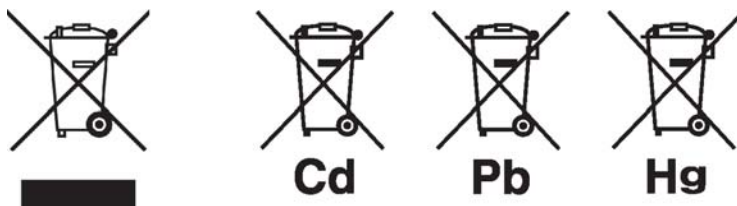
The crossed out wheeled bin symbol with underbar shown on the product or accompanying documents indicates the product requires appropriate treatment, collection and recycle for waste electrical and electronic equipment (WEEE) under the Directive 2002/96/EC, and/or waste batteries and accumulators under the Directive 2006/66/EC in the European Union.

The symbol might be put with one of the chemical symbols below. In this case, it satisfies the requirements of the Directive 2006/66/EC for the object chemical.

This product should not be disposed of as unsorted household waste.

Your correct disposal of WEEE, waste batteries and accumulators will contribute to reducing wasteful consumption of natural resources, and protecting human health and the environment from potential negative effects caused by hazardous substance in products.

Contact your supplier for information on applicable disposal methods.



FCC Rules

Any changes or modifications not expressly approved by the party responsible for compliance shall void the user's authority to operate the equipment.

■ WARNING

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

For your safety

Warning messages are described in the following manner. Read the messages and follow the instructions carefully.

● Meaning of warning messages

 **DANGER**

This indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.

 **WARNING**

This indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

 **CAUTION**

This indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Without safety alert indication of hazardous situation which, if not avoided, could result in property damage.

● Symbols



Description of what should be done, or what should be followed



Description of what should never be done, or what is prohibited

■ Safety Precautions

This section provides precautions to enable you to use the product safely and correctly and to prevent injury and damage. The terms of DANGER, WARNING, and CAUTION indicate the degree of imminency and hazardous situation. Read the precautions carefully as it contains important safety messages.

 WARNING	
	Do not disassemble or modify the meter. May cause overheating or fire, resulting in accidents.

 CAUTION	
	The pH and ORP sensors are made of glass. Handle them carefully to avoid breakage.
	Do not ingest the DO, pH or ORP standard solutions. If it comes into contact with the eyes, rinse thoroughly with water. If swallowed, consult a physician.
	Keep away from water when using USB communication. Improper use may result in fire or damage.

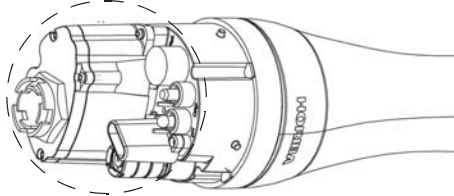
Points of concern

Use of the equipment in a manner not specified by the manufacturer may impair the protection provided by the equipment. It may also reduce equipment performance.

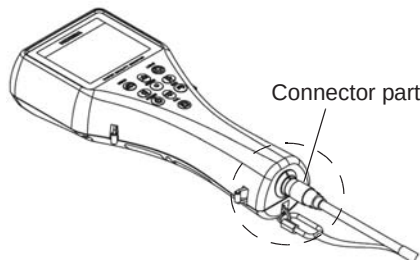
● Sensor probe

- Do not immerse the sensor probe in seawater or other samples with high salinity. Doing so may erode metallic parts. After use, promptly wash the sensor probe thoroughly in water.
- Do not immerse the sensor probe in alcohol, organic solvent, strong acid, strong alkaline, and other similar solutions.
- Do not subject to strong shocks.
- Do not perform measurement in environments of magnetic fields. Measurement errors may result.
- The sensor probe is no longer waterproof when the sensors are not mounted.

Appearance of mounted sensors

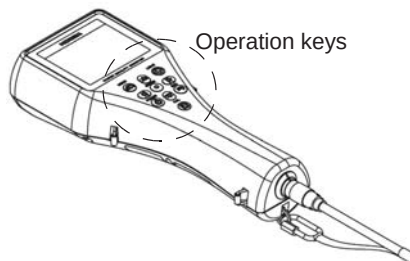


- Does not support measurement of samples containing fluorine.
- To disconnect the sensor cable or interface cable, pull them out with holding the connector part. Do not pull the cable part; it may cause breakage.



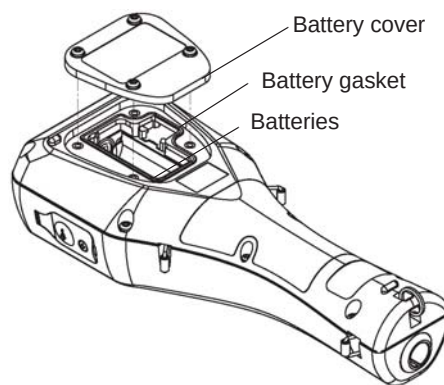
● Control unit

- Do not subject to strong shocks.
- The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.



- The control unit is no longer waterproof when the USB cable is connected.
- When operating the control unit only, protect the connector with the connector cap provided.

- Remove the batteries when not using the control unit for an extended period of time. Battery fluid leakage may cause equipment failure.
- Do not wipe the control unit with organic solvents or powder polish. The surface may deteriorate or its printing may disappear. If the display becomes dirty, wipe the dirt off with a soft cloth soaked in neutral detergent.
- Do not turn the power OFF or disconnect the cable during calibration or setting. Memory data may be erased.
- To perform measurement, connect the sensor probe cable before turning the power ON.
- Do not remove the battery gasket or twist it.
- When opening the battery case, make sure that no foreign matter is attached to the battery gasket.
- Do not use any unspecified batteries; it may cause breakage.



● Measurement

- Do not pull the cable when lowering the sensor probe into the sample during measurement. Lower the sensor probe into the sample on a chain or string.
- Before lowering the sensor probe into the sample, do not connect the hook on the unit to a human body.
- The correct values are not displayed if the sensor is not mounted when the measurement display is activated.
- Perform DO measurement with no air bubbles in the internal solution.
- Do not reuse a membrane cap of DO sensor.
- Use the spanner for DO sensor provided to attach or remove the DO sensor.
- Avoid both U-53 and U-53G turbidity measurement in air, since the rubber wiper will quickly become damaged.
- Avoid turbidity measurement in direct sunlight, since the readout may be affected.

● Calibration

During atmosphere calibration for the DO electrode with DO salinity compensation set to automatic, values are compensated based on electrical conductivity, but calibration is performed normally.

Location of use and storage

- Storage temperature: –10°C to 60°C
- Relative humidity: Under 80% and free from condensation

Store the meter in locations void of dust, strong vibrations, direct sunlight, corrosive gases, near air conditioners or windy areas.

Disposal of the product

When disposing of the product, follow the related laws and/or regulations of your country for disposal of the product.

Description in this manual

Note

This interprets the necessary points for correct operation and notifies the important points for handling the unit.

Reference

This indicates where to refer for information.

Tip

This indicates reference information.

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1 About this Unit

The U-50 Series Multi Water Quality Checker features an integrated control unit and sensors. It is capable of making a maximum of eleven simultaneous measurements for various parameters, and is perfect for use in the field. The U-50 Series is designed with on-site ease-of-use in mind, provides a wide variety of functions, and can be used for water quality measurements and inspections of river water, groundwater, and waste water.

2 Device Information

2.1 Measurement parameters

Parameters	Model				
	U-51	U-52	U-52G	U-53	U-53G
pH (pH)	✓	✓	✓	✓	✓
pH (mV)	✓	✓	✓	✓	✓
Oxidation reduction potential (ORP)	✓	✓	✓	✓	✓
Dissolved oxygen (DO)	✓	✓	✓	✓	✓
Electrical conductivity (COND)	✓	✓	✓	✓	✓
Salinity (SAL) [expressed as electrical conductivity]	✓	✓	✓	✓	✓
Total dissolved solids (TDS) [expressed as electrical conductivity]	✓	✓	✓	✓	✓
Seawater specific gravity (SG) [expressed as electrical conductivity]	✓	✓	✓	✓	✓
Water temperature (TEMP)	✓	✓	✓	✓	✓
Turbidity (TURB) [LED transmission/front 30° scattering method]	–	✓	✓	–	–
Turbidity (TURB) [tungsten lamp 90° transmission/scattering method] with wiper	–	–	–	✓	✓
Water depth (DEP)	–	–	✓	✓	✓
GPS	–	–	✓	–	✓

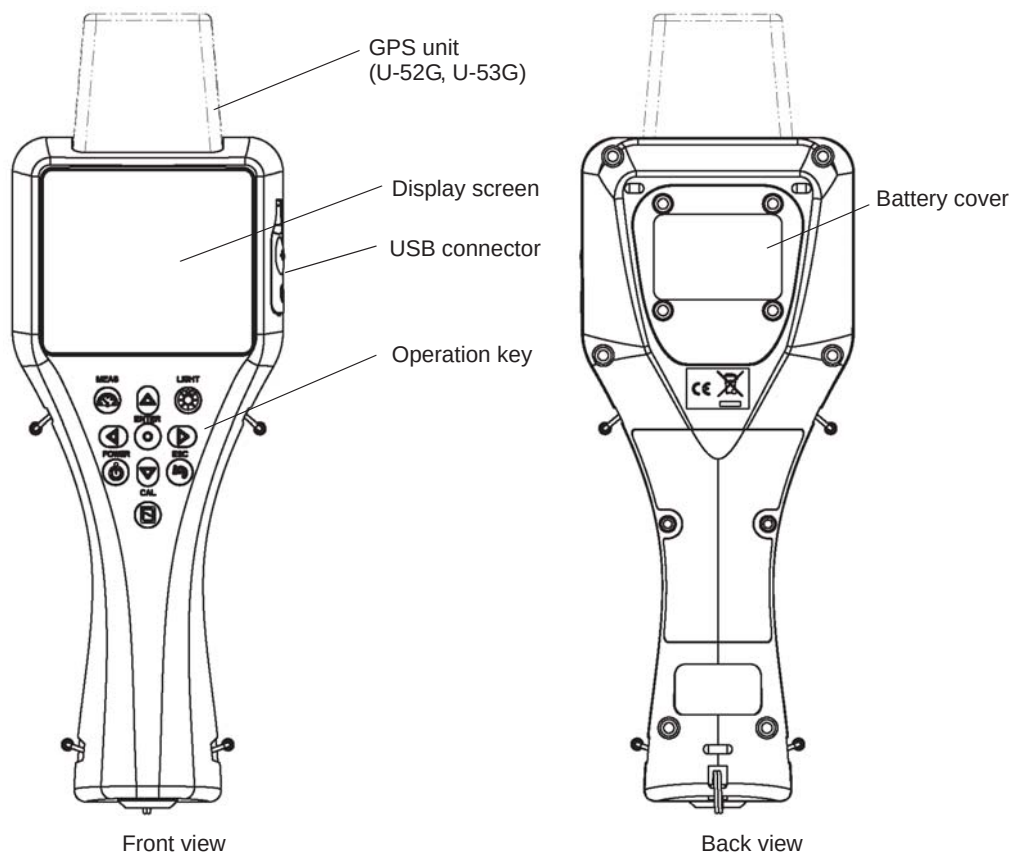
"✓" indicates a measurable parameter.

2.2 Packing list

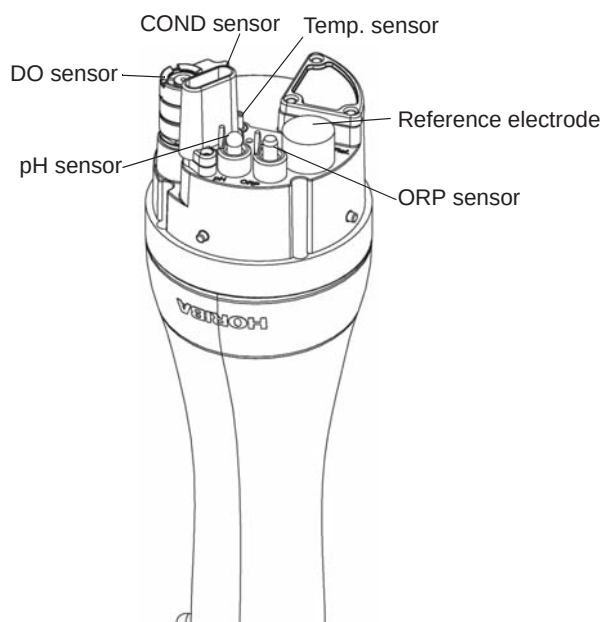
Parts Name	Quantity	Note
Control unit	1	
Sensor probe	1	
pH sensor (#7112)	1	
ORP sensor (#7313)	1	
Reference electrode (#7210)	1	
DO sensor (#7543)	1	
Turbidity sensor (#7800)	1	With U-52/U-52G only. Attached to the sensor probe.
Turbidity sensor (#7801)	1	With U-53/U-53G only. Attached to the sensor probe.
pH 4 standard solution (#100-4)	1	500 mL
pH reference internal solution (#330)	1	250 mL
DO sensor internal solution set (#306)	1	Internal solution (50 mL), Sandpaper (#8000, #600), Syringe
DO Membrane spare parts set	1	
Spanner for DO sensor	1	
Cleaning brush	1	
calibration cup	1	transparent calibration cup, black calibration cup
Back pack	1	
Strap	1	
Alkaline batteries	4	LR14
Silicon grease	1	
Instruction manual	1	

2.3 Parts name and functions

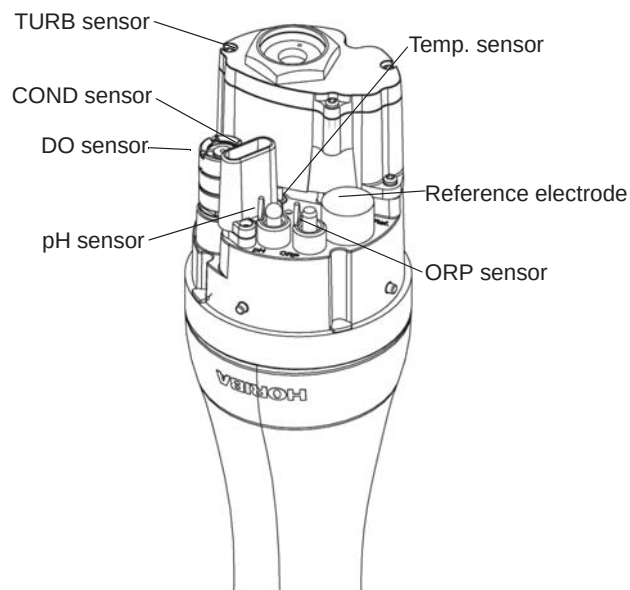
● Display



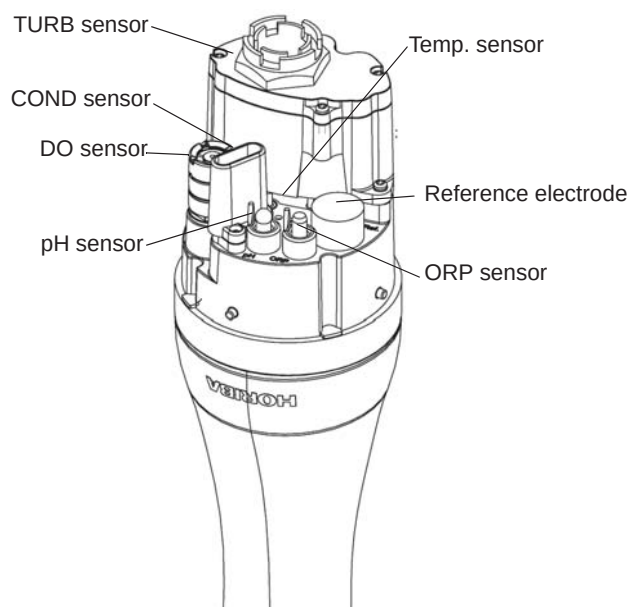
● Sensor probe (U-51)



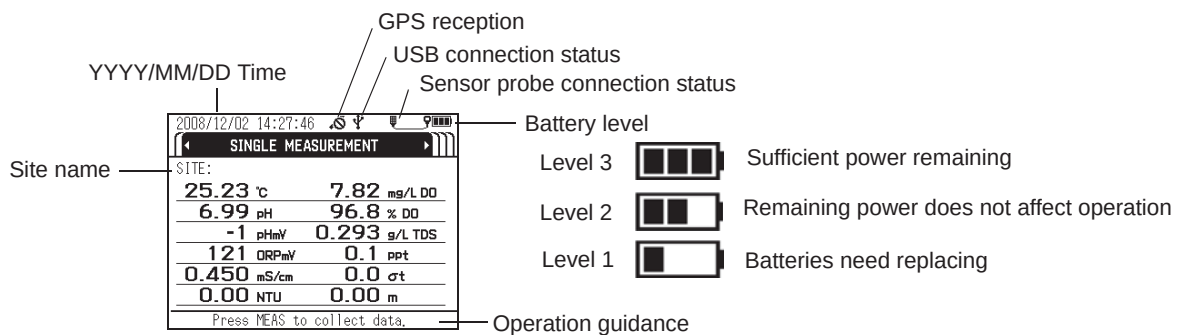
● Sensor probe (U-52)



● Sensor probe (U-53)



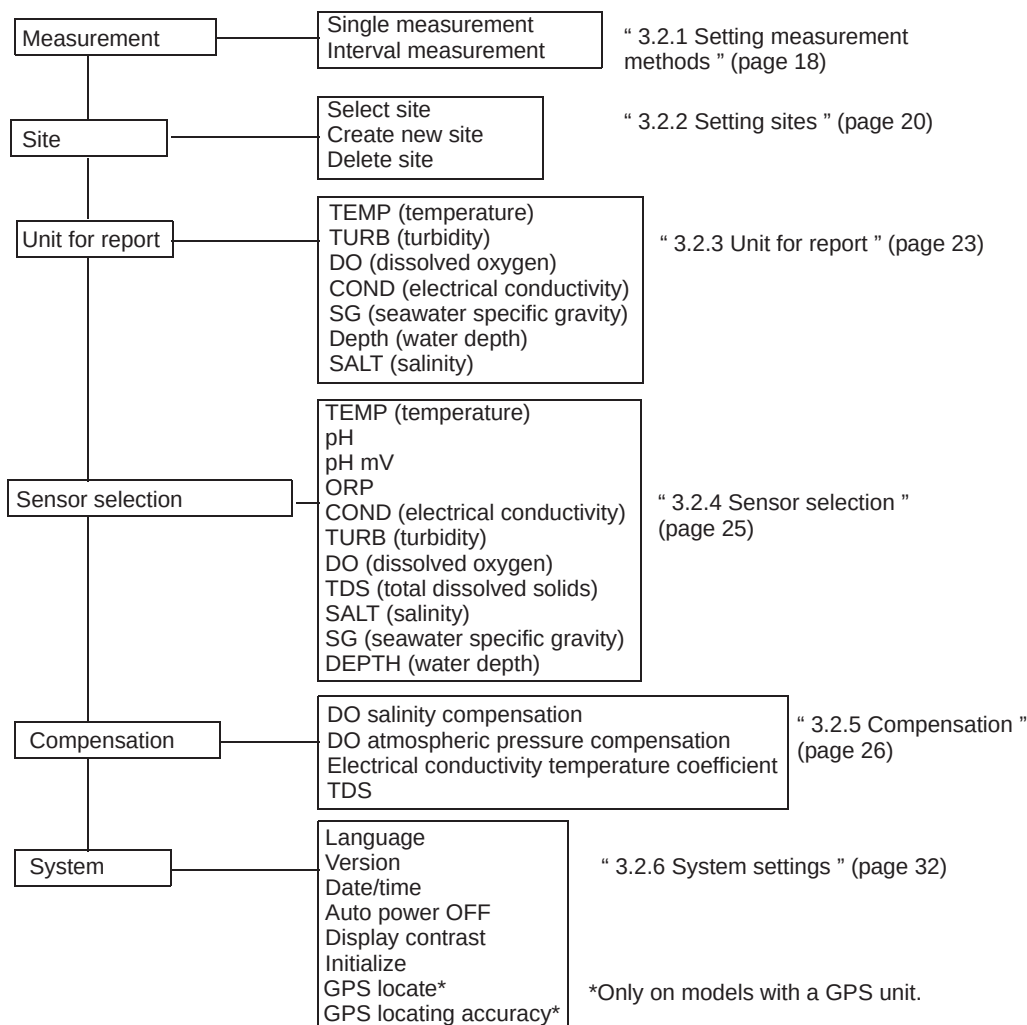
● Display screen



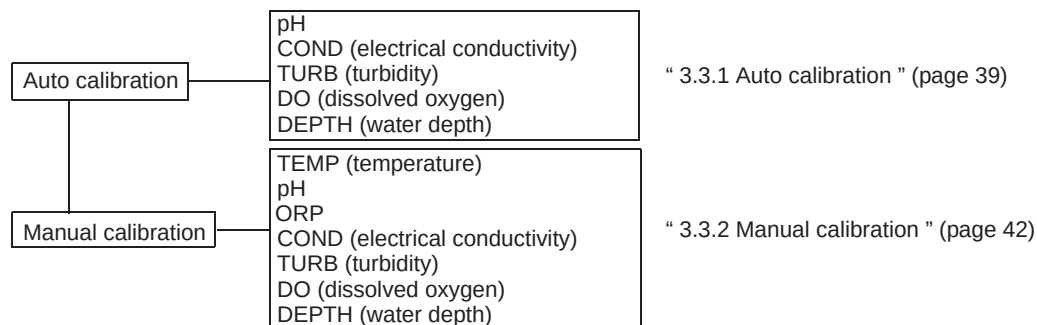
● Operation key

	Key name	description
POWER 	POWER key	Turns the system's power ON/OFF. The initial screen appears immediately after turning the power ON. Press and hold down the POWER key for about 3 seconds to turn the power ON and OFF.
MEAS 	MEAS key	When pressed in the measurement screen, used to set the measurement values of all the measurement parameters. Measurement values flash until the data stabilizes. When pressed in the setting, calibration or data operation screen, returns to the measurement screen.
ENTER 	ENTER key	Used to execute functions, set entered values or store data in memory.
CAL 	CAL key	Switches to the calibration screen.
ESC 	ESC key	Returns to the immediately preceding operation.
LIGHT 	LIGHT key	Turns the backlight ON/OFF. ● Using the backlight shortens battery life. ● The backlight does not light for about 3 seconds after power ON. ● When the sensor probe is connected while the display's backlight is lit, the backlight goes out for about 3 seconds.
	Left key	Moves the cursor to the left.
	Right key	Moves the cursor to the right.
	Up key	Moves the cursor up.
	Down key	Moves the cursor down.

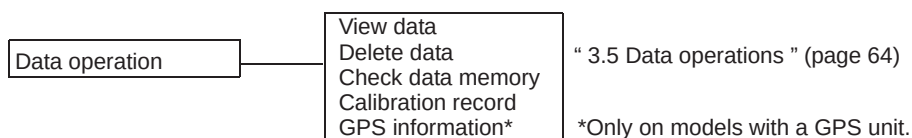
2.4 Setting menu items



2.5 Calibration menu items



2.6 Data operation menu items



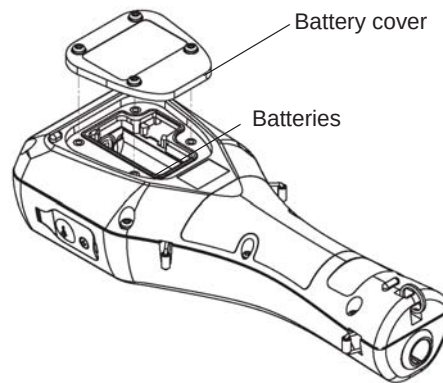
3 Basic Operation

3.1 System setup

3.1.1 Inserting and replacing the batteries

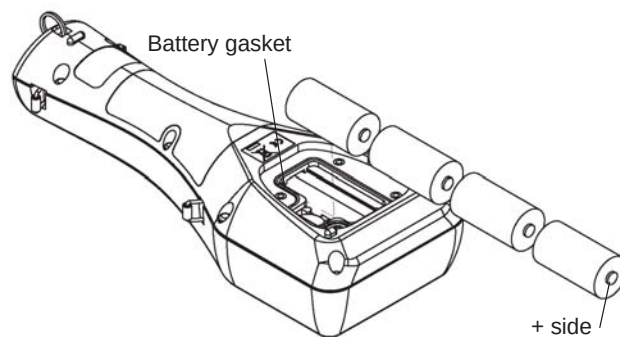
The control unit is shipped without batteries. Follow the steps below to insert the batteries when using the system for the first time or replacing old batteries.

1. Loosen the 4 screws on the battery cover by using No. 2 Phillips head screwdriver and remove the cover.



2. If replacing the batteries, discard the old batteries.
3. Insert new batteries in the control unit.

Check that the battery gasket is not dirty or twisted.



4. Replace the battery cover and fasten it with the 4 screws.
- Tighten the screws to less than 0.5 N·m.

Note

- Data and settings will not be lost when the batteries are replaced.
- If dirty or twisted, the battery gasket will fail to keep the batteries dry. Check its condition before closing the cover.
- To ensure long service life, replacing the battery gasket periodically (once a year) is recommended.

Precautions when using dry cell batteries

- Batteries to use: LR14 alkaline dry cell batteries (C-size dry cell batteries) or rechargeable nickel-metal hydride dry cell batteries (C-size)
Do not use manganese batteries.
- Dry cell batteries used incorrectly may leak or burst. Always observe the following
 - Orient the batteries correctly (positive and negative ends in correct positions).
 - Do not combine new and used batteries, or batteries of different types.
 - Remove the batteries when not using the system for a prolonged period.
 - If batteries leak, have the system inspected at your nearest Horiba service station.

● Battery life

- The battery life for continuous operation when using C-size alkaline dry cell batteries is about 70 hours.
- Using the backlight consumes a proportionate amount of battery power, shortening battery life.
- Searching position information using the GPS unit consumes a proportionate amount of battery power, shortening battery life.
- Nickel-metal hydride secondary batteries can be used, but the battery life is not guaranteed since it will vary according to usage (number of times data is saved, number of charges and amount of each charge). In general, secondary batteries have one-half to one-third the life of C-size alkaline batteries.
- The 70-hour battery life figure applies to a control unit operating temperature of 20°C or more. The battery characteristics shorten the battery life at operating temperatures lower than 20°C, so check the remaining battery level, and replace the batteries before it reaches Level 1.
- The batteries packed with the system at the time of shipment are for checking operation. Their life is not guaranteed.
- The 70-hour battery life figure is the amount of operating time the batteries can provide until the system stops operating. The system may fail during operation if the remaining battery level is low, so it is a good idea to check the remaining battery level and replace the batteries with new ones well before the batteries run out completely.

U-51/52

Battery life: 70 hours (backlight off)

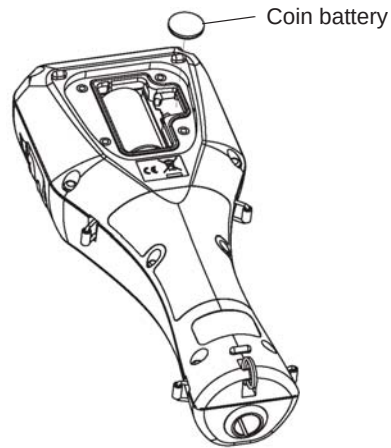
U-53

Battery life: 500 measurements (backlight off)

- Since U-53 is designed for turbidity measurement with wiper, its battery life is estimated in terms of the number of turbidity measurement sequences performed.
- Battery power is also consumed by measurement operations other than turbidity measurement.
- The battery life when turbidity measurement is not performed is about 70 hours.

3.1.2 Replacing the coin battery

- Coin battery to use: CR-2032
- The coin battery is only for the clock. It will provide problem-free operation for three years, but when using the clock continuously, it should be replaced every two years as a precaution.
- When replacing the coin battery for the clock, leave the control unit ON. If the coin battery is replaced when the control unit is turned OFF, the clock will be reset to the default settings.



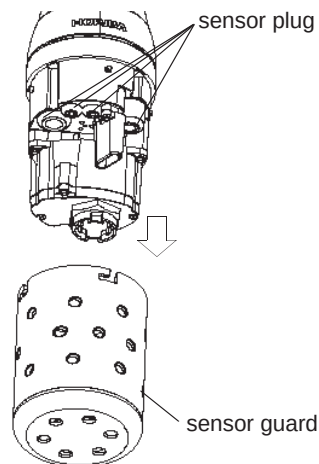
3.1.3 Attaching sensors

Note

- When attaching or replacing a sensor, wipe any moisture off the sensor probe and sensor.
- Be sure to keep water out of sensor connectors. If moisture comes in contact with a sensor connector, blow-dry it with dry air.
- The sensor probe is not waterproof when the sensor is not mounted.
- Take care not to tighten the sensor too much.

● Attaching the pH sensor

1. Remove the sensor guard.

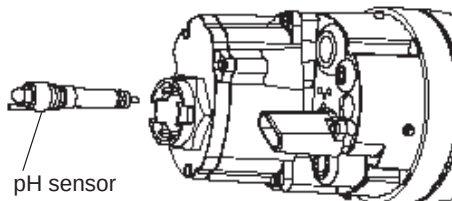


2. Remove the sensor plug.
3. Coat the pH sensor O-ring with a thin layer of silicon grease (part No. 3014017718).

Note

Be sure no grease from the O-ring gets on the sensor connector. If the sensor connector gets grease on it, wipe it off with a soft cloth soaked in alcohol.

4. Make sure there is no moisture on the sensor probe's sensor connector (marked "pH").
5. Fasten the pH sensor securely by hand.



6. Clean the sensor with an alcohol-soaked cloth.

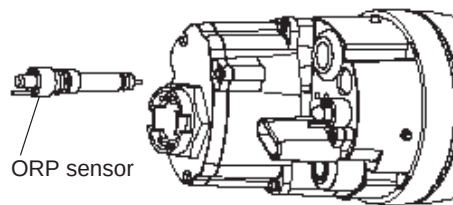
● **Attaching the ORP sensor**

1. Remove the sensor guard.
2. Remove the sensor plug.
3. Coat the ORP sensor O-ring with a thin layer of grease (part No. 3014017718).

Note

Be sure no grease from the O-ring gets on the sensor connector. If the sensor connector gets grease on it, wipe it off with a soft cloth soaked in alcohol.

4. Make sure there is no moisture on the sensor probe's sensor connector (marked "ORP").
5. Fasten the ORP sensor securely by hand.



6. Clean the sensor with an alcohol-soaked cloth.

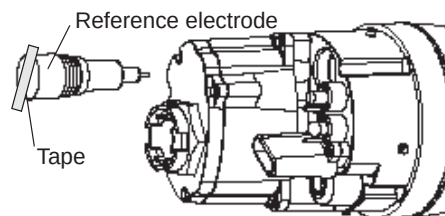
● **Attaching the reference electrode**

1. Remove the sensor guard.
2. Remove the sensor plug.
3. Coat the reference electrode O-ring with a thin layer of grease (part No. 3014017718).

Note

Be sure no grease from the O-ring gets on the sensor connector. If the sensor connector gets grease on it, wipe it off with a soft cloth soaked in alcohol.

4. Make sure there is no moisture on the sensor probe's sensor connector (marked "REF").
5. Fasten the reference electrode securely by hand.
6. Remove the tape from the liquid junction part of the reference electrode.



● Attaching the dissolved oxygen (DO) sensor

1. Remove the membrane cap mounted on the DO sensor beforehand, and replace it with the new membrane cap provided. Replace the internal solution with fresh solution. The main component of the internal solution is potassium chloride (KCl), so the old solution can be disposed of down a sink or other drain.

Reference

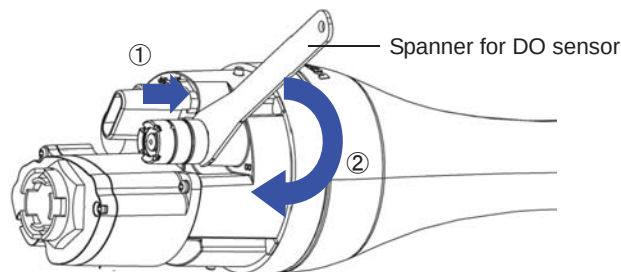
“ 4.5 Replacing the membrane cap ” (page 87)

2. Screw in the DO sensor to attach it, allowing the internal solution to overflow slightly.
3. Use a soft cloth to wipe off the internal solution that overflowed onto the DO sensor.
4. Remove the sensor guard.
5. Remove the sensor plug.
6. Coat the DO sensor O-ring with a thin layer of grease (part No. 3014017718).

Note

Be sure no grease from the O-ring gets on the sensor connector. If the sensor connector gets grease on it, wipe it off with a soft cloth soaked in alcohol.

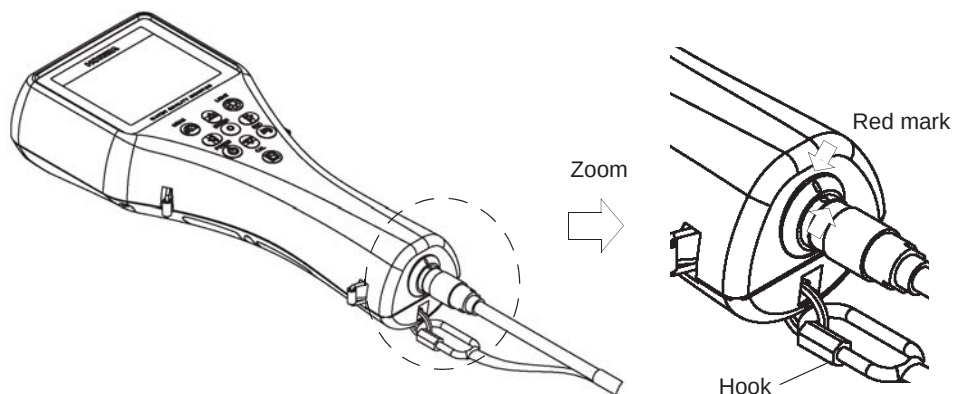
7. Make sure there is no moisture on the sensor probe's sensor connector (marked "DO").
8. Fasten the DO sensor securely using the spanner for DO sensor.
 - Hold the DO sensor with the provided spanner for DO sensor and push the sensor down. (Step 1 in figure below)
 - Screw the DO sensor in place. (Step 2 in figure below)



3.1.4 Connecting the control unit and sensor probe

Note

Connect the control unit with its power OFF.

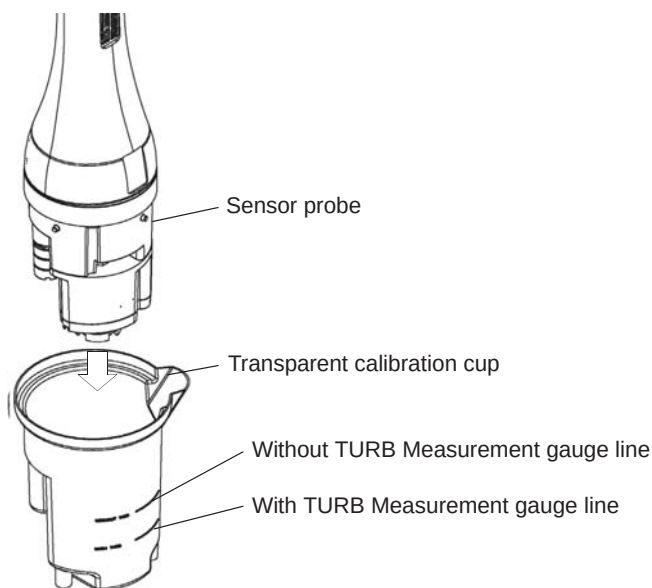


1. Align the red mark on the connector, and press the connector in until you hear it click.
2. Connect the cable's hook to the display.

3.1.5 Conditioning

Carry out the steps below when using the unit for the first time or when the system has not been used for 3 months or longer.

1. **Fill the transparent calibration cup to the line with pH 4 standard solution.**
The transparent calibration cup has With TURB Measurement and Without TURB Measurement gauge lines.
2. **Insert the sensor probe in the transparent calibration cup.**



Note

Check that all sensors are attached.

3. Press and hold down the control unit's **POWER** key for about 3 seconds to turn the power ON. Leave the unit for at least 20 minutes to condition the sensors.

Note

The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

Tip

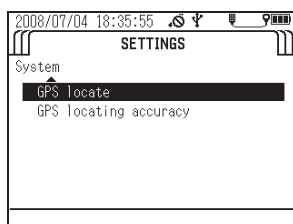
- The procedure for immersing the sensor probe in the pH standard solution is the same as that described in " 3.3.1 Auto calibration " (page 39).
Auto calibration can be performed using the same pH 4 standard solution that was used in the conditioning procedure.
- Immersing the sensor in the standard solution is generally required for sensor conditioning, but a voltage supply is required for DO sensor conditioning. Turning ON the power of the control unit is necessary during sensor conditioning.

3.1.6 GPS (U-52G, U-53G)

The GPS position measurement precision is proportional to the GPS position measurement time. When the position measurement precision increases, the position measurement time also increases. See " ● GPS locating accuracy" (page 17) for how to set the position measurement precision. See " ● GPS locate" (page 15) below for how to check acquired GPS data.

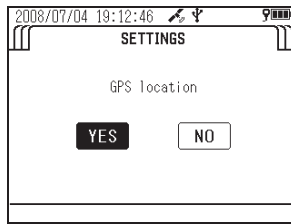
● GPS locate

1. Press the right (▶) key to switch the display to the "SETTINGS" screen.
2. Press the down (▽) key to move the cursor to "System", then press the ENTER key.
3. Press the down (▽) key to move the cursor to "GPS locate", then press the ENTER key.

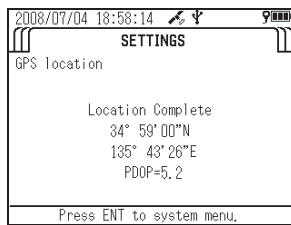


4. The message "Press ENT key to start position measurement." appears. Press the ENTER key.

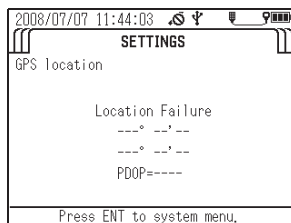
5. The message "Execute GPS position measurement?" appears. Move the cursor to "YES", then press the ENTER key.



6. The message "Warming up. Please wait." appears. Wait until the system has finished warming up (about 10 seconds).
 - Position measurement starts automatically when warmup has finished. Position measurement is performed up to 10 times.
 - The GPS location complete screen appears after successful position measurement.

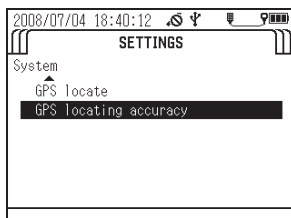


- The GPS location failure screen appears after position measurement has failed. Redo the measurement in a location free from obstacles, or wait for the meteorological conditions to improve before redoing the measurement.

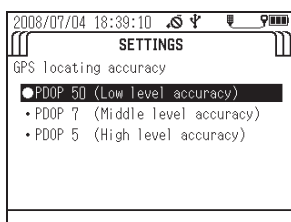


● **GPS locating accuracy**

1. Press the right (▶) key to switch the display to the "SETTINGS" screen.
2. Press the down (▽) key to move the cursor to "System", then press the ENTER key.
3. Press the down (▽) key to move the cursor to "GPS locating accuracy", then press the ENTER key.



4. The screen below appears. Move the cursor to the locating accuracy, then press the ENTER key. The black circle (●) indicates the currently set precision.



3.2 Settings

3.2.1 Setting measurement methods

This section describes how to set the measurement method.

● Measurement methods

● U-51/U-52

Single measurement	Pressing the MEAS key acquires the 5-second average for the selected measurement parameter.
Interval measurement	Pressing the MEAS key acquires and saves the 5-second average for the selected measurement parameter in the set interval. The measurement interval can be set to any value between 10 seconds and 24 hours.

● U-53

The U-53 turbidity sensor uses a tungsten lamp. The lamp lights for about 10 seconds, and the average measurement value acquired during this interval is displayed.

Single measurement	Pressing the MEAS key acquires the 5-second average for the selected measurement parameter after wiper operation. The 10-second average is acquired when measuring turbidity.
Interval measurement	Pressing the MEAS key acquires and saves the 5-second average for the selected measurement parameter in the set interval. The 10-second average is acquired when measuring turbidity. The measurement interval can be set to any value between 10 seconds (final check of this value required; 30 seconds may be better for U-52) and 24 hour.

Reference

“ 3.4 Measurement ” (page 61)

● Operation method

1. Press and hold down the control unit's POWER key for about 3 seconds to turn the power ON.

The "MEASUREMENT" screen appears after about 10 seconds.

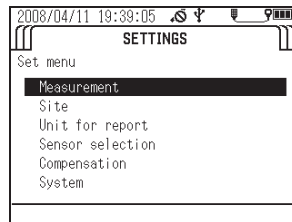
2008/12/02 14:27:46	
SINGLE MEASUREMENT	
SITE:	
25.23 °C	7.82 mg/L DO
6.99 pH	96.8 % DO
-1 pHmV	0.293 g/L TDS
121 ORPmV	0.1 ppt
0.450 mS/cm	0.0 σt
0.00 NTU	0.00 m
Press MEAS to collect data.	

Note

The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

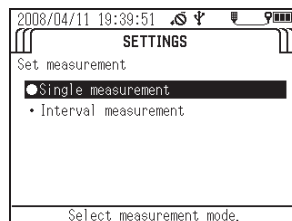
2. Press the right (▷) key to switch the display to the "SETTINGS" screen.

3. Press the down (▽) key to move the cursor to "Measurement", then press the ENTER key.



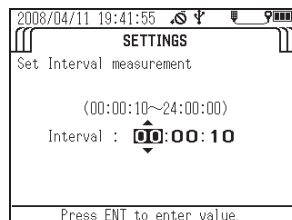
4. Press the down (▽) key to move the cursor to the desired measurement mode. Press the ENTER key to save the setting.

The black circle (●) indicates the currently selected measurement mode.



5. If you selected "Interval measurement", the display switches to the screen used to set the measurement interval. Press the up (△) and down (▽) keys to set the measurement interval.

The measurement interval can be set to any value between 10 seconds and 24 hours in the case of the U-51 and U-52, or between 30 seconds and 24 hours in the case of the U-53.



3.2.2 Setting sites

The site function allows position data to be connected to corresponding measurement data. Sites have the following specifications and features:

- Site names: Text data consisting of up to 20 one-byte alphanumeric characters, spaces, etc.
Site names can be used for control unit searches and as labels for computer processing.
- Site names allow measurement data to be saved with a name corresponding to the actual location where it was measured.

You can use site information as a search key when viewing data uploaded by a PC or data saved in the control unit (see "3.5 Data operations" (page 64)).

● Selecting sites

You can select previously created sites. The black circle (●) indicates the name of the currently selected site. No sites are created at new purchasing or after initialization. Select a site after first creating one from the "Create new site" menu.

● Creating new sites

You can create and save new sites. Up to 20 site names can be registered.

● Deleting sites

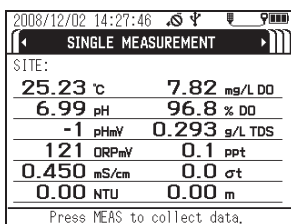
You can select a previously created site and delete it.

● Operation methods

● Selecting a site

1. Press and hold down the control unit's POWER key for about 3 seconds to turn the power ON.

The "MEASUREMENT" screen appears after about 10 seconds.

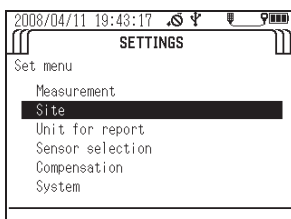


2008/12/02 14:27:46	
SINGLE MEASUREMENT	
SITE:	
25.23 °C	7.82 mg/L DO
6.99 pH	96.8 % DO
-1 pHmV	0.293 g/L TDS
121 ORPmV	0.1 ppt
0.450 mS/cm	0.0 σt
0.00 NTU	0.00 m
Press MEAS to collect data.	

Note

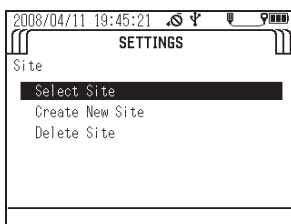
The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

2. Press the right (▷) key to switch the display to the "SETTINGS" screen.
3. Press the down (▽) key to move the cursor to "Site", then press the ENTER key.

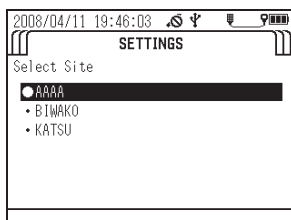


2008/04/11 19:43:17	
SETTINGS	
Set menu	
Measurement	
Site	
Unit for report	
Sensor selection	
Compensation	
System	

4. Press the down (▽) key to move the cursor to "Select Site", then press the ENTER key to display the names of the currently saved sites.



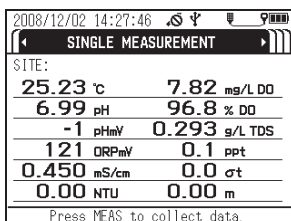
The black circle (●) indicates the currently selected site.



● Creating a new site

1. Press and hold down the control unit's POWER key for about 3 seconds to turn the power ON.

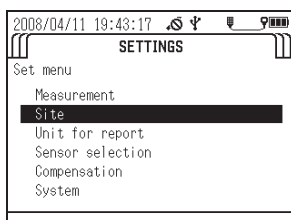
The "MEASUREMENT" screen appears after about 10 seconds.



Note

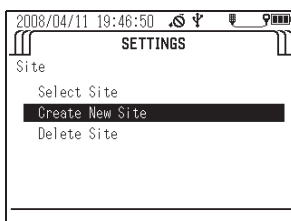
The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

2. Press the right (▷) key to switch the display to the "SETTINGS" screen.
3. Press the down (▽) key to move the cursor to "Site", then press the ENTER key.

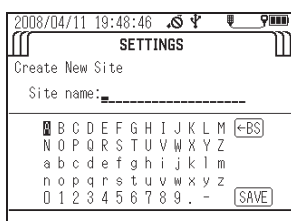


- Press the down (▽) key to move the cursor to "Create New Site", then press the ENTER key.

Enter the desired site name (up to 20 alphanumeric non-Asian width characters).



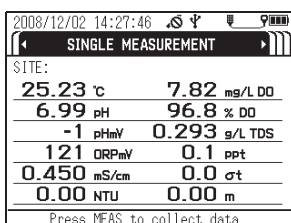
- Press the up (△), down (▽), right (▷), and left (◁) keys to move the cursor to each letter or number to use in the name, then press the ENTER key to confirm the entered characters. To delete incorrectly entered characters, move the cursor to "BS" and press the ENTER key to start deleting from the last character. When you have finished entering the name, save it by moving the cursor to "SAVE" and pressing the ENTER key.



● Deleting a site

- Press and hold down the control unit's POWER key for about 3 seconds to turn the power ON.

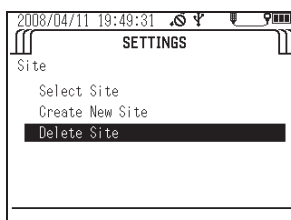
The "MEASUREMENT" screen appears after about 10 seconds.



Note

The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

- Press the right (▷) key to switch the display to the "SETTINGS" screen.



- Press the down (▽) key to move the cursor to "Site", then press the ENTER key.

4. Press the down (▽) key to move the cursor to "Delete Site", then press the ENTER key.

A list of the currently saved sites appears. The black circle (●) indicates the currently selected site.

2008/12/02 14:27:46	
SINGLE MEASUREMENT	
SITE:	
25.23 °C	7.82 mg/L DO
6.99 pH	96.8 % DO
-1 pHmV	0.293 g/L TDS
121 ORPmV	0.1 ppt
0.450 mS/cm	0.0 σt
0.00 NTU	0.00 m
Press MEAS to collect data.	

5. Press the down (▽) key to move the cursor to the site to delete, then press the ENTER key to delete it.

The currently selected site can be deleted after a different site has been selected from the site selection menu or after all unselected sites have been deleted. The same site name cannot be registered more than once.

2008/04/11 19:50:19	
SETTINGS	
Delete Site	
● AAAA	
• BIWAKO	
• KATSU	

3.2.3 Unit for report

Note

Units can only be selected when the sensor probe is connected.

Follow the steps below to set the measurement units of measurement parameters. No units are displayed if a measurement parameter has not been selected in the measurement parameter selection screen (see "3.2.4 Sensor selection" (page 25)).

1. Press and hold down the control unit's POWER key for about 3 seconds to turn the power ON.

The "MEASUREMENT" screen appears after about 10 seconds.

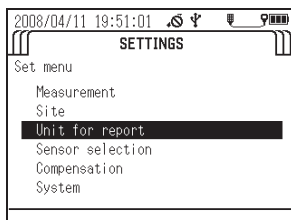
Note

The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

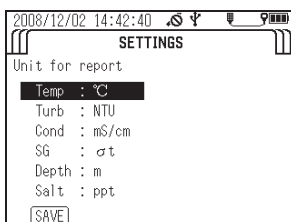
2. Press the right (▷) key to switch the display to the "SETTINGS" screen.

3. Press the down (▽) key to move the cursor to "Unit for report", then press the ENTER key.

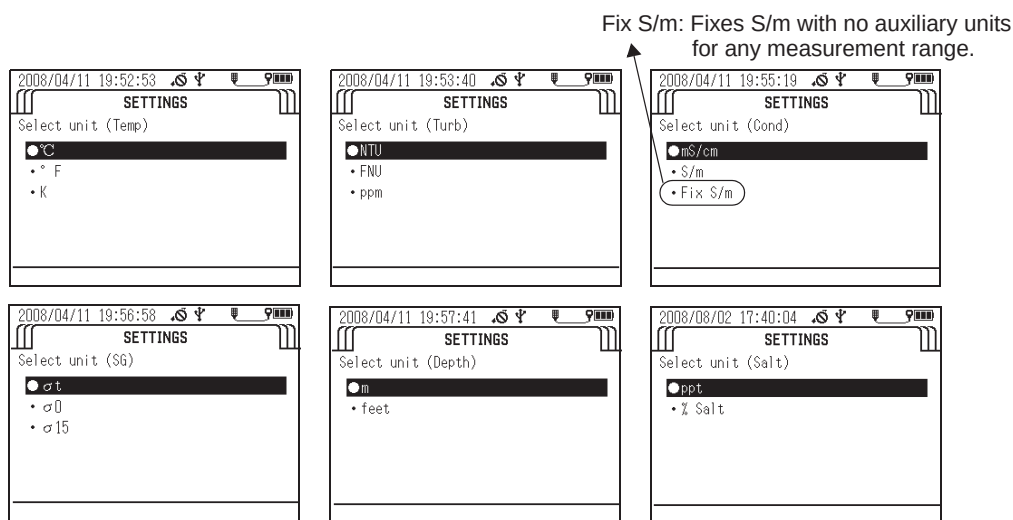
A list of the currently selected measurement parameters and their units appears. Note that measurement parameters not selected (in the measurement parameter selection screen) are not displayed.



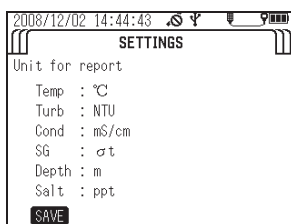
4. Press the up (△) and down (▽) keys to move the cursor to the item to change, then press the ENTER key.



5. A list of the units that can be selected appears. The black circle (●) indicates the currently selected unit. Press the up (△) and down (▽) keys to move the cursor to the desired unit, then press the ENTER key.



6. To save the changes, press the up (△) and down (▽) keys to move the cursor to SAVE, then press the ENTER key. If you do not want to save the changes, press the ESC key.



3.2.4 Sensor selection

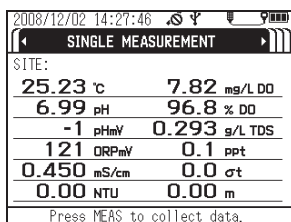
Note

Measurement parameters can only be selected when the sensor probe is connected.

You can set between 1 and 11 measurement parameters to display in the control unit screen. Follow the steps below to select the desired measurement parameters.

1. Press and hold down the control unit's **POWER** key for about 3 seconds to turn the power ON.

The "MEASUREMENT" screen appears after about 10 seconds.



SINGLE MEASUREMENT	
SITE:	
25.23 °C	7.82 mg/L DO
6.99 pH	96.8 % DO
-1 pHmV	0.293 g/L TDS
121 ORPmV	0.1 ppt
0.450 mS/cm	0.0 σt
0.00 NTU	0.00 m

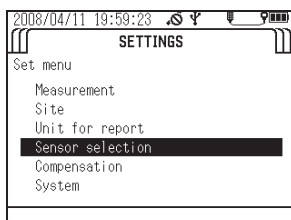
Press MEAS to collect data.

Note

The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

2. Press the right (▷) key to switch the display to the "SETTINGS" screen.
3. Press the down (▽) key to move the cursor to "Sensor selection", then press the ENTER key.

A list of the measurement parameters that can be set and the currently set units are displayed.

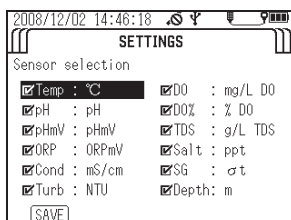


SETTINGS	
Set menu	
Measurement	
Site	
Unit for report	
Sensor selection	
Compensation	
System	

4. Move the cursor to each measurement parameter to change, then press the ENTER key.

A check in the check box of a measurement parameter indicates it will be displayed.

5. To save the changes, press the up (△), down (▽), left (◀) and right (▶) keys to move the cursor to **SAVE**, then press the ENTER key. If you don't want to save the changes, press the ESC key.



Sensor selection	
☒ Temp : °C	☒ DO : mg/L DO
☒ pH : pH	☒ DO% : % DO
☒ pHmV : pHmV	☒ TDS : g/L TDS
☒ ORP : ORPmV	☒ Salt : ppt
☒ Cond : mS/cm	☒ SG : σt
☒ Turb : NTU	☒ Depth: m
SAVE	

Note

Available measurement parameters differ according to product specifications.

3.2.5 Compensation

Note

Compensation settings can only be made when the sensor probe is connected.

U-50 series have following functions of compensation.

- Salinity compensation and atmospheric pressure compensation for dissolved oxygen (DO)
- Temperature compensation for conductivity (COND)
- Setting total dissolved solid (TDS) coefficient for TDS

● Salinity compensation (DO)

The dissolved oxygen (DO) value is presented higher than actual value if salinity compensation is not added, because the increase of salinity gives higher DO value. To obtain correct value salinity compensation is needed. The following modes are available for calculation of salinity compensation.

AUTO: Salinity compensation is performed automatically with salinity converted from conductivity.

Value input: Press the up (Δ) and down (∇) keys to enter a setting value when the salinity is known.

1. Press and hold down the control unit's POWER key for about 3 seconds to turn the power ON.

The "MEASUREMENT" screen appears after about 10 seconds.

2008/12/02 14:27:46	
SINGLE MEASUREMENT	
SITE:	
25.23 °C	7.82 mg/L DO
6.99 pH	96.8 % DO
-1 pHmV	0.293 g/L TDS
121 ORPmV	0.1 ppt
0.450 mS/cm	0.0 σt
0.00 NTU	0.00 m
Press MEAS to collect data.	

Note

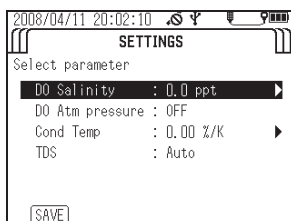
The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

2. Press the right ($\triangleright$) key to switch the display to the "SETTINGS" screen.
3. Press the down (∇) key to move the cursor to "Compensation", then press the ENTER key.

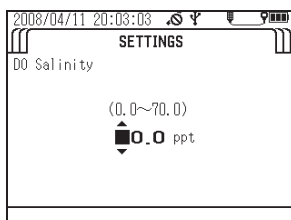
2008/04/11 20:01:14	
SETTINGS	
Set menu	
Measurement	
Site	
Unit for report	
Sensor selection	
Compensation	
System	

- Press the down (▽) key to move the cursor to "DO Salinity", then press the ENTER key to toggle the setting between "Auto" and "Input mode".

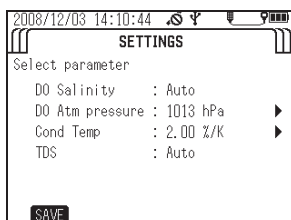
Default: Auto



- If you selected "Input mode", press the right (▷) key to display the compensation value input screen. Press the up (△) and down (▽) keys to enter the desired value, then press the ENTER key to set it.



- To save the change, press the up (△) and down (▽) keys to move the cursor to SAVE, then press the ENTER key. If you don't want to save the change, press the ESC key.

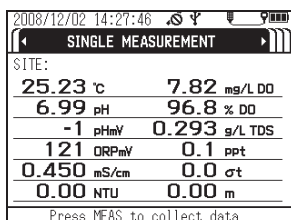


● Atmospheric pressure compensation (DO)

Differences in the atmospheric pressure of the measurement location influence the Dissolved Oxygen (DO) measurement. By setting (input) the actual atmospheric pressure of the measurement location into the control unit, it is possible to standardize the measured Dissolved Oxygen (DO) value to a value at the standard atmospheric pressure (1013 hPa).

- Press and hold down the control unit's POWER key for about 3 seconds to turn the power ON.

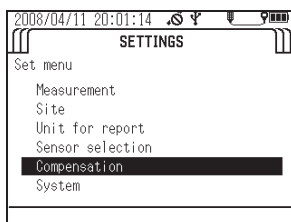
The "MEASUREMENT" screen appears after about 10 seconds.



Note

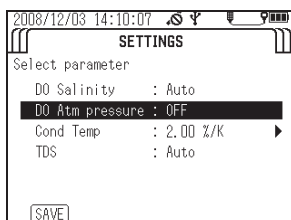
The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

2. Press the right (▷) key to switch the display to the "SETTINGS" screen.
3. Press the down (▽) key to move the cursor to "Compensation", then press the ENTER key.

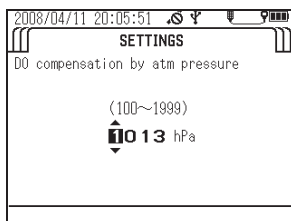


4. Press the down (▽) key to move the cursor to "Cond Temp", then press the ENTER key to toggle the setting between "OFF" and "Input mode".

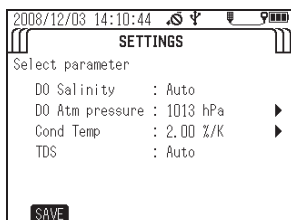
Default: OFF



5. If you selected "Input mode", press the right (▷) key to display the compensation value input screen. Press the up (△) and down (▽) keys to enter the desired value, then press the ENTER key to set it.



6. To save the change, press the up (△) and down (▽) keys to move the cursor to SAVE, then press the ENTER key. If you don't want to save the change, press the ESC key.



● Temperature compensation for conductivity (COND)

Sample conductivity (COND) varies with temperature, and this control unit uses a temperature compensation coefficient to automatically standardize the conductivity (COND) at 25°C. The initial setting coefficient is 2%/K, which is the generally used.

1. Press and hold down the control unit's **POWER** key for about 3 seconds to turn the power ON.

The "MEASUREMENT" screen appears after about 10 seconds.

2008/12/02 14:27:46	
SINGLE MEASUREMENT	
SITE:	
25.23 °C	7.82 mg/L DO
6.99 pH	96.8 % DO
-1 pHmV	0.293 g/L TDS
121 ORPmV	0.1 ppt
0.450 mS/cm	0.0 σt
0.00 NTU	0.00 m
Press MEAS to collect data.	

Note

The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

2. Press the right (▷) key to switch the display to the "SETTINGS" screen.
3. Press the down (▽) key to move the cursor to "Compensation", then press the ENTER key.

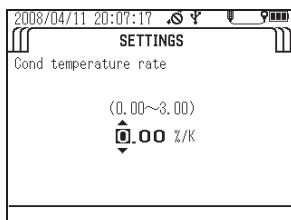
2008/04/11 20:01:14	
SETTINGS	
Set menu	
Measurement	
Site	
Unit for report	
Sensor selection	
Compensation	
System	

4. Press the down (▽) key to move the cursor to "Cond Temp", then press the ENTER key to toggle the setting between "OFF" and "Input mode".

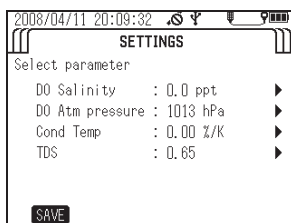
Default: 2.00%/K

2008/12/03 14:10:07	
SETTINGS	
Select parameter	
DO Salinity	: Auto
DO Atm pressure	: OFF
Cond Temp	: 2.00 %/K ▶
TDS	: Auto
[SAVE]	

5. If you selected "Input mode", press the right (▶) key to display the compensation value input screen. Press the up (▲) and down (▼) keys to enter the desired value, then press the ENTER key to set it.



6. To save the change, press the up (▲) and down (▼) keys to move the cursor to **SAVE**, then press the ENTER key.
If you don't want to save the change, press the ESC key.



● Setting a total dissolved solid (TDS) coefficient

The total dissolved solid amount (TDS) is a converted value obtained by multiplying the conductivity (COND) by a known coefficient. The coefficient initially set for the control unit is based on a conversion for KCl and CaCO_3 solutions and it depends on the conductivity (COND) value as shown below.

Conductivity (COND) (S/m)	Conversion coefficient
< 0.05	0.65
0.05 to 0.5	0.64
0.5 to 1	0.63
1 to 3	0.62
3 to 5	0.61
> 5	0.60

1. Press and hold down the control unit's **POWER** key for about 3 seconds to turn the power ON.

The "MEASUREMENT" screen appears after about 10 seconds.

2008/12/02 14:27:46	
SINGLE MEASUREMENT	
SITE:	
25.23 °C	7.82 mg/L DO
6.99 pH	96.8 % DO
-1 pHmV	0.293 g/L TDS
121 ORPmV	0.1 ppt
0.450 mS/cm	0.0 σt
0.00 NTU	0.00 m
Press MEAS to collect data.	

Note

The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

2. Press the right (▷) key to switch the display to the "SETTINGS" screen.
3. Press the down (▽) key to move the cursor to "Compensation", then press the ENTER key.

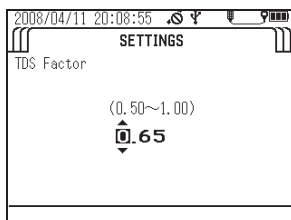
2008/04/11 20:01:14	
SETTINGS	
Set menu	
Measurement	
Site	
Unit for report	
Sensor selection	
Compensation	
System	

4. Press the down (▽) key to move the cursor to "TDS", then press the ENTER key to toggle the setting between "AUTO" and "Input mode".

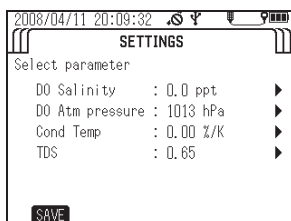
Default: Auto

2008/04/11 20:08:15	
SETTINGS	
Select parameter	
DO Salinity	: 0.0 ppt ▶
DO Atm pressure	: 1013 hPa ▶
Cond Temp	: 0.00 %/K ▶
TDS	: 0.65 ▶
[SAVE]	

5. If you selected "Input mode", press the right (➤) key to display the compensation value input screen. Press the up (Δ) and down (▽) keys to enter the desired value, then press the ENTER key to set it.



6. To save the change, press the up (Δ) and down (▽) keys to move the cursor to SAVE, then press the ENTER key. If you don't want to save the change, press the ESC key.



3.2.6 System settings

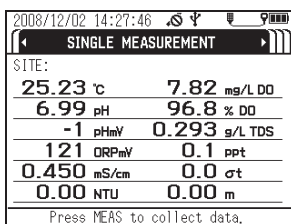
The system settings let you change the display language, check the system software version, set the date/time, set the auto power OFF time, set the display contrast, and initialize the settings.

● Display language

Follow the steps below to select either English or Japanese as the display language.

1. Press and hold down the control unit's POWER key for about 3 seconds to turn the power ON.

The "MEASUREMENT" screen appears after about 10 seconds.

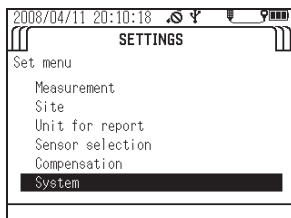


Note

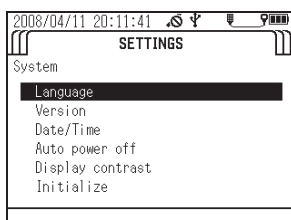
The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

2. Press the right (➤) key to switch the display to the "SETTINGS" screen.

3. Press the down (▽) key to move the cursor to "System", then press the ENTER key.

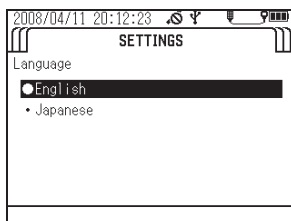


4. Press the down (▽) key to move the cursor to "Language", then press the ENTER key.



5. A list of the supported display languages appears. Press the up (△) and down (▽) keys to move the cursor to the desired language, then press the ENTER key.

The black circle (●) indicates the currently selected display language.



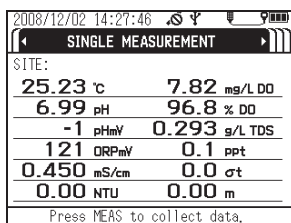
● Version

Follow the steps below to display the program No. and version of the control unit and sensor probe software.

The program No. and version of the sensor probe software will not be displayed if the sensor probe is not connected.

1. Press and hold down the control unit's POWER key for about 3 seconds to turn the power ON.

The "MEASUREMENT" screen appears after about 10 seconds.

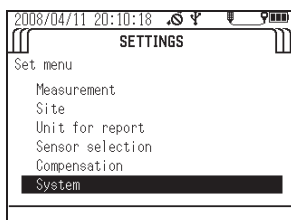


Note

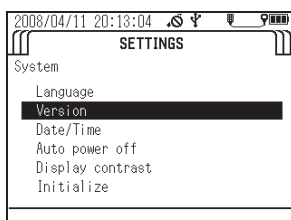
The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

2. Press the right (▷) key to switch the display to the "SETTINGS" screen.

3. Press the down (▽) key to move the cursor to "System", then press the ENTER key.



4. Press the down (▽) key to move the cursor to "Version", then press the ENTER key.
The program No. of the control unit and sensor probe software appears.

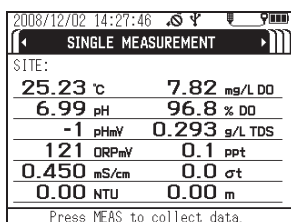


● Setting the date/time

Follow the steps below to set the date and time.

1. Press and hold down the control unit's POWER key for about 3 seconds to turn the power ON.

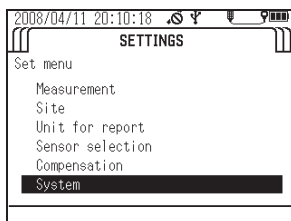
The "MEASUREMENT" screen appears after about 10 seconds.



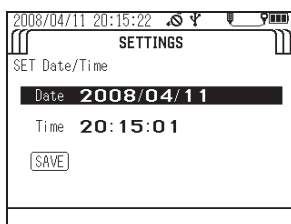
Note

The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

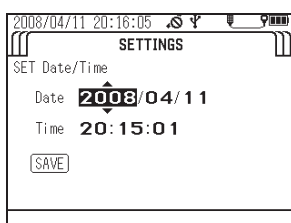
2. Press the right (▷) key to switch the display to the "SETTINGS" screen.
3. Press the down (▽) key to move the cursor to "System", then press the ENTER key.



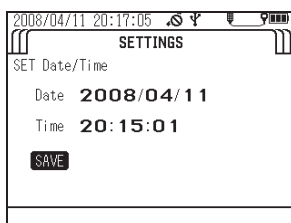
4. Press the down (▽) key to move the cursor to "Date/time", then press the ENTER key.



5. Move the cursor to the date, then press the ENTER key.
 6. Press the right (▷) key to move the cursor to the year, month, day, hour, minute and second, and press the up (△) and down (▽) keys to enter each value.



7. When finished entering settings, press the ENTER key to move the cursor to SAVE, then press the ENTER key again to save the settings.

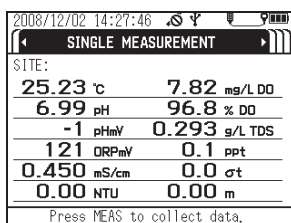


● Setting the auto power OFF time

Follow the steps below to set the time for the auto power OFF function (which turns the power OFF automatically when no operation is performed for the preset amount of time).

1. Press and hold down the control unit's POWER key for about 3 seconds to turn the power ON.

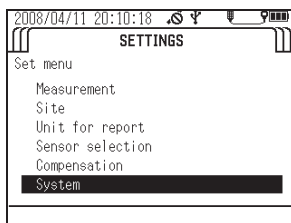
The "MEASUREMENT" screen appears after about 10 seconds.



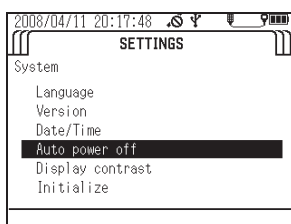
Note

The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

2. Press the right (▶) key to switch the display to the "SETTINGS" screen.
3. Press the down (▼) key to move the cursor to "System", then press the ENTER key.



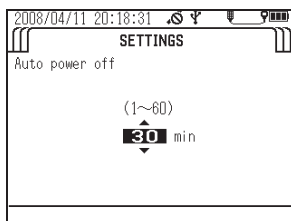
4. Press the down (▼) key to move the cursor to "Auto power off", then press the ENTER key.



5. Press the up (▲) and down (▼) keys to select the desired time setting, then press the ENTER key.

You can select OFF, or settings of 1, 2, 5, 10, 20, 30 or 60 minutes.

Default: 30 minutes

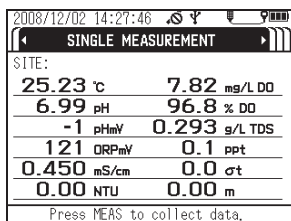


● Display contrast

Follow the steps below to adjust the display's contrast.

1. Press and hold down the control unit's POWER key for about 3 seconds to turn the power ON.

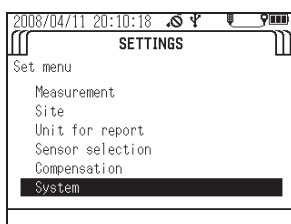
The "MEASUREMENT" screen appears after about 10 seconds.



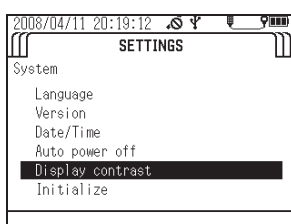
Note

The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

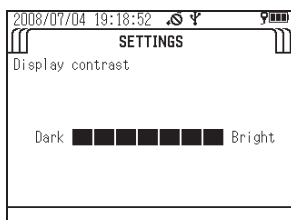
2. Press the right (▷) key to switch the display to the "SETTINGS" screen.
3. Press the down (▽) key to move the cursor to "System", then press the ENTER key.



4. Press the down (▽) key to move the cursor to "Display contrast", then press the ENTER key.



5. Press the left (◀) and right (▷) keys to adjust the contrast.
Adjustment can be made in 26 steps.



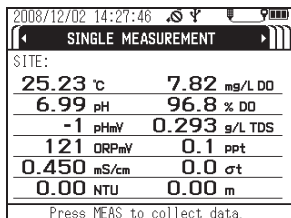
6. Press the ENTER key.

● Initialization

Follow the steps below to restore all the settings except date/time to their factory defaults. Factory default calibration data for the electrical conductivity and turbidity sensors will also be deleted at the same time.

1. Press and hold down the control unit's POWER key for about 3 seconds to turn the power ON.

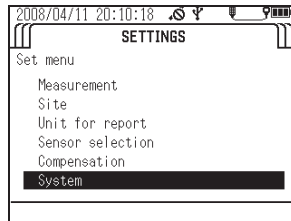
The "MEASUREMENT" screen appears after about 10 seconds.



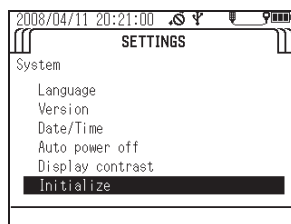
Note

The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

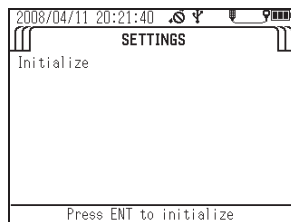
2. Press the right (▷) key to switch the display to the "SETTINGS" screen.
3. Press the down (▽) key to move the cursor to "System", then press the ENTER key.



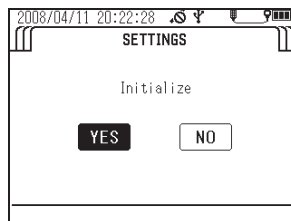
4. Press the down (▽) key to move the cursor to "Initialize", then press the ENTER key.



5. Press the ENTER key again.



6. A confirmation message appears asking whether to execute initialization. Press the left (◀) key to move the cursor to YES, then press the ENTER key.
The message "Initialize Complete" appears to indicate the process has finished.



3.3 Calibration

To obtain correct measurement values, the sensors need to be calibrated using standard solution before measurement. You can select simultaneous auto calibration of the pH, COND and TURB sensors in pH4 standard solution and DO and DEP sensors simultaneously in air, or manual calibration of individual measurement parameters. You can check the result of the previous calibration using the procedure on “ 3.5.4 Checking the calibration record ” (page 70).

Note

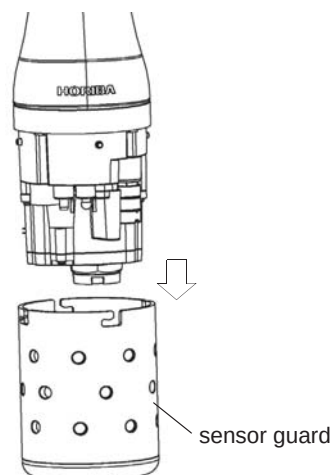
- Wait at least 20 minutes after turning the system power ON before calibrating the DO sensor.
- Make the DO and COND compensation settings before calibration since these settings are applied during calibration.
- You can select only the desired parameters for calibration and calibrate just those parameters (see “ 3.2.4 Sensor selection ” (page 25)).
- Use about 200 mL of standard solution in the calibration cup.
- Calibration data is stored in the sensor probe.

3.3.1 Auto calibration

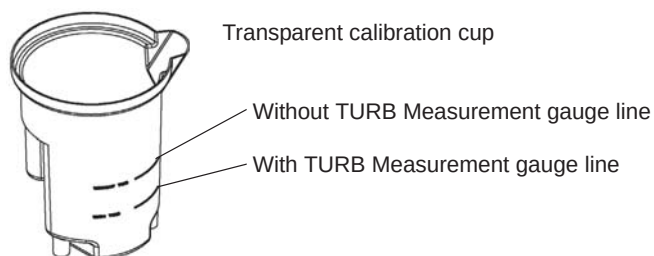
Tip

- The following parameters are calibrated (at 25°C):
 pH: Set to 4.01 (zero-point calibration); the span is adjusted to the factory default value.
 COND: 0.449 S/m (4.49 mS/cm, span calibration); the zero point is adjusted to the factory default value.
 TURB: 0 NTU (zero-point calibration); the span is adjusted to the factory default value.
 DO: 8.92 mg/L (span calibration); the zero point is adjusted to the factory default value.
 DEP: 0 m (zero-point calibration); the zero point is adjusted to the factory default value.
- If the air temperature changes, the readout value may not be stable. Ensure that the ambient air temperature is the same temperature as the calibration solution, because the internal probe temperature sensor and external temperature sensor (in the calibration solution) are used for the auto calibration. Allow the probe and standard solution to equilibrate for 1 hour if a thermometer is not available to verify that these temperatures are the same.
- Do not hold the probe while performing the auto calibration. Body temperature may elevate the internal temperature sensor measurement creating DO calibration error.

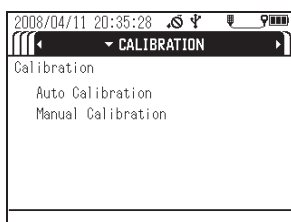
1. Remove the sensor guard and wash the sensor probe 2 or 3 times with deionized water.



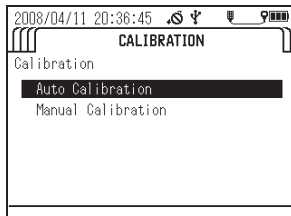
2. Remove the transparent calibration cup.
3. Fill the transparent calibration cup to the line with pH 4 standard solution.
The transparent calibration cup has With TURB Measurement and Without TURB Measurement gauge lines.



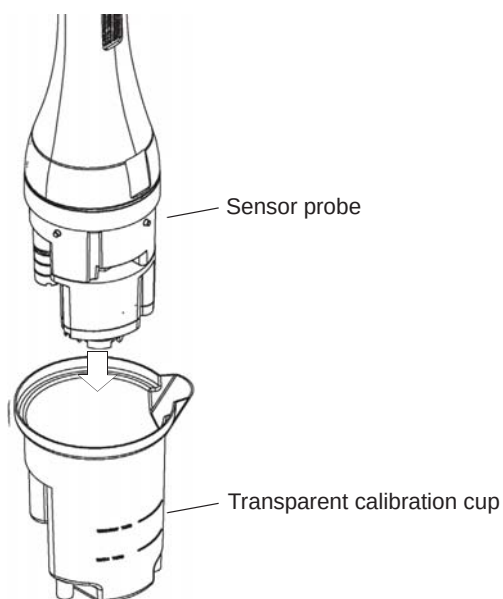
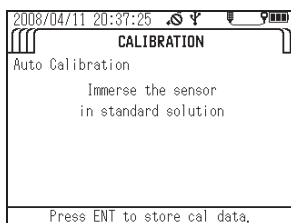
4. Press the control unit's CAL key to set the calibration mode.



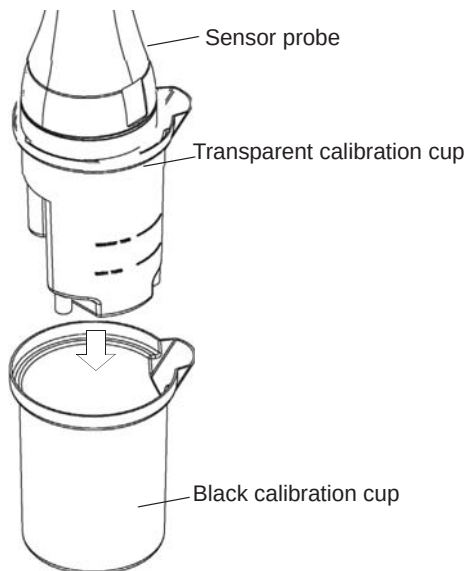
5. Press the down (▽) key to move the cursor to "Auto Calibration", then press the ENTER key.



6. Immerse the sensor probe in the transparent calibration cup. Check that the pH sensor, ORP sensor, reference electrode, COND sensor, TURB sensor and temperature sensor are submerged in the pH 4 standard solution and check that there are no air bubbles on the sensor.



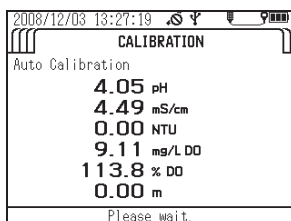
7. With the sensor probe still in the transparent calibration cup, place the transparent calibration cup into the black calibration cup.



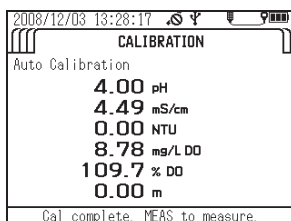
8. When all the sensor values have stabilized, press the ENTER key to start calibration.

Note

Do not remove the sensor probe from the calibration solution. U-53 turbidity data will display "----" until the calibration is completed.



Calibration is finished when the message "Cal complete. MEAS to measure." appears. Press the MEAS key to set the measurement screen, then start measurement.



If a calibration error occurs, start calibration after first resolving the issue according to the instructions in "4.6 Troubleshooting" (page 89).

3.3.2 Manual calibration

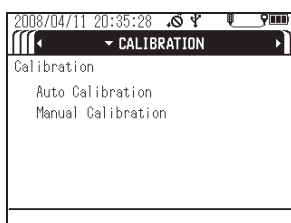
The procedures below describe how to calibrate each sensor individually.

Note

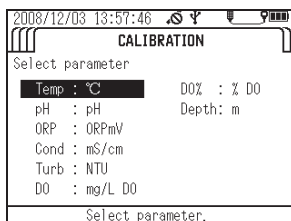
The displayed units are the units set by selecting "Unit for report" in the "SETTINGS" screen.

● Temperature (TEMP) calibration

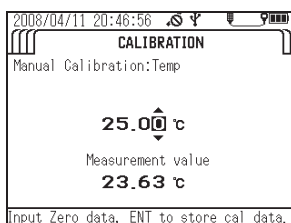
1. Fill a bucket or similar container with water of a known temperature, and insert the sensor probe in it.
Wait 5 minutes before starting calibration to allow the sensor probe temperature to stabilize.
2. Press the control unit's CAL key to set the calibration mode.
3. Press the down (▽) key to move the cursor to "Manual Calibration", then press the ENTER key.



4. In the parameter selection screen, move the cursor to "Temp", then press the ENTER key.



5. Press the up (Δ) and down (▽) keys to set the calibration value - the temperature of the water containing the submerged sensor probe.



6. Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.

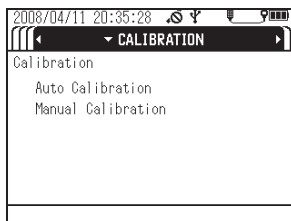
Calibration is finished when the message "Cal complete. CNT to measure." appears.

● pH calibration

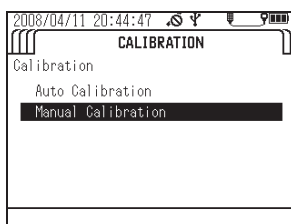
Note

You can select one calibration point (zero-point calibration) or two calibration points (zero-point calibration and span calibration). Carry out two calibration procedures to ensure good measurement precision throughout all measurement ranges.

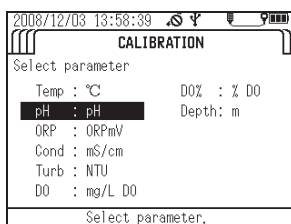
1. Calibrate the zero point. Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with pH 7 standard solution.
2. Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.
3. Press the control unit's CAL key to set the calibration mode.



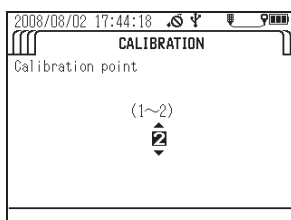
4. Press the down (▽) key to move the cursor to "Manual Calibration", then press the ENTER key.



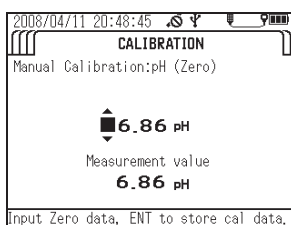
5. In the parameter selection screen, move the cursor to "pH", then press the ENTER key.



6. Set the number of calibration points, then press the ENTER key.



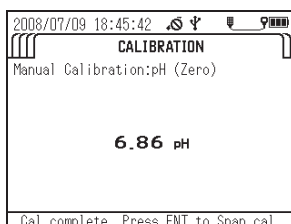
7. Press the up (Δ) and down (▽) keys to set the pH value of the pH 7 standard solution containing the submerged sensor probe at the measurement temperature



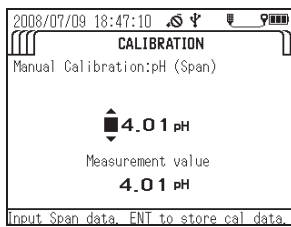
Temp. (°C)	pH 4 standard solution Phthalate	pH 7 standard solution Neutral phosphate	pH 9 standard solution Borate
0	4.01	6.98	9.46
5	4.01	6.95	9.39
10	4.00	6.92	9.33
15	4.00	6.90	9.27
20	4.00	6.88	9.22
25	4.01	6.86	9.18
30	4.01	6.85	9.14
35	4.02	6.84	9.10
40	4.03	6.84	9.07
45	4.04	6.84	9.04

8. Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.

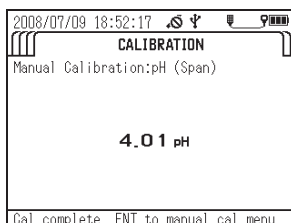
9. Press the ENTER key to start the span calibration procedure when the message "Cal complete. Press ENT to Span cal." appears.



10. Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with pH 4 or pH 9 standard solution.
11. Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.
12. Press the up (Δ) and down (∇) keys to set the pH value of the pH 4 or pH 9 standard solution containing the submerged sensor probe at the measurement temperature.



13. Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.
14. Calibration is finished when the message "Cal complete. ENT to manual cal menu." appears. Press the ENTER key to return to the calibration parameter

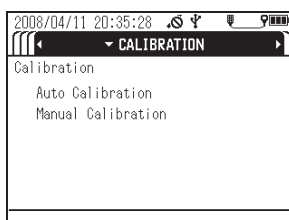


● ORP calibration

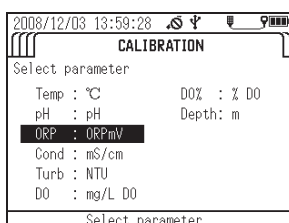
Note

- If the prepared ORP standard solution is left in open air for one hour or more, the solution may be transformed. For this reason ORP standard solution cannot be stored. Calibrate within one hour of preparing the solution.
- When measuring sample with low concentrations of oxidants and reductants after conducting an operational check using a standard substance, the measured values may not stabilize or the results of measurement might not be repeatable. If this is the case, start the measurement after immersing the sensors in the sample water sufficiently.
- Note that when measuring the ORP of solution with extremely low concentrations of oxidants and reductants, such as tap water, well water, or water treated with purifying equipment, there may be less responsiveness, repeatability, and stability, in general.
- When alkaline ion water is left for 5 minutes, its ORP undergoes changes significantly. Always measure alkaline ion water promptly.

1. Fill a clean beaker with one bag of ORP standard powder No. 160-22 or No. 160-51. Add 250 mL of deionized water and agitate the solution thoroughly (there will be some excess quinhydrone (a black powder) that floats on the surface when agitating the solution). Fill the transparent calibration cup to the reference line with this standard solution.
2. Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.
3. Press the control unit's CAL key to set the calibration mode.
4. Press the down (▽) key to move the cursor to "Manual Calibration", then press the ENTER key.



5. In the parameter selection screen, move the cursor to ORP, then press the ENTER key.



6. Press the up (△) and down (▽) keys to set the mV value of the ORP standard solution containing the submerged sensor probe at the measurement temperature.

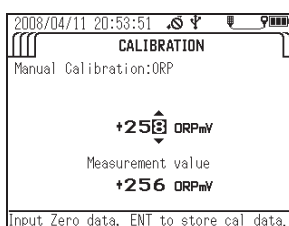


Table 1 Indicated value of ORP standard solution at various temperatures (mV)

Temperature	160-22	16051
5	+274	+112
10	+271	+107
15	+267	+101
20	+263	+95
25	+258	+89
30	+254	+83
35	+249	+76
40	+244	+69

7. Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.
8. Calibration is finished when the message "Cal complete. ENT to manual cal menu." appears. Press the ENTER key to return to the calibration parameter selection screen.

● Conductivity (COND) calibration

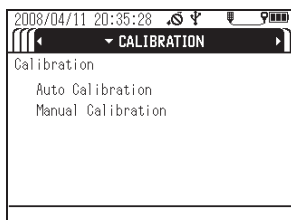
Note

- To support a wide range of sample concentrations, electrical conductivity is divided into three measurement ranges: 0.0 mS/m to 99.9 mS/m, 0.090 S/m to 0.999 S/m, and 0.9 S/m to 9.99 S/m.
- When manually calibrating conductivity, you can select two calibration points (one zero-point calibration point and a span calibration point for one of the three measurement ranges) or four calibration points (one zero-point calibration point and span calibration points for all three measurement ranges). Carry out the four calibration points to ensure good measurement precision throughout all measurement ranges.
- Make the compensation setting before calibration since this setting is applied during calibration. (Refer to “ 6.5.3 Temperature coefficient ” (page 104)).

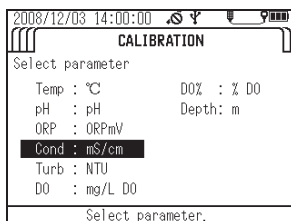
1. Prepare the standard solution. Dry Potassium chloride (KCl) powder (high-grade commercially available) at 105°C for two hours, and leave it to cool in a desiccator.
2. Consult the following table and weigh potassium chloride (KCl), then prepare three standard potassium chloride (KCl) solutions following the procedure below.

Potassium chloride (KCl) standard solution	Conductivity (COND) value	Potassium chloride (KCl) mass (g) at solution temperature of 25 °C	Calibration range
0.005 mol/L	71.8 mS/m (0.718 mS/cm)	0.373	0.0 mS/m to 99.9 mS/m (0.00 mS/cm to 0.999 mS/cm)
0.050 mol/L	0.667 S/m (6.67 mS/cm)	3.73	0.090 S/m to 0.999 S/m (1.00 mS/cm to 9.99 mS/cm)
0.500 mol/L	5.87 S/m (58.7 mS/cm)	37.2	0.9 S/m to 9.99 S/m (10.0 mS/cm to 99.9 mS/cm)

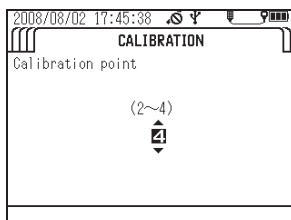
3. Dissolve the weighed Potassium Chloride (KCl) in deionized water.
4. Put the dissolved Potassium Chloride (KCl) into a 1 L measuring flask, and fill to the 1 L mark with deionized water.
5. Calibrate the zero point. Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then remove all moisture from the sensor probe (it will be calibrated in air).
6. Press the control unit's CAL key to set the calibration mode.
7. Press the down (▽) key to move the cursor to "Manual Calibration", then press the ENTER key.



8. In the parameter selection screen, move the cursor to "Cond", then press the ENTER key.

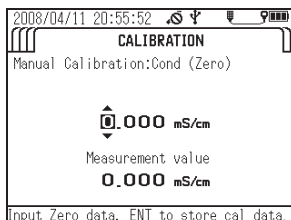


9. Set the number of calibration points, then press the ENTER key.

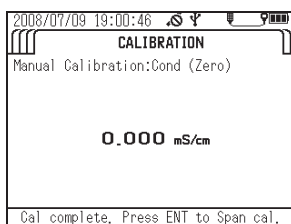


The instructions below assume that four calibration points have been set.

10. Press the up (Δ) and down (∇) keys to set the "Cond" value to 0.0 mS/m (0.000 mS/cm).
11. Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.



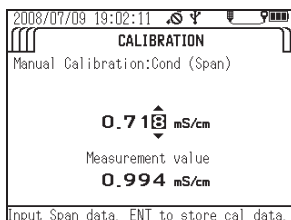
12. When the message "Cal complete. Press ENT to Span cal." appears, press the ENTER key to start the first span calibration procedure.



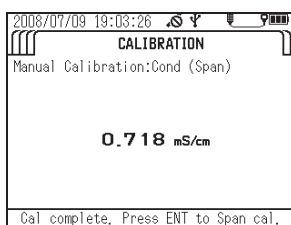
13. Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with 71.8 mS/m (0.718 mS/cm) standard solution.
14. Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.

15. Press the up (Δ) and down (∇) keys to set the "Cond" value to 71.8 mS/m (0.718 mS/cm).

Calibration range = 0 mS/m to 99.9 mS/m (0 mS/cm to 0.999 mS/cm)

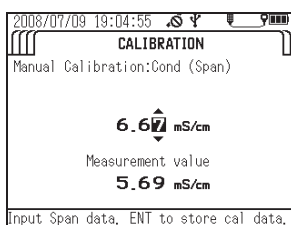


16. Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.
17. When the message "Cal complete. Press ENT to Span cal." appears, press the ENTER key to start the next span calibration procedure.

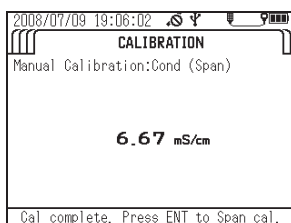


18. Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with 0.667 S/m (6.67 mS/cm) standard solution.
19. Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.
20. Press the up (Δ) and down (∇) keys to set the "Cond" value to 0.667 S/m (6.67 mS/cm).

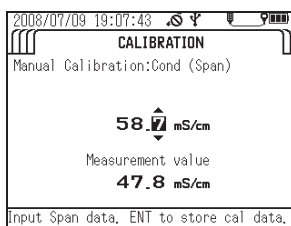
Calibration range = 0.100 S/m to 0.999 S/m (1.00 mS/cm to 9.99 mS/cm)



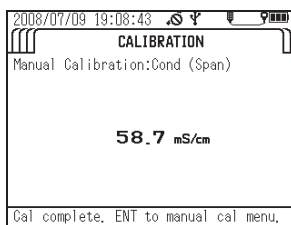
21. Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.
22. When the message "Cal complete. Press ENT to Span cal." appears, press the ENTER key to start the next span calibration procedure.



23. Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with 5.87 S/m (58.7 mS/cm) standard solution.
24. Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.
25. Press the up (Δ) and down (∇) keys to set the "Cond" value to 5.87 S/m (58.7 mS/cm).
Calibration range = 1.00 S/m to 10.00 S/m (10.0 mS/cm to 100.0 mS/cm)



26. Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.
27. Calibration is finished when the message "Cal complete. ENT to manual cal menu." appears. Press the ENTER key to return to the calibration parameter selection screen.



● Turbidity (TURB) calibration

Note

- To support a wide range of sample concentrations, turbidity is divided into three measurement ranges: 0.0 to 9.9 NTU, 10 to 100 NTU, and over 100 NTU.
- When manually calibrating turbidity, you can select two calibration procedures (one zero-point calibration procedure and a span calibration procedure for one of the three measurement ranges), three calibration procedures (one zero-point calibration procedure and a span calibration procedure for two of the three measurement ranges) or four calibration procedures (one zero-point calibration procedure and span calibration procedures for all three measurement ranges). Carry out the four calibration procedures to ensure good measurement precision throughout all measurement ranges.
- Always use the calibration cup provided. Using other containers can create effects from ambient light that cause incorrect calibration.

● Preparing the standard solutions

1. Weigh out 5.0 g of hydrazine sulfate (commercial special grade or above), and dissolve it in 400 mL of deionized water. Dissolve 50 g of hexamethylene tetramine (commercial special grade or above) in 400 mL of deionized water in another flask.
2. Mix the two solutions and add deionized water until the total solution volume is 1000 mL, and mix well. Store this solution at a temperature of $25^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for 48 hours.

The turbidity value (TURB) of this solution is equivalent to 4000 NTU.

3. Dilute 4000 NTU-solution 5 times (use a pipette to measure 50 mL of the 4000 NTU solution and pour it into a 250 mL measuring flask, and fill up to 250 mL meniscus)
The turbidity value (TURB) of this solution is equivalent to 800 NTU.

4. Dilute 800 NTU solution 10 times (use a pipette to measure 25 mL of the 800 NTU solution and pour it into a 250 mL measuring flask, and fill up to 250 mL meniscus)
The turbidity value (TURB) of this solution is equivalent to 80 NTU.

5. Dilute 80 NTU solution 10 times (use a pipette to measure 25 mL of the 80 NTU solution and pour it into a 250 mL measuring flask, and fill up to 250 mL meniscus)
The turbidity value (TURB) of this solution is equivalent to 8 NTU.

Note

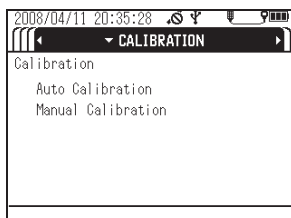
Instead of the standard solutions above, you can use other standard solutions of known concentration measured with other standard instruments.

● U-52, U-53 turbidity calibration

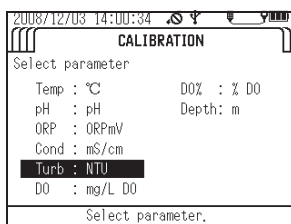
Set the number of calibration points.

You can set between 2 and 4 points.

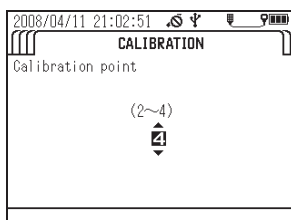
1. Press the control unit's CAL key to set the calibration mode.
2. Press the down (∇) key to move the cursor to "Manual Calibration", then press the ENTER key.



3. In the parameter selection screen, move the cursor to "Turb", then press the ENTER key.

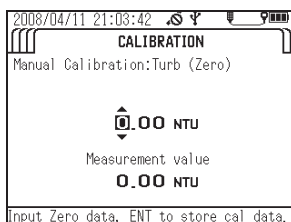


4. Press the up (△) and down (▽) keys to set the number of calibration points, then press the ENTER key.

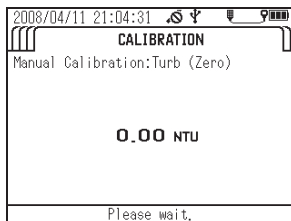


The instructions below assume that four calibration points have been set.

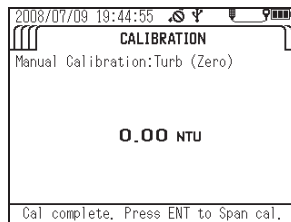
5. Calibrate the zero point. Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with deionized water.
6. Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.
7. Press the up (△) and down (▽) keys to set the "Turb" value to 0.0 NTU.



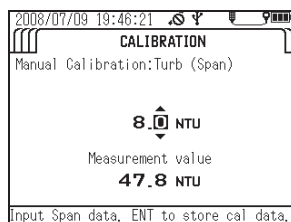
8. Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.



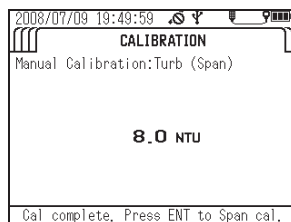
9. When the message "Cal complete. Press ENT to Span cal." appears, press the ENTER key to start the first span calibration procedure.



10. Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with 8 NTU standard solution, or a standard solution of known concentration between 0.1 and 10 NTU.
11. Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.
12. Press the up (Δ) and down (∇) keys to set the "TURB" value to 8 NTU, or to the known concentration of the standard solution between 0.1 and 10 NTU. (Input range = 0 NTU to 9.9 NTU (U-51) or 0 NTU to 9.99 NTU (U-52))

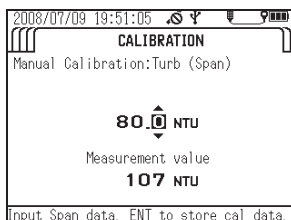


13. Check that "Current measurement value" has stabilized, then press the ENTER key to start calibration.
14. When the message "Cal complete. Press ENT to Span cal." appears, press the ENTER key to start the next span calibration procedure.

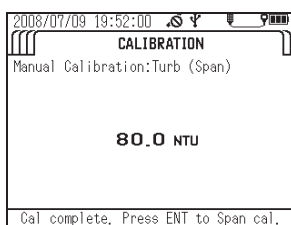


15. Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with 80 NTU standard solution, or a standard solution of known concentration between 10 and 100 NTU.
16. Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.

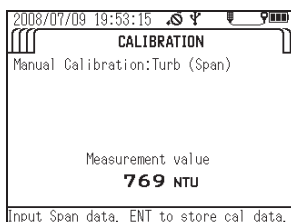
17. Press the up (Δ) and down (∇) keys to set the "Turb" value to 80 NTU, or to the known concentration of the standard solution between 10 and 100 NTU. (Input range = 10.0 NTU to 99.9 NTU)



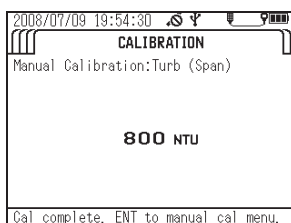
18. Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.
19. When the message "Cal complete. Press ENT to Span cal." appears, press the ENTER key to start the next span calibration procedure.



20. Wash the transparent calibration cup 2 or 3 times with deionized water, then fill it to the reference line with 800 NTU standard solution, or a standard solution of known concentration 100 NTU above.
21. Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the transparent calibration cup.
22. Press the up (Δ) and down (∇) keys to set the "TURB" value to 800 NTU, or to the known concentration of the standard solution 100 NTU above. (Input range = 100 NTU to 800 NTU (U-51), 100 NTU to 1000 NTU (U-52))



23. Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.
24. Calibration is finished when the message "Cal complete. ENT to manual cal menu." appears. Press the ENTER key to return to the calibration parameter selection screen.



● Dissolved oxygen (DO) calibration

Note

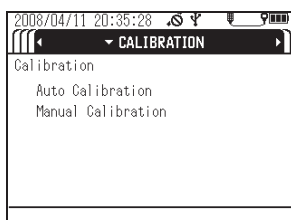
- You can select one calibration procedure (span calibration) or two calibration procedures (zero-point calibration and span calibration). Carry out the two calibration procedures to ensure good measurement precision throughout all measurement ranges.
- It is necessary to prepare new solution before calibration of the Dissolved Oxygen (DO) sensor.
- The calibration cup (included) cannot be used to manually calibrate the DO sensor. Use a suitable bottle in which the DO sensor and the temperature sensor can be immersed.
- Wait at least 20 minutes after turning the system power ON before calibrating the DO sensor.
- Make the compensation setting before calibration since the setting is applied during calibration.
- The DO sensor is affected by flow. When performing span calibration with saturated dissolved oxygen water, move the cable slowly up and down (move the sensor probe at a rate of roughly 20 to 30 cm a second) or agitate the saturated dissolved oxygen water.

1. Prepare the standard solution.

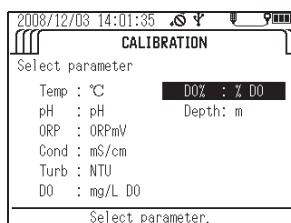
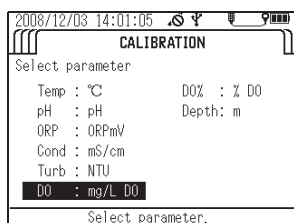
- Add about 50 g of sodium sulfite to 1000 mL of water (either deionized water or tap water) and stir the mixture to dissolve the sodium sulfite in it.
- Pour 1 to 2 liters of water into a suitable flask (either deionized water or tap water). Using a air pump, feed air into the water and aerate the solution until oxygen is saturated.

2. First, calibrate the zero point. Press the control unit's CAL key to set the calibration mode.

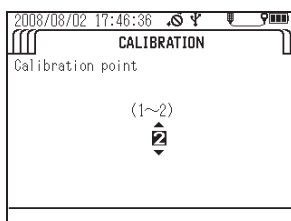
3. Press the down (▽) key to move the cursor to "Manual Calibration", then press the ENTER key.



4. In the parameter selection screen, move the cursor to DO or DO%, then press the ENTER key.

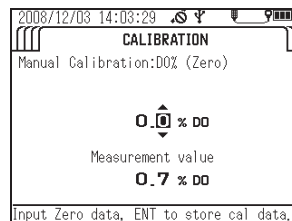
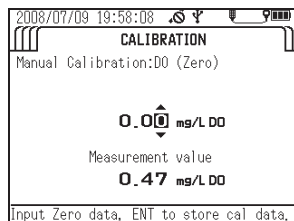


5. Set the number of calibration procedures, then press the ENTER key.

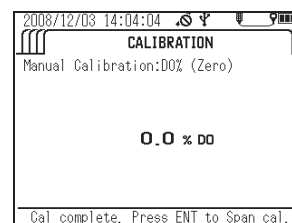
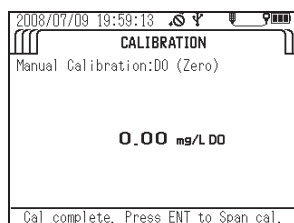


The instructions below assume that two calibration points have been set.

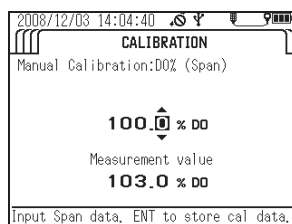
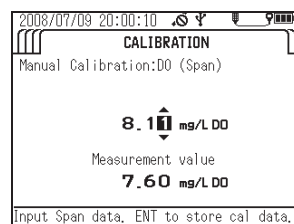
6. Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then submerge the sensor probe in the bottle.
7. Press the up (Δ) and down (∇) keys to set the DO value to 0.00 mg/L or 0.0%.



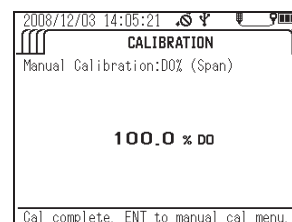
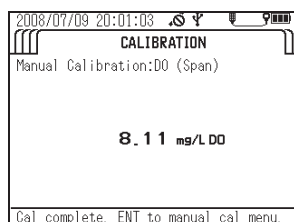
8. Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.
9. When the message "Cal complete. Press ENT to Span cal." appears, press the ENTER key to start the span calibration procedure.



10. Wash the sensor probe 2 or 3 times with deionized water to remove any dirt, then submerge the sensor probe in the container filled with the span solution.
11. Press the up (Δ) and down (∇) keys to set the DO value to the saturated dissolved oxygen value (mg/L) of the water at that temperature or the dissolved oxygen saturation ratio.



12. Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.
13. Calibration is finished when the message "Cal complete. ENT to manual cal menu." appears. Press the ENTER key to return to the calibration parameter selection screen.



**Amounts of saturated dissolved oxygen in water at various temperatures
(salinity=0.0%)**

JIS K0101

Temp. (°C)	DO (mg/L)	Temp. (°C)	DO (mg/L)	Temp. (°C)	DO (mg/L)	Temp. (°C)	DO (mg/L)
0	14.16						
1	13.77	11	10.67	21	8.68	31	7.42
2	13.40	12	10.43	22	8.53	32	7.32
3	13.04	13	10.20	23	8.39	33	7.22
4	12.70	14	9.97	24	8.25	34	7.13
5	12.37	15	9.76	25	8.11	35	7.04
6	12.06	16	9.56	26	7.99	36	6.94
7	11.75	17	9.37	27	7.87	37	6.86
8	11.47	18	9.18	28	7.75	38	6.76
9	11.19	19	9.01	29	7.64	39	6.68
10	10.92	20	8.84	30	7.53	40	6.59

ISO5814

Temp. (°C)	DO (mg/L)	Temp. (°C)	DO (mg/L)	Temp. (°C)	DO (mg/L)
0	14.62				
1	14.22	11	11.03	21	8.91
2	13.83	12	10.78	22	8.74
3	13.46	13	10.54	23	8.58
4	13.11	14	10.31	24	8.42
5	12.77	15	10.08	25	8.26
6	12.45	16	9.87	26	8.11
7	12.14	17	9.66	27	7.97
8	11.84	18	9.47	28	7.83
9	11.56	19	9.28	29	7.69
10	11.29	20	9.09	30	7.56

● Span setting values for calibration in air

The software should display these values when auto calibration is performed.

Use this table to input values for manual span calibrations in air.

— Tip —

The DO measurement value of “air-saturated water” and air are different.

Due to the pressure difference against the membrane in air versus the membrane in water, the measurement value in air is about 10% higher than the value of air-saturated water on average.

Amounts of saturated dissolved oxygen in air at various temperatures

Following tables are applicable only to the air calibration of the U-50 DO sensor. Do not use them for other purpose.

Air calibration value in adopting evaluation based on JIS K0101

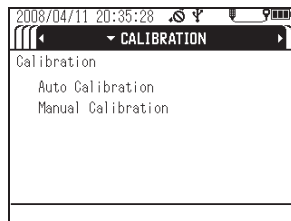
Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
0	15.58						
1	15.15	11	11.74	21	9.55	31	8.16
2	14.74	12	11.47	22	9.38	32	8.05
3	14.34	13	11.22	23	9.23	33	7.94
4	13.97	14	10.97	24	9.08	34	7.84
5	13.61	15	10.74	25	8.92	35	7.74
6	13.27	16	10.52	26	8.79	36	7.63
7	12.93	17	10.31	27	8.66	37	7.55
8	12.62	18	10.10	28	8.53	38	7.44
9	12.31	19	9.91	29	8.40	39	7.35
10	12.01	20	9.72	30	8.28	40	7.25

Air calibration value in adopting evaluation based on ISO5814

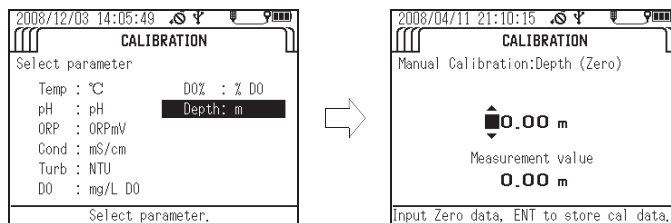
Temp. (°C)	DO (mg/L)	Temp. (°C)	DO (mg/L)	Temp. (°C)	DO (mg/L)
0	16.08				
1	15.64	11	12.13	21	9.80
2	15.21	12	11.86	22	9.61
3	14.81	13	11.59	23	9.44
4	14.42	14	11.34	24	9.26
5	14.05	15	11.09	25	9.09
6	13.70	16	10.86	26	8.92
7	13.35	17	10.63	27	8.77
8	13.02	18	10.42	28	8.61
9	12.72	19	10.21	29	8.46
10	12.42	20	10.00	30	8.32

● Water depth (DEPTH) calibration

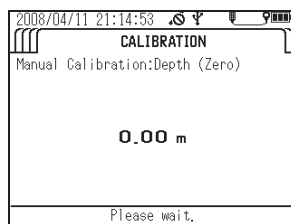
1. Calibrate the zero point. Wash the sensor probe 2 or 3 times in deionized water to remove any dirt, then remove all moisture from the sensor probe (it will be calibrated in air).
2. Press the control unit's CAL key to set the calibration mode.
3. Press the down (▽) key to move the cursor to "Manual Calibration", then press the ENTER key.



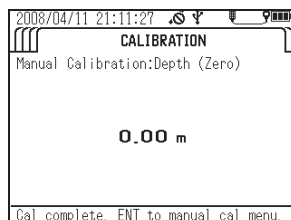
4. In the parameter selection screen, move the cursor to "Depth", then press the ENTER key.



5. Press the up (△) and down (▽) keys to set the "Depth" value to 0.00 m.
6. Check that "Measurement value" has stabilized, then press the ENTER key to start calibration.



7. Calibration is finished when the message "Cal complete. ENT to manual cal menu." appears. Press the ENTER key to return to the calibration parameter selection screen.



3.4 Measurement

You can perform measurement by either of the methods below.

- Storing data in memory manually with reference to the measurement value (single measurement)
- Having data stored in memory automatically and continuously
 - U-51/U-52: Interval measurement (minimum memory interval of 10 seconds)
 - U-53: Interval measurement (minimum memory interval of 30 seconds)

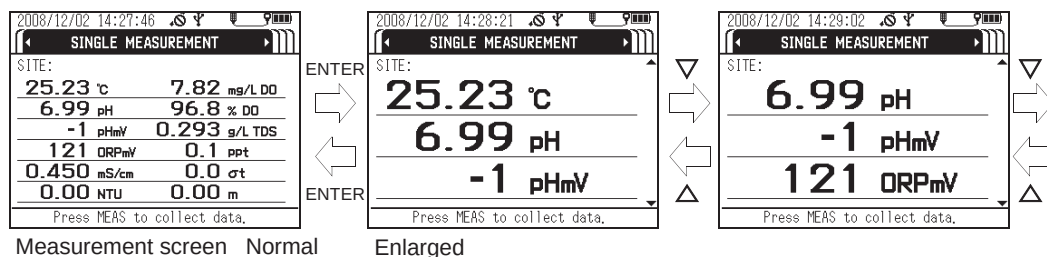
Select the measurement method that meets your requirements.

Note

- Lower sensor probe slowly when submerging them in samples.
- Sensors may break if sensor probe are dropped from a height of 1 meter or more.
- Do not submerge sensor probe in water depths of over 30 meters. Sensor probe are only resistant to water pressure of up to 30 meters.
- After turning the power ON, check that the DO readout value has stabilized before starting measurement (takes around 20 minutes).

Tip

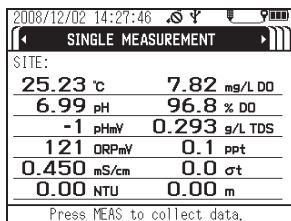
- When on the measurement screen, pressing the ENTER key enlarges the display and shows three measured values at a time.
- Pressing the up (Δ) and down (▽) keys scrolls through the measured values one item at a time.
- Pressing the ENTER key again reverts to the normal measurement screen display.



3.4.1 Storing data in memory manually

Follow the steps below to manually store data in memory while referring to the measurement value to check the readout value is stable.

- **U-51/U-52**
 1. Check that each sensor and sensor guard is mounted.
 2. Check that "SINGLE MEASUREMENT" has been selected in the measurement screen.



3. Submerge the sensor probe in the sample, gently shaking them in the sample to remove any air bubbles from the sensors.

If the sample is non-flowing, move the cable slowly up and down (move the sensor probe at a rate of roughly 20 to 30 cm a second) to ensure that fresh sample is continuously supplied to the DO sensor.

4. When the measurement values are stable, press the MEAS key to acquire the 5-second average.

2008/12/02 15:24:22	
SINGLE MEASUREMENT	
SITE:AAAA	
22.71 °C	8.34 mg/L DO
6.42 pH	98.9 % DO
30 pHmV	0.441 g/L TDS
475 ORPmV	0.2 ppt
0.689 mS/cm	0.0 σt
0.00 NTU	0.00 m
Collecting data.	

5. Press the ENTER key to save the held measurement values, or press the ESC key to cancel the operation.

2008/12/02 15:25:06	
SINGLE MEASUREMENT	
SITE:AAAA	
22.71 °C	8.36 mg/L DO
6.42 pH	99.1 % DO
30 pHmV	0.441 g/L TDS
475 ORPmV	0.2 ppt
0.689 mS/cm	0.0 σt
0.00 NTU	0.00 m
Press ENT to store data.	



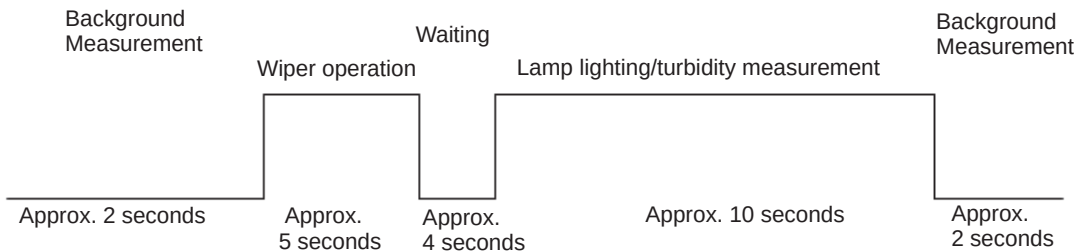
2008/12/02 15:25:45	
SINGLE MEASUREMENT	
SITE:AAAA	
22.71 °C	8.30 mg/L DO
6.42 pH	98.5 % DO
30 pHmV	0.441 g/L TDS
475 ORPmV	0.2 ppt
0.689 mS/cm	0.0 σt
0.00 NTU	0.00 m
Store data complete, Press ESC key.	

U-53

Note

Do not perform turbidity measurement in air as it may damage the wiper.

U-53 turbidity measurement follows the sequence below. The measurement values are held after each sequence.



1. Check that each sensor and sensor guard is mounted.
2. Check that "SINGLE MEASUREMENT" has been selected in the measurement screen.

2008/12/02 14:27:46	
SINGLE MEASUREMENT	
SITE:	
25.23 °C	7.82 mg/L DO
6.99 pH	96.8 % DO
-1 pHmV	0.293 g/L TDS
121 ORPmV	0.1 ppt
0.450 mS/cm	0.0 σt
0.00 NTU	0.00 m
Press MEAS to collect data.	

3. Submerge the sensor probe in the sample, gently shaking them in the sample to remove any air bubbles from the sensors.

If the sample is non-flowing, move the cable slowly up and down (move the sensor probe at a rate of roughly 20 to 30 cm a second) to ensure that fresh sample is continuously supplied to the DO sensor.

4. When the non-turbidity meter measurement values are stable, press the MEAS key to start the sequence above.

2008/12/02 15:24:22	
SINGLE MEASUREMENT	
SITE:AAAA	
22.71 °C	8.34 mg/L DO
6.42 pH	98.9 % DO
30 pHmV	0.441 g/L TDS
475 ORPmV	0.2 ppt
0.689 mS/cm	0.0 σt
0.00 NTU	0.00 m
Collecting data.	

5. When the sequence has finished, hold the measurement values. Press the ENTER key to store the held measurement values, or press the ESC key to cancel the operation.

2008/12/02 15:25:06	
SINGLE MEASUREMENT	
SITE:AAAA	
22.71 °C	8.36 mg/L DO
6.42 pH	99.1 % DO
30 pHmV	0.441 g/L TDS
475 ORPmV	0.2 ppt
0.689 mS/cm	0.0 σt
0.00 NTU	0.00 m
Press ENT to store data.	

→

2008/12/02 15:25:45	
SINGLE MEASUREMENT	
SITE:AAAA	
22.71 °C	8.30 mg/L DO
6.42 pH	98.5 % DO
30 pHmV	0.441 g/L TDS
475 ORPmV	0.2 ppt
0.689 mS/cm	0.0 σt
0.00 NTU	0.00 m
Store data complete. Press ESC key.	

3.4.2 Automatic, continuous measurement

● Interval measurement

1. Select the "Interval measurement" measurement setting (see " 3.2.1 Setting measurement methods " (page 18)).
2. Press the up (Δ) and down (▽) keys to set the interval value to the desired value (U-51/U-52: minimum interval: 10 seconds, U-53: minimum interval: 30 seconds), then press the ENTER key.

The measurement screen appears automatically, and the system becomes ready for measurement.

3. Check that each sensor and sensor guard is mounted.
4. Submerge the sensor probe in the sample, gently shaking them in the sample to remove any air bubbles from the sensors.

If the sample is non-flowing, move the cable slowly up and down (move the sensor probe at a rate of roughly 20 to 30 cm a second) to ensure that fresh sample is continuously supplied to the DO sensor.

5. Press the ENTER key to start measurement.

2008/12/02 15:28:24	
INTERVAL MEASUREMENT	
SITE:HORI BA	
22.76 °C	8.38 mg/L DO
6.44 pH	99.6 % DO
28 pHmV	0.442 g/L TDS
462 ORPmV	0.2 ppt
0.690 mS/cm	0.0 σt
0.00 NTU	0.00 m
Interval measuring. ESC to previous.	

3.5 Data operations

Use the procedures below to retrieve data stored in memory, delete all the data, check the remaining data memory capacity, and check the calibration record.

3.5.1 Displaying data

For maximum efficiency, there are 3 methods of displaying data.

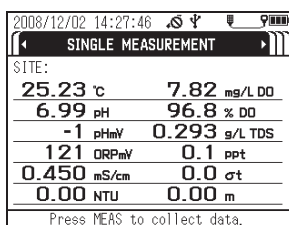
- Displaying the data for a specified site
- Displaying the data for a specified date/time
- Displaying all the data

Use the method that best suits your requirements.

● Displaying the data for a specified site

1. Press and hold down the control unit's POWER key for about 3 seconds to turn the power ON.

The "MEASUREMENT" screen appears after about 10 seconds.

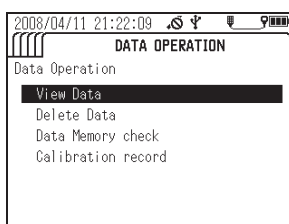


SINGLE MEASUREMENT	
SITE:	
25.23 °C	7.82 mg/L DO
6.99 pH	96.8 % DO
-1 pHmV	0.293 g/L TDS
121 ORPmV	0.1 ppt
0.450 mS/cm	0.0 σt
0.00 NTU	0.00 m
Press MEAS to collect data.	

Note

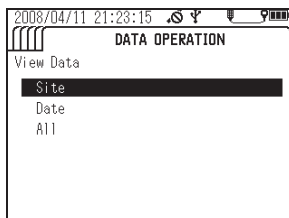
The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

2. Press the right (▷) key 3 times to display the "DATA OPERATION" screen.
3. Press the down (▽) key to move the cursor to "View Data", then press the ENTER key.



DATA OPERATION	
Data Operation	
View Data	
Delete Data	
Data Memory check	
Calibration record	

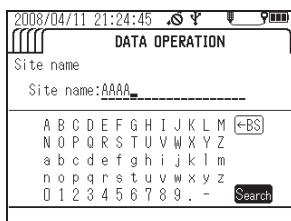
4. Move the cursor to "Site", then press the ENTER key.



DATA OPERATION	
View Data	
Site	
Date	
All	

5. Press the up (Δ), down (▽), left (◀) and right (▷) keys to enter the site to retrieve.

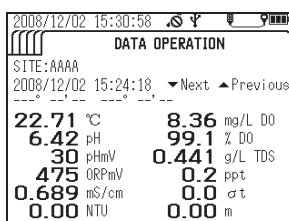
6. Move the cursor to "Search", then press the ENTER key.



All site names that begin with the entered text are displayed.

The most recently measured data for the entered site is displayed.

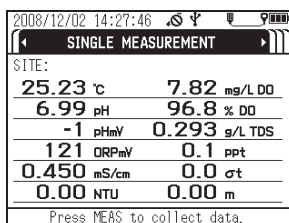
7. Press the up (△) and down (▽) keys to display earlier data.



● Displaying the data for a specified date/time

1. Press and hold down the control unit's POWER key for about 3 seconds to turn the power ON.

The "MEASUREMENT" screen appears after about 10 seconds.

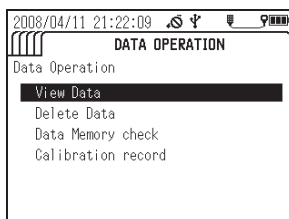


Note

The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

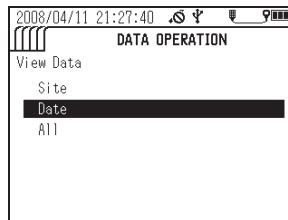
2. Press the right (▷) key 3 times to display the "DATA OPERATION" screen.

3. Press the down (▽) key to move the cursor to "View Data", then press the ENTER key.



4. Move the cursor to "Date", then press the ENTER key.

5. With the cursor on the Date, press the ENTER key.



6. Press the up (Δ), down (▽), left (◀) and right (▶) keys to enter the desired date/time, then press the ENTER key to apply the setting.
7. The cursor moves to "Search". Press the ENTER key to start the search.
8. Press the up (Δ) and down (▽) keys to display earlier data.

● Displaying all the data

1. Press and hold down the control unit's POWER key for about 3 seconds to turn the power ON.

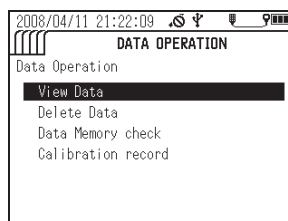
The "MEASUREMENT" screen appears after about 10 seconds.

2008/12/02 14:27:46	
SINGLE MEASUREMENT	
SITE:	
25.23 °C	7.82 mg/L DO
6.99 pH	96.8 % DO
-1 pHmV	0.293 g/L TDS
121 ORPmV	0.1 ppt
0.450 mS/cm	0.0 σt
0.00 NTU	0.00 m
Press MEAS to collect data.	

Note

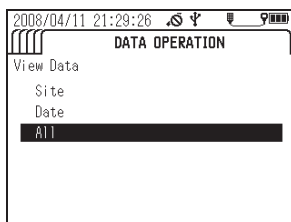
The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

2. Press the right (▶) key 3 times to display the "DATA OPERATION" screen.
3. Press the down (▽) key to move the cursor to "View Data", then press the ENTER key.



4. Move the cursor to "All", then press the ENTER key.

The most recently measured data is displayed.



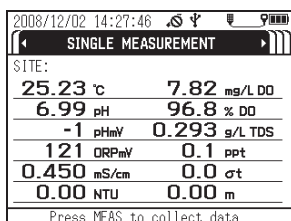
5. Press the up (△) and down (▽) keys to display earlier data.

3.5.2 Deleting data

Follow the steps below to delete all the data stored in memory.

1. Press and hold down the control unit's **POWER** key for about 3 seconds to turn the power ON.

The "MEASUREMENT" screen appears after about 10 seconds.

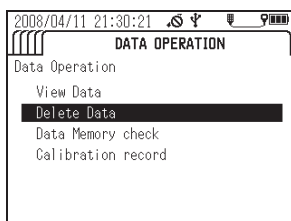


SINGLE MEASUREMENT	
SITE:	
25.23 °C	7.82 mg/L DO
6.99 pH	96.8 % DO
-1 pHmV	0.293 g/L TDS
121 ORPmV	0.1 ppt
0.450 mS/cm	0.0 σt
0.00 NTU	0.00 m
Press MEAS to collect data.	

Note

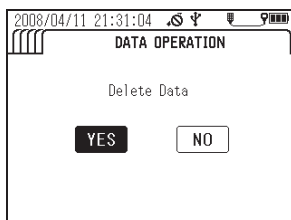
The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

2. Press the right (➤) key 3 times to display the "DATA OPERATION" screen.
3. Press the down (▽) key to move the cursor to "Delete Data", then press the ENTER key.



DATA OPERATION
Data Operation
View Data
Delete Data
Data Memory check
Calibration record

4. Press the left (◀) key to move the cursor to YES, then press the ENTER key.
All the data has been deleted when the indicator appears along with the message "No data exists".



DATA OPERATION
Delete Data
YES NO

3.5.3 Checking the data memory

You can check the used data capacity and the remaining data capacity.

1. Press and hold down the control unit's **POWER** key for about 3 seconds to turn the power ON.

The "MEASUREMENT" screen appears after about 10 seconds.

2008/12/02 14:27:46	
SINGLE MEASUREMENT	
SITE:	
25.23 °C	7.82 mg/L DO
6.99 pH	96.8 % DO
-1 pHmV	0.293 g/L TDS
121 ORPmV	0.1 ppt
0.450 mS/cm	0.0 σt
0.00 NTU	0.00 m
Press MEAS to collect data.	

Note

The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

2. Press the right (▷) key 3 times to display the "DATA OPERATION" screen.
3. Press the down (▽) key to move the cursor to "Data Memory Check", then press the ENTER key.

2008/04/11 21:32:30	
DATA OPERATION	
Data Operation	
View Data	
Delete Data	
Data Memory check	
Calibration record	

The amount of memory in use and amount of available memory are displayed.

2008/04/11 21:34:21	
DATA OPERATION	
Data Memory check	
Used memory	
0 Data	
Available memory	
10000 Data	

3.5.4 Checking the calibration record

Follow the steps below to check the latest calibration history.

1. Press and hold down the control unit's **POWER** key for about 3 seconds to turn the power ON.

The "MEASUREMENT" screen appears after about 10 seconds.

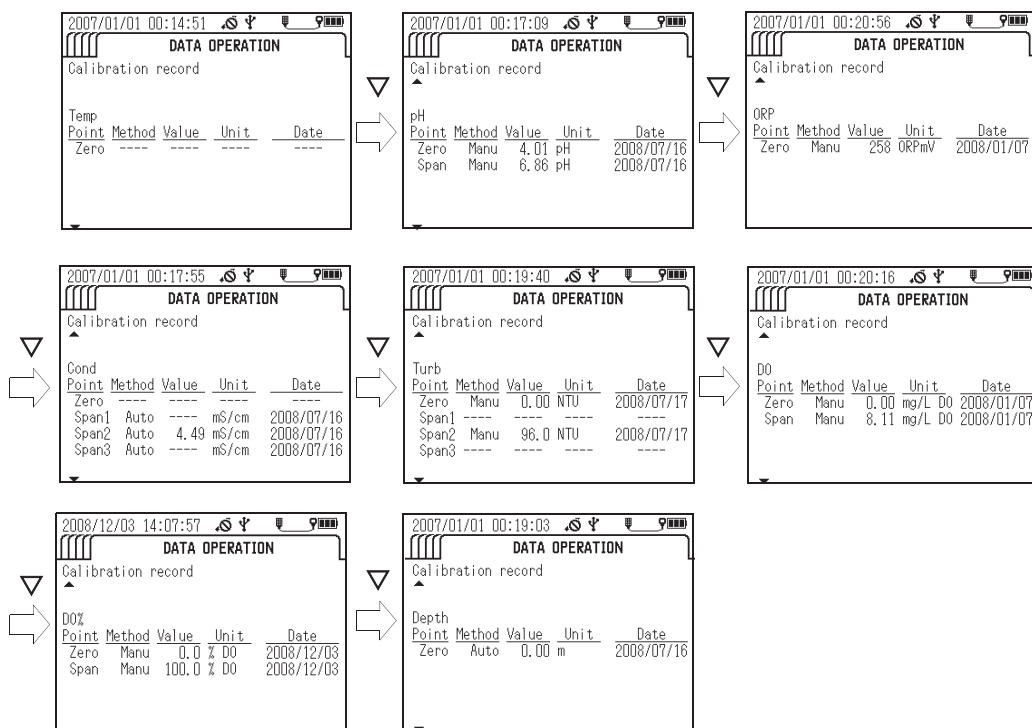
2008/12/02 14:27:46	
SINGLE MEASUREMENT	
SITE:	
25.23 °C	7.82 mg/L DO
6.99 pH	96.8 % DO
-1 pHmV	0.293 g/L TDS
121 ORPmV	0.1 ppt
0.450 mS/cm	0.0 σt
0.00 NTU	0.00 m
Press MEAS to collect data.	

Note

The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

2. Press the right (▷) key 3 times to display the "DATA OPERATION" screen.
3. Press the down (▽) key to move the cursor to "Calibration record", then press the ENTER key.

The latest calibration record is displayed.



3.5.5 GPS data operations

The menu for GPS data operations appears on the display to which the GPS unit is mounted.

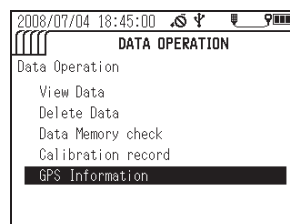
● GPS information

Follow the steps below to display acquired GPS information.

Note

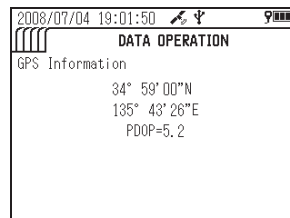
Turning the power OFF erases the GPS information.

1. Press the right (▷) key to switch the display to the "DATA OPERATION" screen.
2. the down (▽) key to move the cursor to "GPS Information", then press the ENTER key.

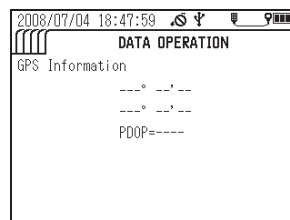


The last GPS information acquired is displayed.

- When received data exists



- When no received data exists



3.6 Sensor information

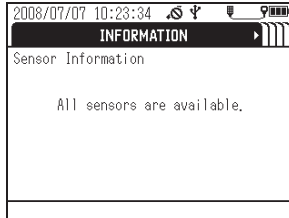
1. Press and hold down the control unit's POWER key for about 3 seconds to turn the power ON.

The "MEASUREMENT" screen appears after about 10 seconds.

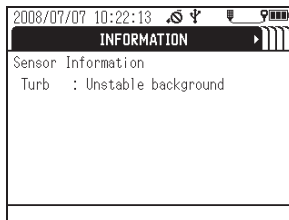
2. Press the left (<) key once to display the "INFORMATION" screen.

The "Sensor Information" screen displays the sensor probe's status.

- When the sensor probe is normal, the display below appears.



- When there is a sensor probe problem, individual measurement parameters generate messages such as the one shown below. Follow the troubleshooting information to remove the problem before continuing to operate the system.

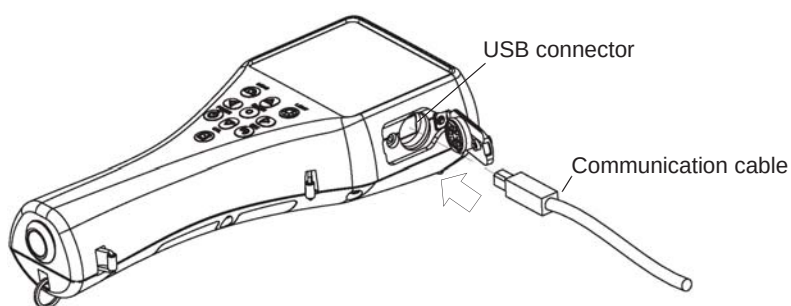


3.7 USB communication

The separately-sold, dedicated PC connection cable comes with data collection software. This software allows data to be downloaded from the control unit in CSV format.

This section contains instructions for communication commands used for USB communication.

● Connecting the cable



Dedicated cable

Part name: Communication cable (with data collection software)

Part no.: 3200174823

● Cautions when using USB communication

Take care to observe the following when using USB communication.

- Use the dedicated cable (with data collection software) or a commercially-available USB cable (A-B type) to connect to a PC.
- Be sure to match the transmission format on the control unit and the computer.
The control unit uses the following transmission format:

Baud rate:	19200 bps
Number of stop bits:	1 bit
Data bit length:	8 bits
Parity:	None
Flow control:	None

Tip

If the transmission formats do not match, a communication error occurs and USB communication will not function normally. After changing the transmission format, restart the control unit and the computer.

- If received data is not sent back or an error occurs after a data request has been sent, adjust the program configuration so that it allows a little waiting time before a data request is sent again. This will enable more stable communication.
- The unit does not use DCD, CTS, or DSR signals. Take care of this when creating programs.

3.7.1 Communication settings

Baud rate:	19200 bps
Number of stop bits:	1 bit
Data bit length:	8 bits
Parity:	None
Flow control:	None

3.7.2 Commands

● Instant data requests

● Request command format

#	RD	@	XX	[CR]	[LF]
1	2	3	4		

1	Header	1 character
2	Command	2 characters
3	Delimiter character	1 character
4	Frame check sequence (FCS)	2 characters

The two ASCII-code characters created by converting the 8 bits of data created by successively combining the value of each character from # through @ in an exclusive OR (XOR) operation with the value of the next character.

Example: #RD@

(1)	0	XOR	35	(ASCII code of # symbol)	⇒	35
(2)	35	XOR	82	(ASCII code of R)	⇒	113
(3)	113	XOR	68	(ASCII code of D)	⇒	53
(4)	53	XOR	64	(ASCII code of @ symbol)	⇒	117 (decimal)
					↓	
						75 (hex)
					↓	
						Sets "75".

Example: 35 XOR 82 operation

35 in binary	⇒	0	0	1	0	0	0	1	1
82 in binary	⇒	0	1	0	1	0	0	1	0
XOR result		0	1	1	1	0	0	0	1
									⇒ 113 (decimal)

Note: Set "XX" if you do not want to test for communication frame errors with FCS.

● Response format

#	RD	AAAAAAAAAAAAAAAAAAAA	X	X	XXXX	XX	X	X	XXXXX	X
1	2	3								
			4	5	6	7	8	9	10	11
XX	X	X	XXXXX	X	XX	X	X	XXXXX	X	XX
12	13	14	15	16	17	18	19	20	21	22
									23	24
XX	X	X	XXXXX	X	XX	X	X	XXXXX	X	XX
27	28	29	30	31	32	33	34	35	36	37
									38	39
									40	41
XX	X	X	XXXXX	X	XX	X	X	XXXXX	X	XX
42	43	44	45	46	47	48	49	50	51	52
									53	54
									55	56

```

XX  X  X  XXXXX X XX  X  X  XXXXX X  XX  X  X  XXXXX X
57  58 59 60      61 62  63 64 65      66 67 68 69 70      71

```

```

XX XX XX XX XX XX XX XX XX X  X  XXX XX XX X  X  @ XX [CR] [LF]
72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89

```

1	Header		1 character
2	Command		2 characters
3	Site name	Upper- and lowercase letters, numbers, periods (.) hyphens (-) and spaces ()	20 characters
4	Probe status	(3) Status code	1 character
5	Probe error	(4) Status error code	1 character
6	Unused		4 characters
7	Parameter 1 code	(1) Parameter code	2 characters
8	Parameter 1 status	(5) Parameter status code	1 character
9	Parameter 1 error	(6) Parameter error code	1 character
10	Parameter 1 data	5 characters including decimal point, right-justified with blanks filled	5 characters
11	Parameter 1 unit	(2) Unit code	1 character
12	Parameter 2 code	(1) Parameter code	2 characters
13	Parameter 2 status	(5) Parameter status code	1 character
14	Parameter 2 error	(6) Parameter error code	1 character
15	Parameter 2 data	5 characters including decimal point, right-justified with blanks filled	5 characters
16	Parameter 2 unit	(2) Unit code	1 character
17	Parameter 3 code	(1) Parameter code	2 characters
18	Parameter 3 status	(5) Parameter status code	1 character
19	Parameter 3 error	(6) Parameter error code	1 character
20	Parameter 3 data	5 characters including decimal point, right-justified with blanks filled	5 characters
21	Parameter 3 unit	(2) Unit code	1 character
22	Parameter 4 code	(1) Parameter code	2 characters
23	Parameter 4 status	(5) Parameter status code	1 character
24	Parameter 4 error	(6) Parameter error code	1 character
25	Parameter 4 data	5 characters including decimal point, right-justified with blanks filled	5 characters
26	Parameter 4 unit	(2) Unit code	1 character
27	Parameter 5 code	(1) Parameter code	2 characters
28	Parameter 5 status	(5) Parameter status code	1 character
29	Parameter 5 error	(6) Parameter error code	1 character
30	Parameter 5 data	5 characters including decimal point, right-justified with blanks filled	5 characters
31	Parameter 5 unit	(2) Unit code	1 character
32	Parameter 6 code	(1) Parameter code	2 characters
33	Parameter 6 status	(5) Parameter status code	1 character
34	Parameter 6 error	(6) Parameter error code	1 character

35	Parameter 6 data	5 characters including decimal point, right-justified with blanks filled	5 characters
36	Parameter 6 unit	(2) Unit code	1 character
37	Parameter 7 code	(1) Parameter code	2 characters
38	Parameter 7 status	(5) Parameter status code	1 character
39	Parameter 7 error	(6) Parameter error code	1 character
40	Parameter 7 data	5 characters including decimal point, right-justified with blanks filled	5 characters
41	Parameter 7 unit	(2) Unit code	1 character
42	Parameter 8 code	(1) Parameter code	2 characters
43	Parameter 8 status	(5) Parameter status code	1 character
44	Parameter 8 error	(6) Parameter error code	1 character
45	Parameter 8 data	5 characters including decimal point, right-justified with blanks filled	5 characters
46	Parameter 8 unit	(2) Unit code	1 character
47	Parameter 9 code	(1) Parameter code	2 characters
48	Parameter 9 status	(5) Parameter status code	1 character
49	Parameter 9 error	(6) Parameter error code	1 character
50	Parameter 9 data	5 characters including decimal point, right-justified with blanks filled	5 characters
51	Parameter 9 unit	(2) Unit code	1 character
52	Parameter 10 code	(1) Parameter code	2 characters
53	Parameter 10 status	(5) Parameter status code	1 character
54	Parameter 10 error	(6) Parameter error code	1 character
55	Parameter 10 data	5 characters including decimal point, right-justified with blanks filled	5 characters
56	Parameter 10 unit	(2) Unit code	1 character
57	Parameter 11 code	(1) Parameter code	2 characters
58	Parameter 11 status	(5) Parameter status code	1 character
59	Parameter 11 error	(6) Parameter error code	1 character
60	Parameter 11 data	5 characters including decimal point, right-justified with blanks filled	5 characters
61	Parameter 11 unit	(2) Unit code	1 character
62	Parameter 12 code	(1) Parameter code	2 characters
63	Parameter 12 status	(5) Parameter status code	1 character
64	Parameter 12 error	(6) Parameter error code	1 character
65	Parameter 12 data	5 characters including decimal point, right-justified with blanks filled	5 characters
66	Parameter 12 unit	(2) Unit code (6) Parameter error code	1 character
67	Parameter 13 code	(1) Parameter code	2 characters
68	Parameter 13 status	(5) Parameter status code	1 character
69	Parameter 13 error	(6) Parameter error code	1 character
70	Parameter 13 data	5 characters including decimal point, right-justified with blanks filled	5 characters
71	Parameter 13 unit	(2) Unit code	1 character
72	Year	00 to 99	2 characters

73	Month	01 to 12	2 characters
74	Day	01 to 31	2 characters
75	Hour	00 to 23	2 characters
76	Minute	00 to 59	2 characters
77	Second	00 to 59	2 characters
78	Longitude (degrees)	00 to 90 or "--" (no GPS data)	2 characters
79	Longitude (minutes)	00 to 59 or "--" (no GPS data)	2 characters
80	Longitude (seconds)	00 to 59 or "--" (no GPS data)	2 characters
81	Unused	1 character	1 character
82	North latitude/South latitude	N: North; S: South	1 character
83	Latitude (degrees)	000 to 180 or "---" (no GPS data)	3 characters
84	Latitude (minutes)	00 to 59 or "--" (no GPS data)	2 characters
85	Latitude (seconds)	00 to 59 or "--" (no GPS data)	2 characters
86	Unused		1 character
87	East longitude/West longitude	E: East; W: West	1 character
88	Delimiter character		1 character
89	Frame check sequence (FCS)		2 characters

● Memory data requests

● Request command format

#	RM	X	X	AAAAAAAAAAAAAAAAAAAA	XX	XX	XX	@	XX	[CR]	[LF]
1	2	3	4	5	6	7	8	9	10		

1	Header		1 character
2	Command		2 characters
3	Data specification ^{*1}	0: Start search; 1: Next data item; 2: Previous data item; 3: Request same data again	1 character
4	Search method specification	0: All data; 1: Site search; 2: Date search	1 character
5	Search site ^{*2}	Upper- and lowercase letters, numbers, periods (.) hyphens (-) and spaces ()	20 characters
6	Search year ^{*3}	00 to 99	2 characters
7	Search month ^{*3}	01 to 12	2 characters
8	Search day ^{*3}	01 to 31	2 characters
9	Delimiter character		1 character
10	Frame check sequence (FCS)		2 characters

*1: When sending the RM command, first send 0 [Start search], then 1 [Next data item], 2 [Previous data item] or 3 [Request same data again].

*2: [Search site] is only needed when [Site search] is specified as the search method. If another search method is specified, fill this field with spaces.

*3: [Search year], [Search month] and [Search day] are only needed when [Date search] is specified as the search method. If another search method is specified, fill this field with spaces.

● Response format
(when data exists)

```

#  RM  AAAAAAAAAAAAAAAAAAAAAA  XX X  X  XXXXX  X
1  2   3                          4  5  6  7      8

XX X  X  XXXXX  X  XX X  X  XXXXX  X  XX X  X  XXXXX  X
9  10 11 12      13 14 15 16 17      18 19 20 21 22      23

XX X  X  XXXXX  X  XX X  X  XXXXX  X  XX X  X  XXXXX  X
24 25 26 27      28 29 30 31 32      33 34 35 36 37      38

XX X  X  XXXXX  X  XX X  X  XXXXX  X  XX X  X  XXXXX  X
39 40 41 42      43 44 45 46 47      48 49 50 51 52      53

XX X  X  XXXXX  X  XX X  X  XXXXX  X  XX X  X  XXXXX  X
54 55 56 57      58 59 60 61 62      63 64 65 66 67      68

XX XX XX XX XX XX XX XX XX X  X  XXX XX XX X  X  @  XX [CR] [LF]
69 70 71 72 73 74 75 76 77 78 79 80      81 82 83 84 85 86

```

1	Header		1 character
2	Command		2 characters
3	Site name	Upper- and lowercase letters, numbers, periods (.) hyphens (-) and spaces ()	20 characters
4	Parameter 1 code	(1) Parameter code	2 characters
5	Parameter 1 selection	0: No selection; 1: Selection made	1 character
6	Parameter 1 error	(6) Parameter error code	1 character
7	Parameter 1 data	5 characters including decimal point, right-justified with blanks filled	5 characters
8	Parameter 1 unit	(2) Unit code	1 character
9	Parameter 2 code	(1) Parameter code	2 characters
10	Parameter 2 selection	0: No selection; 1: Selection made	1 character
11	Parameter 2 error	(6) Parameter error code	1 character
12	Parameter 2 data	5 characters including decimal point, right-justified with blanks filled	5 characters
13	Parameter 2 unit	(2) Unit code	1 character
14	Parameter 3 code	(1) Parameter code	2 characters
15	Parameter 3 selection	0: No selection; 1: Selection made	1 character
16	Parameter 3 error	(6) Parameter error code	1 character
17	Parameter 3 data	5 characters including decimal point, right-justified with blanks filled	5 characters
18	Parameter 3 unit	(2) Unit code	1 character
19	Parameter 4 code	(1) Parameter code	2 characters
20	Parameter 4 selection	0: No selection; 1: Selection made	1 character

21	Parameter 4 error	(6) Parameter error code	1 character
22	Parameter 4 data	5 characters including decimal point, right-justified with blanks filled	5 characters
23	Parameter 4 unit	(2) Unit code	1 character
24	Parameter 5 code	(1) Parameter code	2 characters
25	Parameter 5 selection	0: No selection; 1: Selection made	1 character
26	Parameter 5 error	(6) Parameter error code	1 character
27	Parameter 5 data	5 characters including decimal point, right-justified with blanks filled	5 characters
28	Parameter 5 unit	(2) Unit code	1 character
29	Parameter 6 code	(1) Parameter code	2 characters
30	Parameter 6 selection	0: No selection; 1: Selection made	1 character
31	Parameter 6 error	(6) Parameter error code	1 character
32	Parameter 6 data	5 characters including decimal point, right-justified with blanks filled	5 characters
33	Parameter 6 unit	(2) Unit code	1 character
34	Parameter 7 code	(1) Parameter code	2 characters
35	Parameter 7 selection	0: No selection; 1: Selection made	1 character
36	Parameter 7 error	(6) Parameter error code	1 character
37	Parameter 7 data	5 characters including decimal point, right-justified with blanks filled	5 characters
38	Parameter 7 unit	(2) Unit code	1 character
39	Parameter 8 code	(1) Parameter code	2 characters
40	Parameter 8 selection	0: No selection; 1: Selection made	1 character
41	Parameter 8 error	(6) Parameter error code	1 character
42	Parameter 8 data	5 characters including decimal point, right-justified with blanks filled	5 characters
43	Parameter 8 unit	(2) Unit code	1 character
44	Parameter 9 code	(1) Parameter code	2 characters
45	Parameter 9 selection	0: No selection; 1: Selection made	1 character
46	Parameter 9 error	(6) Parameter error code	1 character
47	Parameter 9 data	5 characters including decimal point, right-justified with blanks filled	5 characters
48	Parameter 9 unit	(2) Unit code	1 character
49	Parameter 10 code	(1) Parameter code	2 characters
50	Parameter 10 selection	0: No selection; 1: Selection made	1 character
51	Parameter 10 error	(6) Parameter error code	1 character
52	Parameter 10 data	5 characters including decimal point, right-justified with blanks filled	5 characters
53	Parameter 10 unit	(2) Unit code	1 character
54	Parameter 11 code	(1) Parameter code	2 characters
55	Parameter 11 selection	0: No selection; 1: Selection made	1 character
56	Parameter 11 error	(6) Parameter error code	1 character
57	Parameter 11 data	5 characters including decimal point, right-justified with blanks filled	5 characters
58	Parameter 11 unit	(2) Unit code	1 character
59	Parameter 12 code	(1) Parameter code	2 characters

60	Parameter 12 selection	0: No selection; 1: Selection made	1 character
61	Parameter 12 error	(6) Parameter error code	1 character
62	Parameter 12 data	5 characters including decimal point, right-justified with blanks filled	5 characters
63	Parameter 12 unit	(2) Unit code	1 character
64	Parameter 13 code	(1) Parameter code	2 characters
65	Parameter 13 selection	0: No selection; 1: Selection made	1 character
66	Parameter 13 error	(6) Parameter error code	1 character
67	Parameter 13 data	5 characters including decimal point, right-justified with blanks filled	5 characters
68	Parameter 13 unit	(2) Unit code	1 character
69	Year	00 to 99	2 characters
70	Month	01 to 12	2 characters
71	Day	01 to 31	2 characters
72	Hour	00 to 23	2 characters
73	Minute	00 to 59	2 characters
74	Second	00 to 5	2 characters
75	Longitude (degrees)	00 to 90 or "--" (no GPS data)	2 characters
76	Longitude (minutes)	00 to 59 or "--" (no GPS data)	2 characters
77	Longitude (seconds)	00 to 59 or "--" (no GPS data)	2 characters
78	Unused		1 character
79	North latitude/South latitude	N: North; S: South	1 character
80	Latitude (degrees)	000 to 180 or "---" (no GPS data)	3 characters
81	Latitude (minutes)	00 to 59 or "--" (no GPS data)	2 characters
82	Latitude (seconds)	00 to 59 or "--" (no GPS data)	2 characters
83	Unused		1 character
84	East longitude/West longitude	E: East; W: West	1 character
85	Delimiter character		1 character
86	Frame check sequence (FCS)		2 characters

When no data exists, or memory is at capacity)

#	RM	@	XX	[CR]	[LF]
1	2	3	4		

1	Header	1 character
2	Command	2 characters
3	Delimiter character\	1 character
4	Frame check sequence (FCS)	2 characters

● Memory data count request

● Request command format

#	RN	@	XX	[CR]	[LF]
1	2	3	4		

1	Header	1 character
2	Command	2 characters
3	Delimiter character\	1 character
4	Frame check sequence (FCS)	2 characters

● Response format

#	RN	XXXXX	@	XX	[CR]	[LF]
1	2	3	4	5		

1	Header	1 character	
2	Command	2 characters	
3	Total data count	0 to 10000	5 characters
4	Delimiter character\	1 character	
5	Frame check sequence (FCS)	2 characters	

● Command parse failure response

#	??	X	XX	X	@	XX	[CR]	[LF]
1	2	3	4	5	6	7		

1	Header	1 character
2	Command	2 characters
3	Command parse failure reason ^{*4}	1 character
4	Received command ^{*5}	2 characters
5	(3) Status code for probe status ^{*5}	1 character
6	Delimiter character	1 character
7	Frame check sequence (FCS)	2 characters

^{*4}: List of command parse failure reasons

- 1: Frame length error
- 2: FCS mismatch
- 3: Undefined command
- 4: Data error
- 5: Data out of range
- 6: No "@" delimiter character
- 7: No "#" header character
- 8: No [Carriage return] + [Line feed] footer
- 9: Cannot accept command in this timing.

^{*5}: Only set for command parse failure reason 9, [Cannot accept command in this timing]. Otherwise this field is filled with spaces.

4 Maintenance

Tip

HORIBA recommends regular manufacturer maintenance checks in order to ensure a long product life.

4.1 Routine care

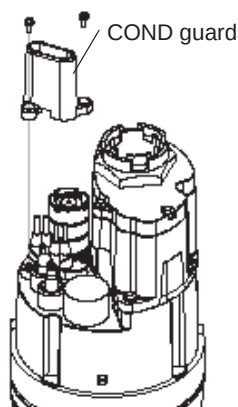
● After measurement

1. Press and hold down the control unit's POWER key for about 3 seconds to turn the power OFF.

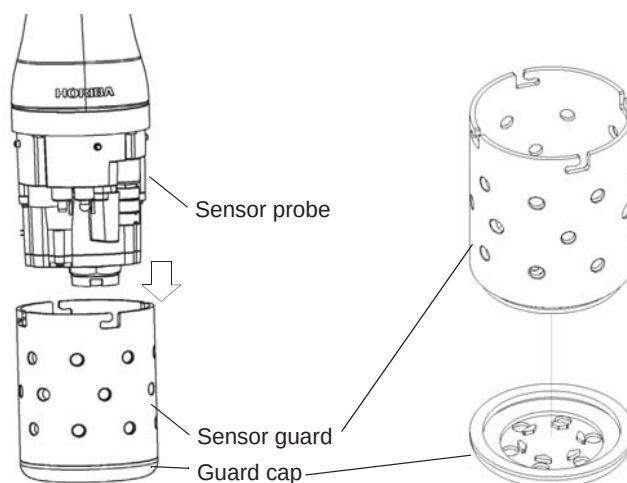
Note

The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

2. Remove the sensor guard, and clean the sensor with tap water.
3. Clean the turbidity sensor with the cleaning brush provided.
4. Remove the two screws securing the COND guard, and the COND guard itself, and use a test tube brush to gently remove any dirt from the electrical conductivity electrode.



5. Wipe off any dirt with a soft cloth. If parts are very dirty, clean them with neutral detergent, then rinse them. If parts are contaminated by oil, wipe it off with a soft cloth soaked in alcohol.
6. Put the COND guard back in place.
7. Remove the sensor guard's guard cap, wash off any dirt with tap water, then put the guard cap back in place.



4.2 Every 2 months maintenance

● Dissolved oxygen (DO) sensor

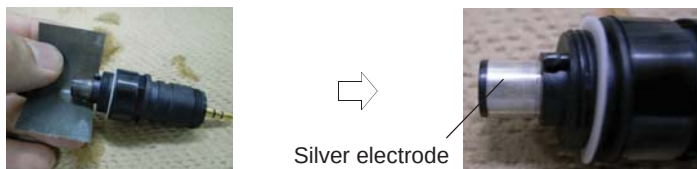
Note

- The DO sensor's internal solution is potassium chloride (KCl). Although KCl is harmless, protective equipment such as gloves and goggles should be worn when working with it.
- Internal solution can be disposed of down a sink.

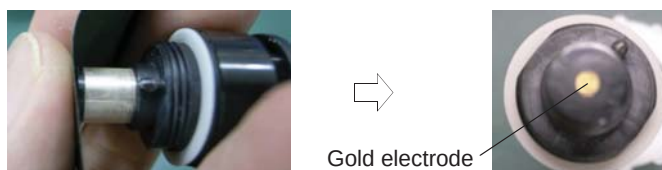
- Replace the membrane cap.
- Polish the gold and silver electrodes when replacing the membrane cap.
The gold electrode does not need to be polished if it is not dirty.

● Silver electrode

Polish a silver electrode part with sandpaper (#500) and then wash metal electrode parts with water.

**● Gold electrode**

Polish a gold electrode part with sandpaper (#8000) and then wash metal electrode parts with water.



Replace a membrane cap after clean metal electrodes parts.
Refer to “ 4.5 Replacing the membrane cap ” (page 87).

● Reference electrode

Note

- The pH reference internal solution is potassium chloride (KCl). Although KCl is harmless, protective equipment such as gloves and goggles should be worn when working with it.
 - Internal solution can be disposed of down a sink.
-

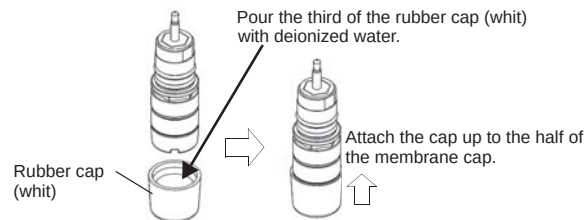
1. Remove the rubber liquid junction plug from the reference electrode and dispose of the internal solution.
2. To prevent air entering, fill the reference electrode to the brim with its internal solution (No. 330).
3. Put the rubber liquid junction plug back in place.

If the rubber liquid junction plug is dirty, replace the liquid junctions (set of two; No. 9037005100). The reference electrode's internal solution will spill when replacing the liquid junctions. Rinse parts with tap water and dry them with a soft cloth.

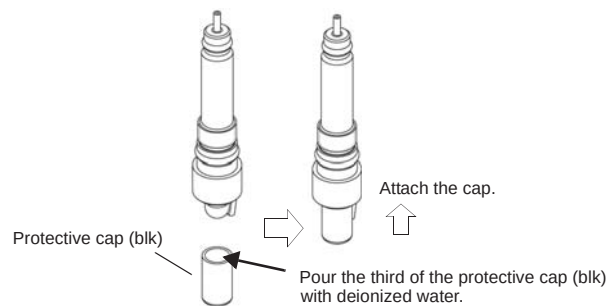
4.3 Storage

● Short-term (under 2 months) storage

- Before storing the DO sensor, pour the third of the rubber cap (whit) provided with deionized water and cover the DO sensor with them.



- Before storing the pH sensor, pour the third of the protective cap (blk) provided with deionized water and cover the pH sensor with them.



Note

Before measuerment, remove the rubber cap (whit) and the protective cap (blk).

● Long-term (2 months or more) storage

- Remove a membrane cap from DO sensor, and wash the gold electrode and silver electrode parts with water. Wipe off the moisture before storing DO sensor in the pack.
- Prevent internal solution seeping out of the reference chip by taping over the point of seepage with electrical tape.
- Before storing the system, remove the control unit's batteries to prevent battery leakage.

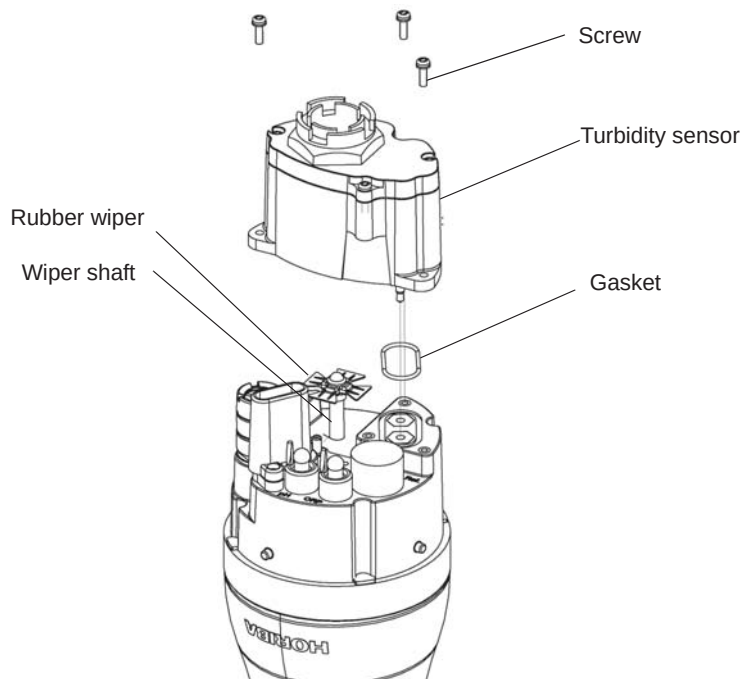
4.4 Replacing the turbidity sensor

1. Press and hold down the control unit's POWER key for about 3 seconds to turn the power OFF.

Note

The operation keys are designed to operate using the pad of a finger, sharp objects can tear the control unit cover damaging the operation keys.

2. Remove the sensor guard, and clean the sensor probe with tap water.
3. Use dry air to blow away and dry off any moisture.
4. Remove the three screws holding the turbidity sensor by using No. 2 Phillips head screwdriver.
5. Pull out the turbidity sensor horizontally.
6. Remove the rubber wiper and gasket, and use a soft cloth to wipe off any dirt from the wiper shaft and turbidity sensor attachment. If parts are very dirty, use a soft cloth soaked in neutral detergent or alcohol.
7. Replace the rubber wiper and gasket with new ones. Coat the gasket with a thin layer of grease (No. 3014017718).
8. Attach the new turbidity sensor and fasten it in place with the three screws.
9. Perform four-point calibration before using the sensor.



4.5 Replacing the membrane cap

● Replacement procedure

1. Prepare the DO sensor.

- Take a DO sensor out of pack (newly purchasing).
- Remove a DO sensor from the sensor probe (after use).



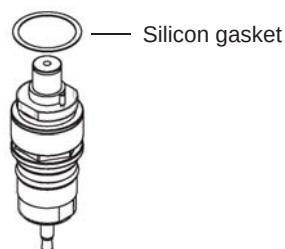
Newly purchasing



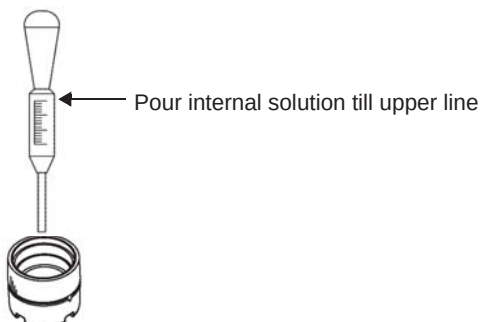
Undo a DO sensor from the sensor probe

- Twist a membrane cap from DO sensor.
- Wash the gold electrode and silver electrode parts with water.

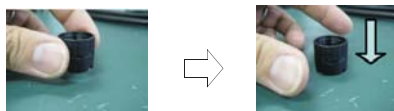
2. Replace the silicone gasket with a new one.



3. Pour internal solution into a membrane cap with a dropper.

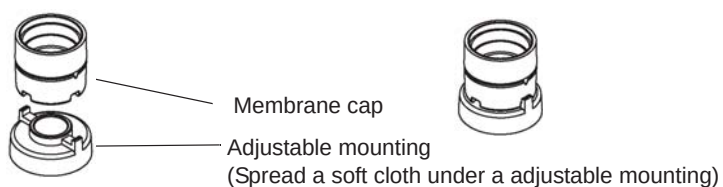


- Check air bubbles in a membrane cap.

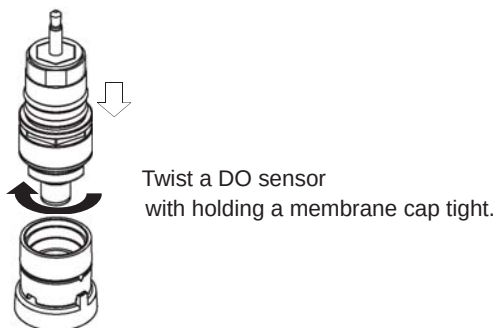


Pick a Cap up and drop it down, if there is air bubbles in internal solution of it.

4. Set up a membrane cap on a adjustable mounting.

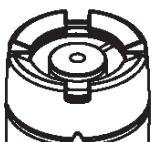


5. Attach a membrane cap to DO sensor

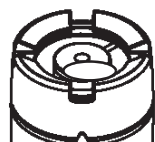


6. Check for membrane surface

Check air bubbles in a membrane cap.



Good: Limited air bubbles



NG: Air bubbles of more than 5 mm in diameter

- NG → Replace a membrane cap again.
- Check that span calibration can be performed.

If the membrane cap is not attached correctly, sensitivity may be lost or response speed may decrease.

4.6 Troubleshooting

Note

If the sensor probe is removed while the control unit is indicating an error, errors cannot be canceled by using the ESC key. Either reconnect the sensor probe or restart the control unit.

4.6.1 Error displays

Error	Cause	Solution
Probe ADC error	Internal IC failure	Contact your nearest sales outlet to have the sensor probe repaired.
Probe EEPROM error/Factory	Internal IC failure	Turn the power OFF, then restart the system. If the error persists, initialize the system from the "System" menu. If the error still persists, contact your nearest sales outlet to have the sensor probe repaired.
Probe EEPROM error/User	Internal IC failure	Turn the power OFF, then restart the system. If the error persists, initialize the system from the "System" menu. If the error still persists, contact your nearest sales outlet to have the sensor probe repaired.
Turbidity sensor light source error	Turbidity sensor light source failure	Turn the power OFF, wipe off any water droplets on the probe, then remove the turbidity sensor. Check there are no water droplets around the turbidity sensor connector, then mount the sensor again. If the error persists, replace the turbidity sensor.
Turbidity sensor wiper motor error	The turbidity sensor wiper is not operating.	Press the ESC key. Check there are no obstacles near the wiper, then perform the measurement again. If the error persists, the motor will need to be replaced. Contact your nearest sales outlet to have the sensor probe repaired.
Probe capacitor error	Low battery voltage or internal IC failure	Turn the power OFF. Replace the display's batteries. If the error persists, contact your nearest sales outlet to have the sensor probe repaired.
Probe EEPROM error	Internal IC failure	Press the ESC key, then redo the operation. If the error persists, turn the power OFF, then restart the system (the current data will not be saved). If the error still persists, contact your nearest sales outlet to have the display repaired.
Probe board error	Probe board failure	Turn the power OFF. Contact your nearest sales outlet to have the sensor probe repaired.

Error	Cause	Solution
Zero-point calibration error	pH sensor 1. The pH standard solution is contaminated. 2. The pH-responsive membrane is dirty. 3. The concentration of the reference electrode's internal solution has changed. 4. The pH-responsive membrane is torn.	pH sensor 1. Replace the standard solution with new solution. 2. Clean the pH-responsive membrane. 3. Refill the reference electrode's internal solution. 4. Replace the sensor.
	COND sensor 1. There is moisture on the sensor. 2. The sensor is dirty. 3. The COND sensor is broken.	COND sensor 1. Blow-dry the moisture off the sensor. 2. Clean the sensor. 3. Contact your nearest sales outlet.
	TURB sensor 1. There are air bubbles on the cell. 2. The cell window is dirty. 3. The sensor is being affected by ambient light. 4. The solution is dirty. 5. The TURB sensor has failed.	TURB sensor 1. Shake the sensor probe vigorously. 2. Clean the cell window. 3. Calibrate using the calibration cup provided. 4. Replace the solution with new solution. 5. Replace the TURB sensor.
	DO sensor 1. There are air bubbles in the internal solution. 2. The DO sensor has failed.	DO sensor 1. Replace the diaphragm with a new one, and fill the DO sensor with new internal solution. 2. Replace the DO sensor.
	Water depth sensor 1. The water depth sensor is dirty. 2. The water depth sensor has failed.	Water depth sensor 1. Clean the water depth sensor. 2. Contact your nearest sales outlet.

Error	Cause	Solution
Span calibration error	pH sensor 1. The pH standard solution is contaminated. 2. The pH-responsive membrane is dirty. 3. The concentration of the reference electrode's internal solution has changed. 4. The pH-responsive membrane is torn.	pH sensor 1. Replace the standard solution with new solution. 2. Clean the pH-responsive membrane. 3. Refill the reference electrode's internal solution. 4. Replace the sensor.
	ORP sensor 1. The ORP standard solution is contaminated. 2. The ORP electrode is dirty. 3. The concentration of the reference electrode's internal solution has changed. 4. The ORP electrode has failed.	ORP sensor 1. Replace the standard solution with new solution. 2. Clean the ORP electrode. 3. Refill the reference electrode's internal solution. 4. Replace the ORP electrode.
	COND sensor 1. The calibration solution is not correct. 2. The sensor is dirty. 3. The COND sensor has failed.	COND sensor 1. Use the correct calibration solution for calibration. 2. Clean the sensor. 3. Contact your nearest sales outlet.
	TURB sensor 1. There are air bubbles on the cell. 2. The cell window is dirty. 3. The sensor is being affected by ambient light. 4. The solution is dirty. 5. The TURB sensor has failed.	TURB sensor 1. Shake the sensor probe vigorously. 2. Clean the cell window. 3. Calibrate using the calibration cup provided. 4. Replace the solution with new solution. 5. Replace the TURB sensor.
	DO sensor 1. The diaphragm is torn. 2. There are air bubbles in the internal solution. 3. The DO sensor has failed.	DO sensor 1. Replace the diaphragm with a new one, and fill the DO sensor with new internal solution. 2. Replace the diaphragm with a new one, and fill the DO sensor with new internal solution. 3. Replace the DO sensor.
	Temperature sensor The temperature sensor has failed.	Temperature sensor Contact your nearest sales outlet.
Calibration stability error	The calibration value of an individual parameter is not stable. 1. The sensor is dirty. 2. The sensor has not adjusted to the standard solution. 3. The temperature was unstable during calibration.	1. Clean the sensor. 2. Fill the transparent calibration cup with pH 4 standard solution, and wait for at least 20 minutes of conditioning before starting calibration. 3. Start calibration after the temperature has stabilized.
Turbidity calibration error	Error in turbidity measurement sequence	Turbidity calibration failed. Redo calibration after removing the displayed error.
Wet check	The cable connector is submerged.	Turn the power OFF and disconnect the cable connector. Wipe or blow-dry off all the water droplets on the probe. If the error persists, contact your nearest sales outlet to have the display and sensor probe repaired.
Power voltage error	The display's power board has failed.	This error could also be caused by poor cable contact. Turn the power OFF and disconnect the cable connector. Reconnect the connector and turn the power ON. If the error persists, contact your nearest sales outlet to have the display and sensor probe repaired.
Turbidity lamp power voltage error	The remaining battery level is low.	Turn the power OFF and replace the display's batteries with new ones.

Error	Cause	Solution
Display RTC error	The time display is incorrect.	Replace the coin battery.
Display FROM error	Internal IC failure	Contact your nearest sales outlet to have the control unit repaired.
Display EEPROM error	Internal IC failure	Contact your nearest sales outlet to have the control unit repaired.
Display save error	Insufficient memory space	Move data from the display, use the data operations screen to delete data, then redo the measurement.
Measurement sequence error	- When the measurement item is turbidity - The battery power is low. - The wiper is not operating normally. - The light source lamp is not lit. - If items other than turbidity are also displayed - Board failure	- Replace the batteries with new ones. - Check there are no obstacles near the wiper, then redo the measurement. If the error persists, the motor will need to be replaced. Contact your nearest sales outlet to have the sensor probe repaired. - Wipe off any water droplets on the probe, then remove the turbidity sensor. Check there are no water droplets around the turbidity sensor connector, then mount the sensor again. If the error persists, replace the turbidity sensor. - Contact your nearest sales outlet to have the sensor probe repaired.
Out of measurement range	The attempted measurement is outside the measurement range supported for that item.	The system must be used within its supported measurement ranges.
Last zero-point calibration invalid	pH sensor - The pH standard solution is contaminated. - The pH-responsive membrane is dirty. - The concentration of the reference electrode's internal solution has changed. - The pH-responsive membrane is torn.	pH sensor - Replace the standard solution with new solution. - Clean the pH-responsive membrane. - Refill the reference electrode's internal solution. - Replace the sensor.
	COND sensor - There is moisture on the sensor. - The sensor is dirty. - The COND sensor has failed.	COND sensor - Blow-dry the moisture off the sensor. - Clean the sensor. - Contact your nearest sales outlet.
	TURB sensor - There are air bubbles on the cell. - The cell window is dirty. - The sensor is being affected by ambient light. - The solution is dirty. - The TURB sensor has failed.	TURB sensor - Shake the sensor probe vigorously. - Clean the cell window. - Calibrate using the calibration cup provided. - Replace the solution with new solution. - Replace the TURB sensor.
	DO sensor - There are air bubbles in the internal solution. - The DO sensor has failed.	DO sensor - Replace the diaphragm with a new one, and fill the DO sensor with new internal solution. - Replace the DO sensor.
	Water depth sensor - The water depth sensor is dirty. - The water depth sensor has failed.	Water depth sensor - Clean the water depth sensor. - Contact your nearest sales outlet.
Out of measurement range	[See above.]	[See above.]
Last zero-point calibration invalid		

Error	Cause	Solution
Last span calibration invalid	pH sensor 1. The pH standard solution is contaminated. 2. The pH-responsive membrane is dirty. 3. The concentration of the reference electrode's internal solution has changed. 4. The pH-responsive membrane is torn.	pH sensor 1. Replace the standard solution with new solution. 2. Clean the pH-responsive membrane. 3. Refill the reference electrode's internal solution. 4. Replace the sensor.
	ORP sensor 1. The ORP standard solution is contaminated. 2. The ORP electrode is dirty. 3. The concentration of the reference electrode's internal solution has changed. 4. The ORP sensor glass is broken.	ORP sensor 1. Replace the standard solution with new solution. 2. Clean the ORP electrode. 3. Refill the reference electrode's internal solution. 4. Replace the sensor.
	COND sensor 1. The calibration solution is not correct. 2. The sensor is dirty. 3. The COND sensor has failed.	COND sensor 1. Use the correct calibration solution for calibration. 2. Clean the sensor. 3. Contact your nearest sales outlet.
	TURB sensor 1. There are air bubbles on the cell. 2. The cell window is dirty. 3. The sensor is being affected by ambient light. 4. The solution is dirty. 5. The TURB sensor has failed.	TURB sensor 1. Shake the sensor probe vigorously. 2. Clean the cell window. 3. Calibrate using the calibration cup provided. 4. Replace the solution with new solution. 5. Replace the TURB sensor.
	DO sensor 1. The diaphragm is torn. 2. There are air bubbles in the internal solution. 3. The DO sensor has failed.	DO sensor 1. Replace the diaphragm with a new one, and fill the DO sensor with new internal solution. 2. Replace the diaphragm with a new one, and fill the DO sensor with new internal solution. 3. Replace the DO sensor.
	Temperature sensor ● The temperature sensor has failed.	Temperature sensor ● Contact your nearest sales outlet.
Out of measurement range	[See above.]	[See above.]
Last zero-point calibration invalid		
Last span calibration invalid	The calibration value of an individual parameter is not stable. 1. The sensor is dirty. 2. The sensor has not adjusted to the standard solution. 3. The temperature was unstable during calibration.	1. Clean the sensors. 2. Fill the transparent calibration cup with pH 4 standard solution, and wait for at least 20 minutes of conditioning before starting calibration. 3. Start calibration after the temperature has stabilized.
Out of measurement range	[See above.]	[See above.]
Last zero-point calibration invalid		
Calibration value is factory default value.	Internal IC failure	Turn the power OFF, then restart the system. If the error persists, initialize the system from the "System" menu. If the error still persists, contact your nearest sales outlet to have the sensor probe repaired.

Error	Cause	Solution
Sample is unstable.	1. The concentration of the sample is unstable. 2. External light disturbance has affected the sensor. 3. Water has entered the turbidity sensor's connector.	1. Use a stirrer to agitate the sample during measurement. 2. Perform measurement away from direct sunlight. 3. Turn the power OFF, wipe off any water droplets on the probe, then remove the turbidity sensor. Check there are no water droplets around the turbidity sensor connector, then mount the sensor again. If the error persists, replace the turbidity sensor.

4.6.2 Error displays in sensor information

Error display	Cause	Solution
Measurement sequence error	Measurement sequence error	Turn the power OFF, then restart the system. If the error persists, have the probe repaired.
Out of measurement range	The measurement value is outside the measurement range.	Samples for measurement must be within the measurement range.
Last calibration invalid	The last calibration failed.	Redo calibration.
Calibration invalid	The calibration value is the factory default value.	Redo calibration.
Background unstable	The U-53 turbidity sensor is exposed to direct light.	Mount the guard cap and sensor guard and perform measurement away from direct sunlight.
	The turbidity value changed rapidly during measurement.	Measure a sample that has stable turbidity.

5 Specifications

Specification		Basic value	Model				
			U-51	U-52	U-52G	U-53	U-53G
Sensor probe	Measurement temperature range	−10°C to 55°C	✓	✓	✓	✓	✓
	Maximum sensor outer diameter	Approx. 96 mm					
	Sensor length	Approx. 340 mm					
	Cable length	2 m (standard) 10 m/30 m (options)					
	Mass	Approx. 1800 g					
	Auto calibration function	Uses pH 4 standard solution.	✓	✓	✓	✓	✓
	Measurement depth	30 m max.					
	Wet-part materials*3	PPS, glass, SUS316L, SUS304, FKM, PEEK, Q, titanium, FEP membrane, POM					
	Waterproofing standard	IP-68					
Control unit	Outer dimensions (W × D × H)	115 × 66 × 283 mm	✓	✓	—	✓	—
		115 × 66 × 335 mm	—	—	✓	—	✓
	Mass	Approx. 800 g	✓	✓	✓	✓	✓
	LCD	320 × 240 mm graphic LCD (monochrome) with backlight	✓	✓	✓	✓	✓
	Memory data items	10000	✓	✓	✓	✓	✓
	Communication interface	USB peripheral	✓	✓	✓	✓	✓
	Batteries	C-size dry cells (×4)	✓	✓	✓	✓	✓
	Waterproofing standard	IP-67	✓	✓	✓	✓	✓
	GPS unit	● Reception method (12 channel parallel) ● Measurement precision [With PDOP (high precision): 30 m or less (2 drms)]	—	—	✓	—	✓
	Estimated battery life*1	—	70 hours (no backlight)			500 measurements (no backlight)	
	Storage temperature range	−10°C to 60°C	✓	✓	✓	✓	✓
	Ambient temperature range	−5°C to 45°C					

5 Specifications

Specification		Basic value	Model				
			U-51	U-52	U-52G	U-53	U-53G
pH measurement Two calibration	Measurement method	Glass electrode method	✓	✓	✓	✓	✓
	Range	pH 0 to 14					
	Resolution	0.01 pH					
	Precision*2	±0.1 pH					
Dissolved oxygen measurement ● Salinity conversion (0 to 70 PPT, automatic) ● Automatic temperature compensation	Measurement method	Polarographic method	✓	✓	✓	✓	✓
	Film thickness	25 μm					
	Range	0 mg/L to 50.0 mg/L					
	Resolution	0.01 mg/L					
	Precision*2	0 mg/L to 20 mg/L: ±0.2 mg/L 20 mg/L to 50 mg/L: ±0.5 mg/L					
Electrical conductivity measurement ● Auto range ● Automatic temperature conversion (25°C)	Measurement method	Four-AC-electrode method	✓	✓	✓	✓	✓
	Range	0 S/m to 10 S/m (0 mS/cm to 100 mS/cm)					
	Resolution	0.000 mS/cm to 0.999 mS/cm: 0.001					
		1.00 mS/cm to 9.99 mS/cm: 0.01					
		10.0 mS/cm to 99.9 mS/cm: 0.1					
	Precision*2	0.0 mS/m to 99.9 mS/m: 0.1 0.100 S/m to 0.999 S/m: 0.001 1.00 S/m to 9.99 S/m: 0.01					
Salinity measurement	Measurement method	Electrical conductivity conversion	✓	✓	✓	✓	✓
	Range	0 PPT to 70 PPT (parts per thousand)					
	Resolution	0.1 PPT					
	Precision	±3 PPT					
TDS (total dissolved solid) measurement ● Conversion coefficient setting	Measurement method	Electrical conductivity conversion	✓	✓	✓	✓	✓
	Range	0 g/L to 100 g/L					
	Resolution	0.1% of full-scale					
	Repeatability	±2 g/L					
	Precision	±5 g/L					
Seawater specific gravity measurement ● σ _t , σ ₀ , σ ₁₅ display	Measurement method	Electrical conductivity conversion	✓	✓	✓	✓	✓
	Range	0 σ _t to 50 σ _t					
	Resolution	0.1 σ _t					
	Precision	±5 σ _t					

Specification		Basic value	Model				
			U-51	U-52	U-52G	U-53	U-53G
Temperature measurement	Measurement method	Platinum temperature sensor	✓	✓	✓	✓	✓
	Range	−10°C to 55°C					
	Resolution	0.01°C					
	Sensor	Platinum temperature sensor, JIS Class B (0.3 + 0.005 t)					
Turbidity measurement	Measurement method		—	LED forward 30° transmission/ scattering method		Tungsten lamp 90° transmission/ scattering method	
	Range			0 NTU to 800 NTU		0 NTU to 1000 NTU	
	Resolution			0.1 NTU		0.01 NTU	
	Precision ^{*2}			±5%of readout or ±1 NTU, whichever is larger		● ±0.5NTU (for 0 NTU to 10 NTU measurement range) ● 3% of readout or 1 NTU, whichever is larger (for 10 NTU to 1000 NTU measurement range)	
	Turbidity sensor wiper			—		✓	
Water depth measurement	Measurement method	Pressure method	—	—	✓	✓	✓
	Range	0 m to 30 m					
	Resolution	0.05 m					
	Precision ^{*2}	±0.3 m					
ORP (oxidation reduction potential) measurement	Measurement method	Platinum electrode method	✓	✓	✓	✓	✓
	Range	−2000 ~ +2000 mV					
	Resolution	1 mV					
	Precision ^{*2}	±15 mV					

*1: Battery life is estimated under following conditions.

- Continuous operation
- Using batteries: C-size alkaline dry cells
- Ambient temperature of the control unit: 20°C or more
- Backlight off

*2: The precision is defined by measuring the standard solution in the following cases.

- Turbidity and conductivity: after four point calibration
- pH and DO: after two point calibration
- Water depth and ORP: after one point calibration

*3: Metallic parts are made of stainless steel. Immersing in seawater may erode metallic parts.

6 Reference

6.1 Consumable parts

● Sensor

Name	Model	No.	Description
pH sensor	#7112	3014057312	Standard type pH sensor
pH sensor ToupH	#7113	3200170923	Tough glass type pH sensor
ORP sensor	#7313	3200170920	
DO sensor	#7543	3200170924	
Reference electrode	#7210	3200043582	
R bush unit	—	3200043587	Reference electrode liquid junction
TURB cell U-52	#7800	3200172803	For U-52/U-52G
TURB cell U-53	#7801	3200172800	For U-53/U-53G
Membrane cap	—	3200170194	For DO sensor

● Standard solution and inner solution

Name	Model	No.	Description
pH 4 (For automatic calibration) 500 mL	#100-4	3200043638	Standard solution for auto calibration. Also used for manual pH span calibration.
pH 4 (For automatic calibration) 4 L	#140-4	3200174430	
pH 7 500 mL	#100-7	3200043637	Standard solution for pH zero-point calibration.
pH 9 500 mL	#100-9	3200043636	Standard solution for pH manual span calibration.
Powder for ORP standard solution 10 packs	#160-51	3200043618	For ORP calibration.
Powder for ORP standard solution 10 packs	#160-22	3200043617	
Inner solution for DO sensor, 50 mL	#306	3200170938	Internal solution for DO sensor.
Internal solution for pH, 250 mL	#330	3200043641	Supplementary internal solution for pH reference electrode.

● Others

Name	Model	No.	Description
Silicone grease	—	3014017718	Silicone grease for coating sensor O-ring.
Sponge brush unit	—	3200169531	Brush for cleaning sensor probe.
O-ring set for reference electrode	—	3200169376	O-rings for reference electrode.
O-ring set for DO sensor	—	3200169426	O-rings for DO sensor.
Rubber cap set for sensor guard	—	3200169428	Rubber caps used between sensor guard and sensor probe.
O-ring set for pH and ORP sensor	—	3200169520	O-rings for pH and ORP sensors.
Wiper unit	—	3200169789	Rubber wiper for U-53/U-53G turbidity sensors.
Protective cap (blk) for pH sensor	—	3200175019	Cap attached to tip of pH sensor for sensor probe storage.
Rubber cap (whit) for DO sensor	—	3200175020	Cap attached to tip of DO sensor for sensor probe storage.

6.2 Options sold separately

Name	Model	No.	Description
Bag	U-5030	3200174772	Storage bag for sensor probes and flow cell. Can be carried in one hand.
Flow cell assy	—	3200156570	Used when collecting measurement samples by pump.
Probe guard	—	3200167002	Used for taking measurements in locations where there is a current or where there is a thick layer of sludge.
Communication cable	—	3200174823	A PC connection cable. Comes with data collection software.

6.3 pH measurement

6.3.1 Principle of pH measurement

U-50 series use the glass electrode method for pH measurements. The glass electrode method measures a potential difference between the glass film for pH and the reference electrode. For more information, refer to “JIS Z 8802 pH measurement method”.

6.3.2 Temperature compensation

The electromotive force generated by the glass electrode changes depending on the temperature of the solution.

Temperature compensation is used to compensate for the change in electromotive force caused by temperature.

This function does not compensate the change in pH caused by the temperature of the solution. When pH is to be measured, the temperature of the solution must be recorded along with that pH value, even if a pH meter has automatic temperature compensation function. If the solution temperature is not recorded, the results of the pH measurement may be meaningless.

6.3.3 Standard solutions

When measuring pH, the pH meter must be calibrated using standard solution. There are five kinds of standard solutions specified in “JIS Z 8802 pH measurement”. For normal measurement, two of standard solutions with pH of 4, 7, and 9 are sufficient to accurately calibrate the meter.

For standard solutions, refer to “JIS Z 8802 pH measurement”.

pH 4 standard solution: 0.05 mol/L potassium hydrogen phthalate aqueous solution (Phthalate)

pH 7 standard solution: 0.025 mol/L potassium dihydrogenphosphate, 0.025 mol/L disodium (Neutral phosphate) hydrogenphosphate aqueous solution

pH 9 standard solution: 0.01 mol/L sodium tetraborate aqueous solution (Borate)

Table 2 pH values of pH standard solutions at various temperatures settings

Temp. (°C)	pH 4 standard solution Phthalate	pH 7 standard solution Neutral phosphate	pH 9 standard solution Borate
0	4.01	6.98	9.46
5	4.01	6.95	9.39
10	4.00	6.92	9.33
15	4.00	6.90	9.27
20	4.00	6.88	9.22
25	4.01	6.86	9.18
30	4.01	6.85	9.14
35	4.02	6.84	9.10
40	4.03	6.84	9.07
45	4.04	6.84	9.04

6.4 DO measurement

6.4.1 Principle of DO measurement

Dissolved oxygen (DO) refers to the amount of oxygen that is contained in water.

The concentration of dissolved oxygen is generally given as mg/L or as a percentage value (the dissolved oxygen saturation ratio).

Dissolved oxygen is essential for maintaining the self-purifying ability of rivers and seas and also for fish to live. The concentration of dissolved oxygen acts as an indicator of water quality. It is often measured when processing waste water and managing water quality. Fig. 1 provides an overview of the principles behind dissolved oxygen sensor measurement.

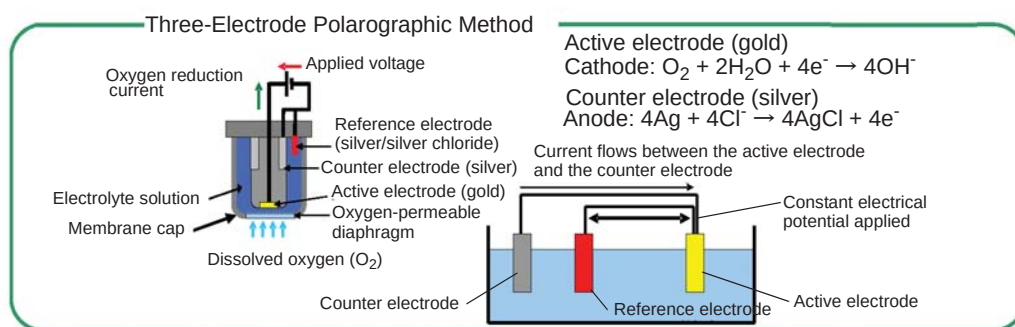


Fig. 1 Overview of principles behind dissolved oxygen sensor

The polarographic oxygen sensor is an enclosed sensor wherein voltage is applied to a cathode made of a precious metal (such as gold or platinum) and an anode also made of a precious metal (such as silver) via an external circuit, and a cap with an oxygen permeable diaphragm (membrane) is filled with electrolyte solution. As indicated in Fig. 1, the concentration of dissolved oxygen can be measured by measuring the current proportional to the amount of reduced oxygen when oxygen that has dispersed through the oxygen permeable diaphragm produces a reductive reaction on the surface of the active electrode (gold). The method of measuring dissolved oxygen based on the above principle is called the Membrane Electrode Method. Compared to the Chemical Analysis Method, which requires complicated pre-processing to alleviate the effect of reduced materials and oxidizing materials, this method allows dissolved oxygen to be measured very easily. It is also easy to remove undesired buildup from the silver electrode by polishing and cleaning if an insulator forms on it due to oxidation, making the method reusable.

6.4.2 Salinity calibration

When the solution and air come into contact and form an equilibrium (i.e. saturation), the relationship between the concentration of dissolved oxygen in the solution, C , [mol/L], and the partial pressure of oxygen in the air, P_s , [MPa/(mg/L)], can be represented by the following formula:

$$C = P_s/H$$

Where H [MPa/(mg/L)] is the Henry constant, a value that changes according to the composition of the solution. As H typically becomes larger as the salinity of the water increases, C becomes smaller.

The DO sensor detects the partial pressure of oxygen (P_s) in the above formula. Accordingly, if the DO sensor is immersed in deionized water saturated with air, or in an aqueous solution containing salt, the output current does not change, resulting in an erroneous measurement. For example, when salt is added to a sample, the amount of oxygen that can be dissolved in the solution decreases, but because the partial pressure of oxygen does not change, the value displayed by the control unit stays the same regardless of salt content. This concept is indicated in graph form below. (Fig. 2)

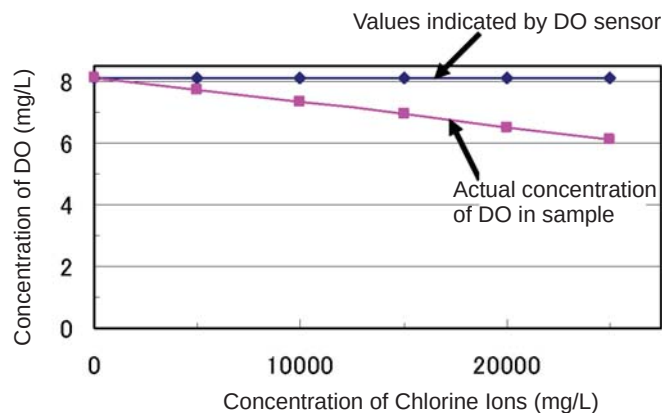


Fig. 2 Relationship between chlorine ion concentration and dissolved oxygen concentration

In samples with a high salt concentration, the solubility of oxygen is lower, but as the partial pressure of oxygen does not change, the value actually indicated on the control unit is higher than the actual value. In order to obtain a measurement of the concentration of dissolved oxygen in an aqueous solution that contains salt, it is therefore necessary to first perform salinity compensation. Conventionally, dissolved oxygen sensors have performed salinity compensation by inputting the salinity of the sample. This is fine as long as the salinity is already known. However, in most cases salinity is unknown, so even if dissolved oxygen sensors contained a salinity compensation function, it was of no practical use.

The U-50 Series can calculate and measure salinity in samples from electrical conductivity values, and can thus be used to automatically compensate for salinity.

6.5 Conductivity (COND) measurement

6.5.1 Four-AC-electrode method

Conductivity is an index of the flow of electrical current in a substance.

Salts dissolved in water are separated into cations and anions. Such solution is called electrolytic solution.

Electrolytic solution has the property of allowing the flow of current according to Ohm's law. This property is referred

to as ionic conductivity, since current flow is caused by ion movement in electrolytic solution.

Metals, on the other hand, allow the flow of current by means of electrons. This property is called electronic conductivity,

which is distinguished from ionic conductivity.

A cube with 1 m on each side, as shown in Fig. 3, is used to demonstrate an electrolytic solution. Two electrode plates are placed on opposite sides, and the cube is filled with solution. If the resistance between these two electrode plates is represented by $r(\Omega)$, the conductivity of the solution $L(\text{S}\cdot\text{m}^{-1})$ is represented as $L=1/r$. S stands for Siemens, a unit of measurement of conductance.

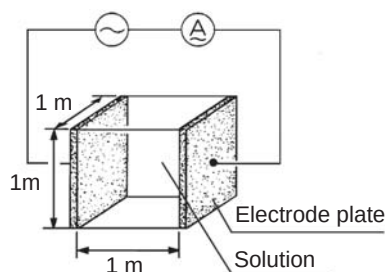


Fig. 3 Definition of conductivity

The most general method for measuring conductivity is based on the above principle, and is called the 2-electrode method.

In the 2-electrode method the influence of polarization cannot be ignored for solutions with high conductivity and conductivity cannot be measured accurately. In addition, contamination on the surface of the electrode increases apparent resistance, resulting in inaccurate measurement of conductivity.

The U-50 series has adopted the 4-electrode method to overcome these disadvantages of the 2-electrode method.

As shown in Fig. 4, the U-50 series uses two voltage-detecting electrodes and two voltage-applying electrodes, for a total of four electrodes. The voltage-detecting electrodes are for detecting AC voltage, and the voltage-applying electrodes are for applying AC voltage.

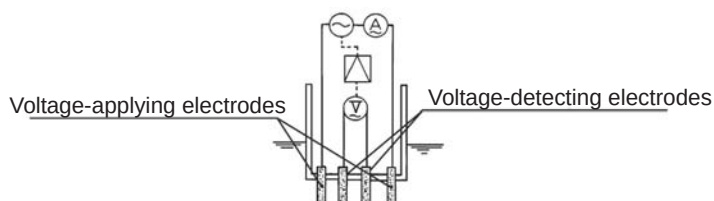


Fig. 4 Principle of the 4-electrode method

Let us assume that the current, $I(A)$, flows in a sample of conductivity L – under automatic control of the voltage-applying electrodes – so that the voltage at the voltage-detecting-electrodes, $E(V)$, remains constant at all times.

Then, the resistance of the sample, $R(\Omega)$, across the voltage-detecting electrodes is represented as $R=E/I$. The resistance, R , of the sample is inversely proportional to its conductivity, L . Accordingly, a measurement of current, I_s ,

of a standard solution of known conductivity, L_s , enables calculation of conductivity of a sample according to the formula $L = L_s (I/I_s)$ from the ratio $L : L_s = I : I_s$.

Even in the 4-electrode method, polarization occurs, since AC current flows in the voltage-applying electrodes. The voltage-detecting electrodes are, however, free from the effects of polarization, since they are separated from the voltage-applying electrodes, and furthermore, current flow is negligible. Therefore, the 4-electrode method is an excellent method to enable measurement of conductivity covering a very high range.

6.5.2 SI units

New measurement units, called SI units, have been in use from 1996. Accordingly, the U-50 series also uses SI units. The following conversion table is provided for people who use the conventional kind of conductivity meter.

Note that along with the change in unit systems, the measurement values and cell counts have also changed.

	Former units	→	SI unit
Measurement value	0.1 mS/cm	→	0.01 S/m
	1 mS/cm	→	0.1 S/m
	100 mS/cm	→	10 S/m

6.5.3 Temperature coefficient

In general, the conductivity of a solution varies largely with its temperature.

The conductivity of a solution depends on the ionic conductivity, described earlier. As the temperature rises, conductivity becomes higher since the movement of the ions becomes more active.

The temperature coefficient shows the change in % of conductivity per °C, with a certain temperature taken as the reference temperature. This is expressed in units of %/°C. The temperature coefficient assumes the premise that the conductivity of a sample changes linearly according to temperature.

Strictly speaking, with actual samples, however, conductivity changes along a curve. Furthermore, the curve varies with the type of sample. In the ranges of smaller temperature changes, however, samples are said to have the temperature coefficient of 2%/°C (at reference temperature 25°C); this holds for most samples, except in certain special cases.

(The temperature coefficients for various types of solutions are listed on the next page.)

The U-50 series uses an automatic temperature conversion function to calculate conductivity at 25°C at a temperature

coefficient of 2 %/°C based on the measured value of the temperature. Results are displayed on the readout.

The U-50 series's temperature conversion function is based on the following formula.

$$L_{25} = L_t / \{ 1 + K (t - 25) \}$$

L_{25} : Conductivity of solution converted to 25°C

t : Temperature of solution at time of measurement (°C)

L_t : Conductivity of solution at t (°C)

K : Temperature coefficient (%/°C)

● **Conductivity and temperature coefficient for various solutions**

Conductivity and related temperature coefficients of representative substances (at 25°C) are shown in the table below.

Substance	Temp. (°C)	Conc. (wt%)	Cond. (S/m)	Temp.coef. (%/°C)	Substance	Temp. (°C)	Conc. (wt%)	Cond. (S/m)	Temp.coef. (%/°C)
NaOH	15	5	19.69	2.01	NaCl	18	5	6.72	2.17
		10	31.24	2.17			10	12.11	2.14
		15	34.63	2.49			15	16.42	2.12
		20	32.70	2.99			20	19.57	2.16
		30	20.22	4.50			25	21.35	2.27
		40	11.64	6.48					
KOH	15	25.2	54.03	2.09	Na ₂ SO ₄	18	5	4.09	2.36
		29.4	54.34	2.21			10	6.87	2.49
		33.6	52.21	2.36	Na ₂ CO ₃	18	15	8.86	2.56
		42	42.12	2.83			5	4.56	2.52
NH ₃	15	0.1	0.0251	2.46	KCl	18	10	7.05	2.71
		1.6	0.0867	2.38			15	8.36	2.94
		4.01	0.1095	2.50			5	6.90	2.01
		8.03	0.1038	2.62			10	13.59	1.88
		16.15	0.0632	3.01			15	20.20	1.79
HF	18	1.5	1.98	7.20	KBr	15	20	26.77	1.68
		4.8	5.93	6.66			21	28.10	1.66
		24.5	28.32	5.83			5	4.65	2.06
HCl	18	5	39.48	1.58	KCN	15	10	9.28	1.94
		10	63.02	1.56			20	19.07	1.77
		20	76.15	1.54			3.25	5.07	2.07
		30	66.20	1.52			6.5	10.26	1.93
H ₂ SO ₄	18				NH ₄ Cl	18	—	—	—
		5	20.85	1.21			5	9.18	1.98
		10	39.15	1.28			10	17.76	1.86
		20	65.27	1.45			15	25.86	1.71
		40	68.00	1.78			20	33.65	1.61
		50	54.05	1.93			25	40.25	1.54
		60	37.26	2.13	NH ₄ NO ₃	15	5	5.90	2.03
		80	11.05	3.49			10	11.17	1.94
		100.14	1.87	0.30			30	28.41	1.68
		—	—	—			50	36.22	1.56
HNO ₃	18	6.2	31.23	1.47	CuSO ₄	18	2.5	10.90	2.13
		12.4	54.18	1.42			5	18.90	2.16
		31	78.19	1.39			10	32.00	2.18
		49.6	63.41	1.57			15	42.10	2.31
		62	49.64	1.57					
H ₃ PO ₄	15	10	5.66	1.04	CH ₃ COOH	18	10	15.26	1.69
		20	11.29	1.14			15	16.19	1.74
		40	20.70	1.50			20	16.05	1.79
		45	20.87	1.61			30	14.01	1.86
		50	20.73	1.74			40	10.81	1.96
							60	4.56	2.06

6.6 Salinity (SAL) conversion

The U-50 series is designed to calculate salinity as well as the other parameters.

Note that the “salinity” here is the salinity of sea water. There is a constant relation between conductivity and salinity at certain temperatures.

Therefore, if data on the conductivity and temperature are available, the corresponding salinity can be known. In other words, the salinity measurement of the U-50 series is based on the principle of calculating the salt content, making use of the measured values of conductivity and temperature.

Note therefore, that measured results of all substances whose conductivity is detected are displayed as salinity. For example, the measured result is displayed as NaCl concentration, even if in fact the sample component is, hydrochloric acid (HCl).

6.7 TDS conversion

TDS is short for Total Dissolved Solids and means the total dissolved solid amount.

The conductivity of a solution is affected by the amount of salinity, minerals, and dissolved gases. That is, conductivity is an index that shows the total amount of all substances in the solution. Of these substances, TDS indicates only the amount of dissolved solids.

TDS can be used for a comparison of the state of substances composed of a single component such as NaCl. However, the use of TDS for the comparison of solutions of different types causes serious errors.

Conductivity and TDS are expressed by the following formulas.

Conductivity in SI units (S/m) $\text{TDS(g/L)} = L \text{ (S/m)} \times K \times 10$

$\text{TDS(g/L)} = L \text{ (mS/m)} \times K \div 100$

Conductivity in the old units (mS/cm) $\text{TDS(g/L)} = L \text{ (mS/cm)} \times K$

$K = \text{TDS coefficient}$

Initial settings use the values listed in the table (Page 80) that generally uses TDS coefficients.

For accurate TDS comparisons, find the TDS coefficient from measured conductivity values. Then set the value thus obtained and make measurements.

6.8 σ_t conversion

● Specific gravity of seawater

The density and specific gravity of seawater are equal numerically and generally are not distinguished strictly. Since seawater density ρ is between 1.000 and 1.031, 1 is subtracted from ρ and σ is obtained by multiplying the value by 1000.

The resultant value is used as the specific gravity of seawater.

$$\sigma = (\rho - 1) \times 1000$$

The density of seawater ρ is expressed by function of temperature, hydraulic pressure, and salinity. The density of seawater under the atmospheric pressure is expressed as σ_t . The density of seawater under the atmospheric pressure is determined by temperature and salinity.

The U-50 Series models make salinity measurement through temperature measurements and conductivity conversion and find σ_t through calculations.

In Japan σ_{15} at 15°C is called a standard specific gravity and widely used while in foreign countries σ_0 at 0°C is employed. σ_{15} and σ_0 are determined by the function of salinity.

In ocean surveys, in particular, these values σ_t , σ_{15} , and σ_0 are more widely used than conductivity and salinity and, in the U-50 Series models, newly added as measurement components.

6.9 Turbidity (TURB) measurement

6.9.1 Principle of turbidity measurement

U-52 and U-53 sensors measure turbidity using the Transmitting and Scattering Method shown in Fig. 5. U-52 sensors use a pulse light LED (infra-red emitting diode) as a light source, and detect scattered light from a 30° angle off center. U-53 sensors use a tungsten lamp as a light source and detect scattered light from a 90° angle. Both models display turbidity as a ratio of scattered light to transmitted light to reduce the affect of the color of the sample. The U-53 method conforms to EPA Method 180.1, and employs wipers to reduce the affect of air bubbles.

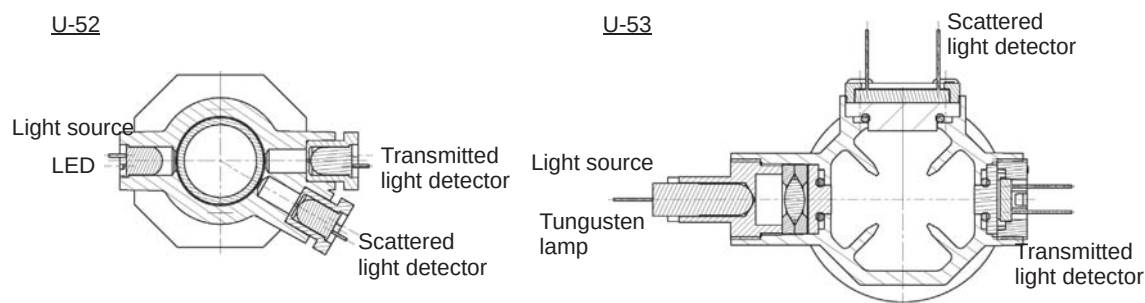


Fig. 5 Turbidity cell

6.9.2 Standard solution

U-50 series can perform calibration using formazin (NTU) or kaolin standard solutions as a turbidity standard solution. However, units for the solution used for calibration should be displayed in measurements. Do not use more than 400 mg/L of kaolin standard solution because it increases precipitation speed, resulting in measurement error.

6.10 Depth (DEPTH) measurement

6.10.1 Principle of depth measurement

For the W-22XD and W-23XD models, depth measurement can be made through use of a pressure gauge. The principle of the depth measurement uses the relation between depth and pressure.

Although the measurement with the depth sensor is affected by atmospheric pressure, the depth sensor, however, makes zero-point adjustments through the automatic calibration before measurements.

6.10.2 Influence of temperature and calibration

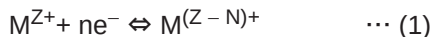
The depth sensor depends greatly on temperature. For a wide difference between the temperature at which the sensor has been automatically calibrated and the temperature of the measurement sample, the sensor can make depth measurements with a higher accuracy by the following method:

1. Immerse the depth sensor of the sensor probe in the sample.
2. Keep the sensor immersed in the sample for about 30 minutes until the temperatures of the sensor and the sample are the same.
3. Then make the zero calibration of the sensor manually.

6.11 Oxidation reduction potential (ORP) measurement

6.11.1 Principle of ORP measurement

ORP is an abbreviation for oxidation-reduction potential. ORP is the energy level (potential) determined according to the state of equilibrium between the oxidants (M^{Z+}) and reductants $M^{(Z-N)+}$ that coexist within a solution.



If only the solution, forming the ORP measuring system shown in Fig. 6. The difference of potential between two electrodes is generally expressed by the following equation.

$$E = E_0 - \frac{RT}{nF} \ln \frac{a_M^{(Z-N)+}}{a_M^{Z+}} \quad \dots (2)$$

E: Electric potential E_0 : Constant R: Gas constant T: Absolute temperature
n: Electron count F: Faraday constant a: Activity

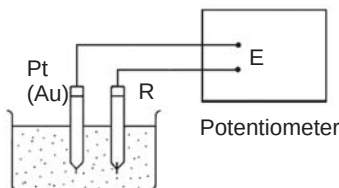
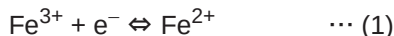


Fig. 6 Measuring mV

For example, for a solution in which trivalent iron ions coexist with bivalent iron ions, equations 1 and 2 would be as follows.



$$E = E_0 - \frac{RT}{F} \ln \frac{a_{Fe^{2+}}}{a_{Fe^{3+}}} \quad \dots (2)$$

When only one type of state of equilibrium uniquely by equation (Fe^{3+}) and the reductant (Fe^{2+}) (using the equation $a_{Fe^{2+}}/a_{Fe^{3+}}$). Actually, however many kinds of states of equilibrium exist simultaneously between various kinds of ions, in most solutions. This means that under actual circumstances, ORP cannot be expressed using the simple equation shown above and that the physical and chemical significance with respect to the solution is not very clear.

In this respect, the value of ORP must be understood to be only one indicator of the property of a solution. The measurement of ORP is widely used, however, as an important index in the analysis of solutions (potentiometric titration) and in the waste water treatment.

6.11.2 Standard electrode (reference electrode) types and ORP

The ORP is obtained comparing with corresponding reference electrode employed.

If different kinds of reference electrodes are used for measurement, the ORP value of the same solution may appear to be different. HORIBA's reference electrode uses Ag/AgCl with 3.33 mol/L KCl as inner solution. According to general technical literature, normal hydrogen electrodes (N.H.E.) are often used as the standard electrode.

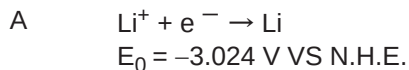
The relationship between N.H.E. and the ORP that is measured using an Ag/AgCl with 3.33 mol/L KCl electrode is expressed by the following equation.

$$E_{N.H.E.} = E + 206 - 0.7(t - 25) \text{ mV} \quad t = 0 - 60^\circ\text{C}$$

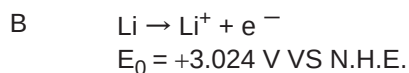
$E_{N.H.E.}$: Measured ORP value using N.H.E. as the reference electrode

E: Measured ORP value using Ag/AgCl with 3.33 mol/L KCl as the reference electrode
Potential sign

Standard ORP is expressed in the following way, in literature related to electrochemistry and analytical chemistry.



However, in some literature, the "+" and "-" signs are reversed.



In expressions like B, above, the reaction is just reversed and there is no essential difference. But this kind of expression does invite confusion. The majority of the world, today, is consistent in its use of the signs as they are used in A, above.

For this reason, HORIBA, too, uses signs concerning ORP that are consistent with A, above.

HORIBA,Ltd.

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Attachment 2: Manufacturer's Instructions

Flow cell for U-50 series U-50FC Instruction Manual



Flow cell for U-50 series U-50FC Instruction Manual

The flow cell U-50FC is used to measure the pumped water stably by using the U-50 series.

■ Warranty and Responsibility

HORIBA warrants that the Product shall be free from defects in material and workmanship and agrees to repair or replace free of charge, at HORIBA's option, any malfunctioned or damaged Product attributable to HORIBA's responsibility for a period of one (1) year from the delivery unless otherwise agreed with a written agreement. In any one of the following cases, none of the warranties set forth herein shall be extended;

- Any malfunction or damage attributable to improper operation
- Any malfunction attributable to repair or modification by any person not authorized by HORIBA
- Any malfunction or damage attributable to the use in an environment not specified in this manual
- Any malfunction or damage attributable to violation of the instructions in this manual or operations in the manner not specified in this manual
- Any malfunction or damage attributable to any cause or causes beyond the reasonable control of HORIBA such as natural disasters
- Any deterioration in appearance attributable to corrosion, rust, and so on
- Replacement of consumables

HORIBA SHALL NOT BE LIABLE FOR ANY DAMAGES RESULTING FROM ANY MALFUNCTIONS OF THE PRODUCT, ANY ERASURE OF DATA, OR ANY OTHER USES OF THE PRODUCT.

■ Trademarks

Generally, company names and brand names are either registered trademarks or trademarks of the respective companies.

■ For your safety

Warning messages are described in the following manner. Read the messages and follow the instructions carefully.

● Meaning of warning messages



This indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.



This indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



This indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices. Without safety alert indication of hazardous situation which, if not avoided, could result in property damage.

● Symbols



Description of what should be done, or what should be followed



Description of what should never be done, or what is prohibited

■ Safety Precautions

This section provides precautions to enable you to use the product safely and correctly and to prevent injury and damage. The terms of DANGER, WARNING, and CAUTION indicate the degree of imminency and hazardous situation. Read the precautions carefully as it contains important safety messages.



CAUTION



Keep the exit of the flow cell open.

If the internal pressure exceeds 30 kPa, it may damage the product or a user.

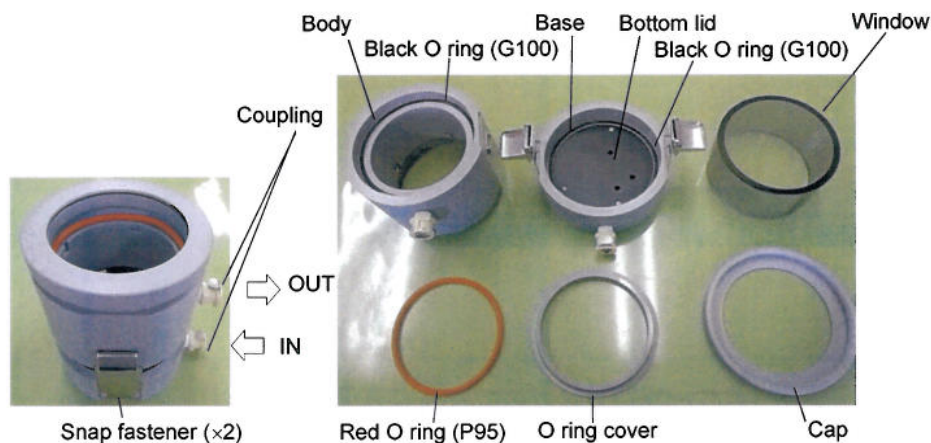
1 Specifications

Items	Specifications
Usable fluid	Water or water solution only
Flow rate	0.1 L/min to 0.5 L/min.
Sample temperature	-5°C to 55°C/23°F to 131°F
Inner diameter of connecting tube	6.4 mm (1/4 inch) or 9.5 mm (3/8 inch) I.D. tubes
Material	Polyvinylchloride, Stainless steel, Acrylic resin, FKM, Silicon rubber

2 Precautions

- The flow cell U-50FC is applicable only to the sensor probe of U-50 series.
- Do not bend the tube and do not put something on the tube to avoid clogging the flow.
- It is necessary to keep the sensor probe standing vertically when measuring.
- The flow cell cannot be used for sample including organic solvent.
Please use tap water and do not use organic solvent when you clean the flow cell.
- Do not use a hard brush when cleaning the cell to avoid rubbing the cell.
- Remove the sensor guard of sensor probe to set up the sensor probe to the flow cell.
Be careful not to make the sensor hit to something.

3 Name of parts



For fitting the sample IN/OUT tube

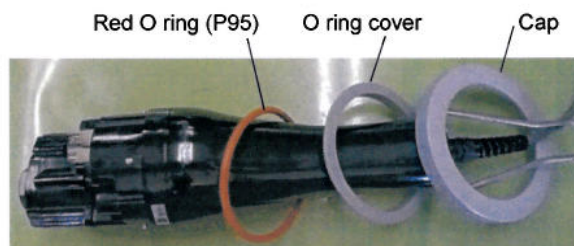
Fitting small (×2)
(For I.D. 6.4 mm tube)



Fitting large (×2)
(For I.D. 9.5 mm tube)

4 Setup

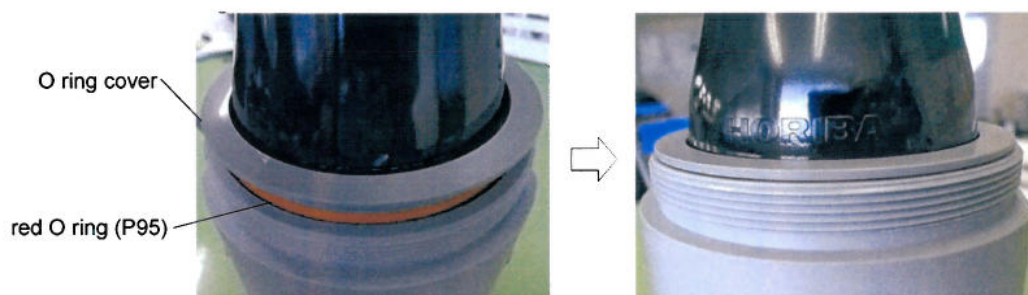
1. Remove the cap, O ring cover, and red O ring (P95) from the flow cell body.
2. Pass the cap, O ring cover, and red O ring (P95) through the sensor probe from sensor side. Remove the sensor guard of sensor probe.



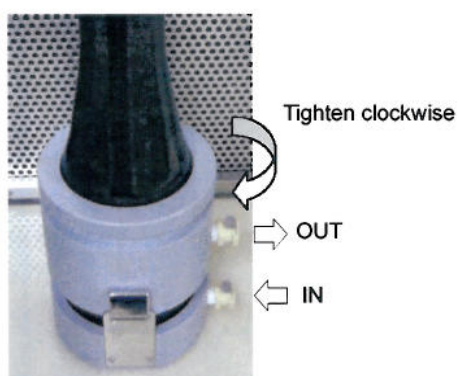
3. Put the sensor probe in the flow cell so that four pins of the sensor probe may get into the guide of the flow cell body.
 - Make the coupling of the flow cell and logo of "HORIBA" of the sensor probe the same direction. It is necessary to match the direction for accurate measurement of turbidity and dissolved oxygen.
 - After putting the sensor probe in the flow cell, turn the sensor probe clockwise until there is a hit according to the guide.
 - Confirm the sensor probe does not remove by pulling up it.



-
4. Put red O ring (P95) between the sensor probe and the flow cell body, and push down it by O ring cover.

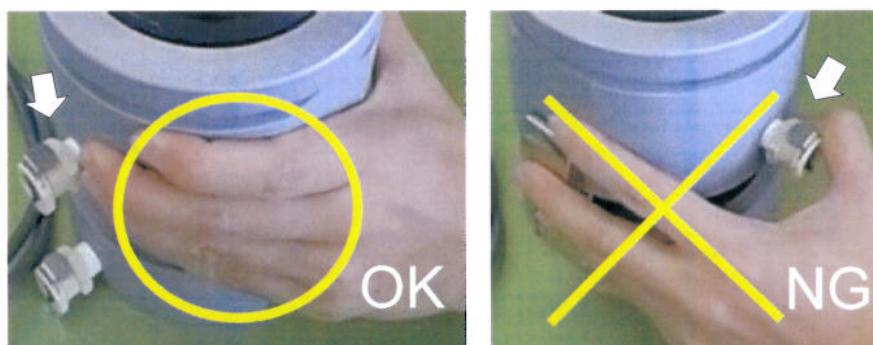


5. Tighten the cap firmly, fit tubes to the fittings, and connect with the couplings.
Setup is completed.

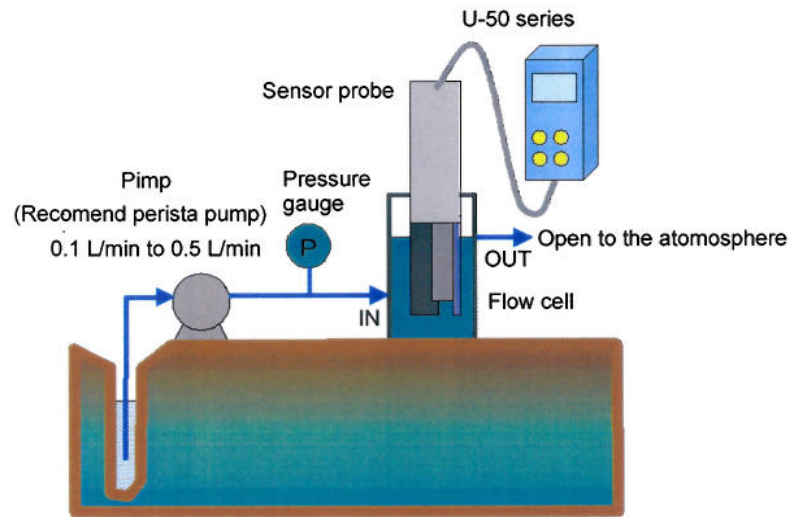


Note

Do not hold the couplings when you tighten the cap.



● **Example for installation of flow cell**



5 **Confirmation of Flow rate**

1. Flow sample through the flow cell.
2. Spill effluent into your graduated cylinder for a fixed time.
3. Convert the amount of the effluent into the flow rate.

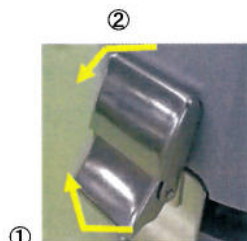
6 Disassembling the flow cell

You can disassemble the flow cell so that it can be cleaned easily. It is recommended to clean the flow cell after the measurement.

1. Remove the cap, O ring cover, and red O ring (P95) from the body.
2. Unfasten two snap fasteners.



Snap fastener



3. Remove the body and remove the window.



4. Remove black O ring (G100) and the bottom lid.



Bottom lid

black O ring (G100)

You can assemble in the reverse order.

Note

When leakage occurs, it may be the cause of O rings deterioration.
In this case, replace the red O ring (P95) and the black O ring (G100).
If leakage cannot be prevented by such countermeasure, contact your local agency.

Parts No.	Parts name	Note
3200192737	Red O ring (P95)	
3200192739	Black O ring (G100)	2 pcs./set



Standard Operating Procedure

500 North Franklin Tpke, Suite 314
Ramsey, New Jersey 07446

T: 201.574.4700

Prepared by: Brown and Caldwell

Project Title: Standard Operating Procedures (BCNNJ-SOP-GWS4-0825)

SOP Version 4.0

Subject: Groundwater Sampling

Date: August 18, 2025

Reviewed by:

A handwritten signature in black ink, appearing to read "Charles Meyn", positioned above a horizontal line.

Charles Meyn, P.G.
Principal Geologist/ Hydrogeologist

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Attachments

Attachment A Low-Flow Groundwater Field Data Sheet

Section 1: Objectives

The objective of this standard operating procedure (SOP) is to provide the methods to be used for the planning and execution of groundwater sampling events and to provide standardized reporting formats for documentation of data. A further objective is to provide a detailed technical resource that can be used both for preparing detailed field sampling plans and for training. These methods are intended to be both technically and legally defensible, while embracing a common-sense approach. Furthermore, these methods attempt to address groundwater sample collection under a wide variety of physical and regulatory conditions. This SOP has been specifically designed with the objective of sampling monitoring wells for environmental investigations.

This procedure has been developed in conformance with the “Field Sampling Procedures Manual”, (NJDEP, 2024) and applicable American Society for Testing and Materials (ASTM) standards including D4448 “Standard Guide for Sampling Ground-Water Monitoring Wells” and D6452 “Guide for Purging Methods for Wells Used for Ground-Water Quality Investigations”.

Section 2: Applicability

This procedure is intended for use by Brown and Caldwell for the sampling and associated documentation of groundwater quality data that will be used for environmental investigations. Specific sampling methods and procedures depend on project specific objectives and subsurface conditions and should be discussed in project specific planning documents.

2.1 Health and Safety

This SOP does not address the safety concerns, if any, associated with its use including potential physical and chemical hazardous. The user must refer and adhere to the site-specific Health and Safety Plan (HASP).

Section 3: Responsibilities

The project manager is responsible for ensuring that the project involving groundwater sampling is properly planned and executed and that the safety of personnel from chemical and physical hazards associated with the sampling is provided for. The field staff is responsible for conducting the sampling and to ensure that the project specifications defined in the planning documents are followed, and that pertinent data are recorded on appropriate forms and in the field notebook. The site safety officer, typically the lead field geologist or engineer, is responsible for overseeing the health and safety of Brown and Caldwell employees and for stopping work if necessary, to address unsafe conditions observed in the field.

Section 4: Required Materials

Many materials are required for successfully completing a groundwater sampling event. The field personnel should be aware of what is required to conduct the work in accordance with the project specific sampling plan and have all required materials available and in working order prior to the beginning of the sampling. The following is a general list of materials that are needed for performing the tasks outlined in this SOP.



- Health and Safety supplies (e.g., steel-toed boots, nitrile gloves, hard hat, hearing protection, etc.);
- Groundwater sampling equipment such as pumps, bailers, etc., in accordance with the project specific goals and procedures;
- Analytical sample containers;
- Water quality instrumentation (e.g., Multi-parameter Horiba U-22 or similar), as required;
- Electronic Water Level Indicator;
- Decontamination Supplies;
- Groundwater sampling data sheets (See Appendix A for example);
- Logbook;
- Site Map; and
- General tools.

Section 5: Procedure

5.1 Introduction

Groundwater samples will be collected from existing and newly installed two-inch diameter, permanent monitoring wells. The field methodology will be either the low flow purging and/or the conventional three-volume purging techniques described below.

5.1.1 Preparatory Office Activities

Analytical sample containers and field equipment will be organized in the office prior to embarking on a field sampling project. The time spent in the field is very valuable and should be spent on sample and field measurement collection and recording data and not on the organization of equipment and containers.

- **Sampling Sequence** - The sequence of sampling will be pre-determined on the basis of existing groundwater quality data. Generally, the least contaminated wells will be sampled first, proceeding to the progressively more contaminated wells, based upon the last event's water quality data.
- **Initiation of Field Data Records** – Certain sections of the field data sheets will be populated prior to the start of sampling. Examples of initial data to be recorded include site and sampling location identification, well depth and construction, and purging and sampling collection methods.

5.1.2 Preparatory Field Activities

The following procedures will be conducted in the field prior to well purging and sampling.

- **Well Maintenance Check** - A well maintenance check that includes visual observation of the condition of the protective casing and surface seal will be performed. In addition, the well will be checked for other signs of damage or unauthorized entry.
- **Preparation of Well Area** - A suitable work area will be established around the perimeter of the well. This will provide a clean surface on which sampling equipment can be placed such that it will not become inadvertently contaminated. This work area may be prepared by placing new polyethylene (PE) sheeting on the ground around the well, taking care not to step on it. Alternatives can include the placement of a clean PE lined trash can or a clean PE covered table adjacent to the well.
- **Water Level Measurements** - The depth to water will be measured prior to initiation of sampling activities following the method that is described in section 5.2.8 and the Work Plan. Water level

measurements will also be made during purging in order to monitor well drawdown, and special care will be taken to thoroughly decontaminate the probe prior to use.

5.2 Low-Flow Purging

Low-flow sampling will be conducted to minimize stress on the water-bearing zone, thereby minimizing the disturbance of any sediment that has settled at the bottom of the well. Accordingly, groundwater samples will be more representative of actual formation conditions and will provide consistency with sampling previously performed on wells installed at the site, thereby allowing the data to be used in water quality trend analyses.

The low-flow purging and sampling method to be implemented is described in detail below. It is consistent with the low-flow procedure described in NJDEP's March 2024 Field Sampling Procedures Manual with the exception of NJDEP's five-foot sampling interval requirement. Instead of collecting one low-flow sample for every five foot of well screen length, only one low-flow sample will be collected per monitoring well.

This variance is consistent with the EPA references that were cited in the Field Sampling Procedures Manual. The two EPA references cited, Region 1 Low Stress (Low Flow) SOP (EPA, 2010) and Region II Ground Water Sampling Procedure; Low Stress (Low Flow) Purging and Sampling (EPA, 1998), state that low flow procedures may be applied to well screen intervals of up to 10 feet in length. Since the majority of well screens are 10 feet in length or less, the collection of only one low-flow sample from each well would be consistent with EPA procedure for most sites.

Furthermore, this variance is consistent with peer reviewed scientific research. This research has indicated that there is significant vertical mixing within a well casing even under low flow purging conditions, making it impossible to define groundwater quality at specific depth intervals by simply adjusting the depth of a pump's intake. Research performed by Varljen, et al. (2006), for example, had demonstrated that the location of a pump's intake within the well screen does not influence the zone sampled, and that neither the intake depth nor the screen length matter, as the groundwater along the entire length of the screen would be drawn uniformly into the well and sampled, even under low-flow purging conditions. The findings of Varljen, et al. (2006) are consistent with Reilly, et al. (1989), Puls and Paul (1998), Hutchins and Acree (2000) and Martin-Hayden and Robbins (2000), who all concluded that significant vertical flow and mixing within a well casing occur under very small head changes or low purging rates.

Based on these research findings, sampling at five-foot intervals in accordance with NJDEP policy would not satisfy the NJDEP's intent of vertically profiling contaminant distribution within a well's screen, but rather would result in the generation of redundant data that would not add any technical value to the monitoring program. Therefore, only one groundwater sample per monitoring well will be sampled using the low flow purging and sampling method.

5.2.1 Pump Intake Location

The sampling pump intake will be installed at the midpoint of the well screen or at a depth that is at least two feet below the static water level if the well is screened across the water table.

5.2.2 Water Quality Indicator Parameters

The following parameters will be measured in order to determine when well stability has been achieved prior to sampling. Their respective measurements will fall within the stated range for three consecutive readings. If the anticipated "third" reading of any individual parameter does not fall within the stated range, then the

process to achieve three consecutive readings for that parameter will be restarted. If, after four hours, stability has not been achieved for the parameters listed below, the recommendations presented in Section 5.2.3 will be followed.

Water Level Drawdown	< 0.3 ft
pH	± 0.1 unit
Specific Conductance	± 3%
Temperature	± 3%
Dissolved Oxygen	± 10%
Turbidity	± 10% for values greater than 1 NTU
ORP/Eh	± 10 millivolts

Measurements should be taken once every 3 minutes. Water Quality Indicator Parameters will be collected in a manner that will ensure integrity of the data being collected.

Low-flow water quality parameters must be reported by a New Jersey certified laboratory for projects performed under NJDEP oversight. This would generally not include USEPA-led CERCLA sites.

5.2.3 Purge Volume vs. Stabilization Time

In some cases, it may take considerable time to achieve stabilization of the Water Quality Indicator Parameters. In other cases, they may never stabilize. However, as provided in agency guidance, the following options are available if stability has not been achieved after four hours of purging: 1) continue purging until stabilization occurs, no matter how long it takes; 2) discontinue purging, do not collect a sample and document the attempts to reach stabilization; or 3) discontinue purging, collect a sample and document the attempts to reach stabilization. In situations where the Water Quality Indicator Parameters do not stabilize, the sampler will document that low flow purging and sampling could not be performed and document how the samples were collected.

If a Water Quality Indicator Parameter is not accurately measured during the monitoring process or if a certain Water Quality Indicator Parameter does not stabilize, and that particular Water Quality Indicator Parameter is not significant with respect to the type of contaminant of concern, sample collection will still proceed. Any Water Quality Indicator Parameters that are affected by field conditions or instrument malfunction will be discussed in the text of the groundwater monitoring report in order to alert the end-user of potential data bias.

5.2.4 Tubing

The inside diameter (ID) of tubing will be no greater than three-eighths of an inch (3/8 in). Larger tubing diameters will reduce flow velocity resulting in a corresponding increase of pump speeds to maintain flow. Increased pump speed may, in turn, elevate the potential for turbulent flow across the screened interval and this may affect the quality of the water being sampled. Conversely, any reduction in flow velocity may allow air to become trapped in the tubing, which may ultimately affect air sensitive parameters or allow particulates to settle, which may affect turbidity values. The length of tubing, from the top of the well casing to the flow through chamber, will be the shortest length practical. Attention to this detail will help ensure that: 1) exposure to ambient temperature, direct sunlight, and bubble formation are kept to a minimum; and 2) deposited solids or air bubbles will less likely be trapped in tubing bends and re mobilized after accidental movement. Occurrence of any one or combination of these factors can cause variations in Water Quality Indicator Parameter measurements, which could increase stabilization time. Therefore, tubing will be completely full of water at all times.

The tubing's material of construction will be either polyethylene, Teflon® or Teflon® lined polyethylene (dependent on state requirements) up to the flow through cell. Tubing downstream of the flow cell may be constructed of a lower quality, more flexible material. Tubing "reuse" will not be permitted.

5.2.5 Flow-Through Cell

Flow-through cells are required to be transparent in order to "see" the physical condition of the purge water or air bubbles passing through the system. The cell will be sealed against unwanted exposure to the atmosphere, thus ensuring accurate measurement of air-sensitive parameters (e.g., dissolved oxygen, pH, etc.). The total capacity of the cell will be small (300-1,000 ml) in order to maintain a desirable turnover rate of water coming into the cell to ensure real-time data integrity. The in-line design will allow for purge water to enter the flow cell from a bottom port and exit at the top. The discharge may be fitted with a check valve.

The cell and probes will be rinsed with distilled/deionized water between each monitor well as accumulation of suspended material may impact probe performance. The probes will then be rinsed using a mild detergent or laboratory glassware cleaning solution, and then rinsed again with distilled/deionized water. Because the location of the flow cell or cells in relation to the sample port is critical, samples for turbidity measurement, general chemistry and laboratory analysis will be collected ahead of the flow cell.

The flow-through cells will be located as close as possible to the well head in order to minimize the length of tubing needed between the well head and flow-through cell. The flow-through cell will be protected from ambient conditions and the ground surface.

5.2.6 Pump Selection

Pumps used for monitoring Water Quality Indicator Parameters will be submersible, positive displacement pumps, and may include bladder, variable speed submersible centrifugal, reciprocating piston, progressive cavity, or gear pumps. Peristaltic pumps will not be used. The pump discharge will be fitted appropriately to receive either 1/4 or 3/8-inch inside diameter (ID) polyethylene, Teflon® or Teflon® lined polyethylene tubing.

Pumps constructed with impellers, helicoils, or gears, which are difficult to clean or are constructed of unacceptable plastic parts, will not be used for sampling. In addition, the power or gas supply line for the pump will be isolated from the sample tubing.

5.2.7 Calibration of Probes

See Field Instrument Calibration SOP.

5.2.8 Water Level Measurements

The depth to the top of the water column will be recorded prior to pump installation and/or prior to purging. If the total depth of the well needs to be determined (e.g., to verify the correct well designation and/or to determine if silt has accumulated in the bottom of a well), then it will be measured at least 48 hours prior to sample collection or after the sample has been collected and the pump removed. Total depth measurements must not be taken immediately before purging as this may cause the re-suspension of solids in the well and potentially prolong the purge time.

The depth to groundwater will be measured with an electronic water level indicator. The probe will be lowered into the well until the meter indicates water is reached. The probe will be raised above the water level and slowly lowered again until the water level is indicated. The cable will be held against the side of the inner well at the point designated for water level measurements and a depth reading will be taken. This procedure will be followed three times or until a consistent value is obtained. The value will be recorded to the nearest 0.01 feet on field data sheets and in the field logbook.

Once the initial water-level measurement has been recorded and the pump installed, the water level probe will be suspended in the well at the point at which drawdown is equivalent to a 0.3-foot drop. The water levels will be recorded simultaneously with water quality instrument parameter measurements once every three minutes. Water level measurement devices, which may impart some disturbance to the water column (i.e., stainless steel “popper” or coated tape) will not be used.

The probe will be raised to the surface and, together with the amount of cable that was wetted in the well, will be decontaminated.

The calibrated cable on the depth indicator will be checked against a surveyor’s steel tape once per quarter year. A new cable will be installed if the cable has changed by more than 0.01 percent (0.01 foot for a 100-foot cable).

5.2.9 Pump Installation

Once pumps have been properly decontaminated and fitted with appropriate tubing, installation of the pump can begin. Pumps will be installed in such a manner as to ensure that any disturbance in the well is kept to an absolute minimum. Once a pump reaches the top of the water column, its descent will proceed very slowly through the water column. The pump will be lowered until the pump’s intake reaches the center of the screen and will be installed at least two feet below the static water level if the well screen intercepts the water table.

The actual level where the pump intake will to be suspended will be predetermined based upon well construction logs and prior groundwater elevation data. Under no circumstance will the pump make contact with, or be “bounced” off, the bottom of the well.

5.2.10Purge Rates

The purge rate will range between 100 to 300 ml/min. The water will be initially purged prior to connecting the tubing to the flow-through cell in order to prevent any fouling of the cell. Tubing will then be connected to the cell with the pump running. After making the connection, the cell will be inspected to verify that purge water has filled the cell and that all air is purged from system. The pump speed will remain constant such that flow rates never exceed 500 ml/min and, once stabilized, the flow rate will not be varied. If drawdown exceeds 0.3 ft., then the pump speed will be reduced until the drawdown has stabilized; however, the pump speed will not be reduced to lower than 100 ml/min. If drawdown does not come under control at 100 ml/min, then a field decision will be rendered as to how far to allow drawdown to continue until sample collection. At no time will evacuation allow any portion of the well screen to be exposed (for wells screened below the water table) or bring the well to dryness. Water quality indicator parameters will be measured once the water level has stabilized.

Purge rates will be monitored by measuring the flow from the discharge side of the flow cell with a graduated cylinder. All of the required water quality indicator parameters will be recorded on appropriate field data sheets once every three minutes. Once stability has been attained and recorded, sampling will begin.

5.3 Volume Average Purging

The volume-averaged (conventional) purging and sampling method may be used when sampling parameters are not substantially impacted by suspended solids. Parameters that may be impacted by elevated levels of solids include those that may sorb to the particles including metals, PCBs, pesticides, and SVOCs. Parameters not generally impacted by levels of suspended solids include those that are particularly soluble including VOCs and most conventional, wet-chemistry parameters.

5.3.1 Estimate of Well Volume

The volume of water standing in the well will be estimated through the application of the depth to water data, the known well depth, and the well diameter using the constants presented below. Well depth data that are obtained from the well completion records are generally sufficiently precise for the purpose of well volume calculations that would be used for subsequent purging determinations.

Well Diameter (inches)	Gallons Per Foot of Water
1.00	0.041
1.25	0.064
2.00	0.16
3.00	0.36
4.00	0.65

5.3.2 Well Purging

Monitoring wells must be purged prior to the collection of aqueous phase samples. Well purging ideally results in the collection of a sample that has not been standing in the well or has not been in contact with the well casing, screen, or sand pack materials for a significant period of time. Proper purging is desired in order to accomplish the collection of a representative groundwater sample. Monitoring well purging will be continued until three to five well volumes have been removed from each well.

5.3.3 Pump and Tubing Selection

Well purging will be accomplished by the use of a non-dedicated, small diameter, electric submersible pump (Whale pump or equivalent) or a peristaltic pump, dependent upon the specific well. Each pump will be equipped with dedicated polyethylene tubing.

5.4 Sample Collection

After the well purging is complete the groundwater samples are collected as follows.

5.4.1 Low-Flow Sampling

Once the water quality indicator parameters have stabilized or once a four-hour (4 hr) time decision has been rendered (see Sections 5.2.2 and 5.3.3), sampling can proceed. The same pumping rate used during well purging will be maintained during sample collection. The sample will be collected directly from the flow control valve at the sample port. A final set of water quality indicator parameter measurements will be recorded immediately after sample collection.

5.4.2 Volume Average Sampling

Sample collection will occur as soon after purging as is practical, immediately, if possible. The wells will be sampled with the use of a dedicated, disposable polyethylene or Teflon® bailer with a check valve at the bottom. The bailer shall be gradually lowered until it contacts the water surface and is then allowed to fill as it slowly sinks in a controlled manner. Samples collected with bailers must be recovered with a minimal amount of aeration. Sample containers should be filled by allowing the bailer discharge to flow gently down the inside of the container with minimal turbulence.

5.4.3 Order of Sample Collection

Sample containers for various parameter groups are to be filled in a particular order. The order is determined on the basis of parameter sensitivity to volatilization and pH change and the priority for

analytical data in cases where the water volume in the well is less than what is required for complete analysis. The order of sample collection is listed as follows:

1. Volatile organic compounds (VOCs)
2. Total organic carbon (TOC)
3. Cyanide
4. Sulfate and chloride
5. Turbidity
6. Nitrate and ammonia
7. Preserved inorganics
8. Other non-preserved inorganics

The volume average method should not be used for metals or extractable organic compounds.

The field quality assurance/quality control for the groundwater sampling will follow the procedure set forth below in Section 6. Non-dedicated sampling equipment will be decontaminated.

5.5 Temporary Well Point Purging and Sampling

Groundwater samples from temporary, small-diameter monitoring wells will be collected by the volume-averaged purging and sample collection method according to Section 6.9.2.4 of the Field Sampling Procedures Manual, (NJDEP, 2024). Preparatory office and field activities will be performed prior to sampling as discussed in Sections 5.1.1 and 5.1.2.

5.5.1 Purging

Temporary wells will be purged using an inertial pump, peristaltic pump or bailer. Every reasonable effort will be made to keep purge rates sufficiently low to avoid purging the well to dryness. To accomplish this, purge rates will be adjusted and purging times extended as necessary in order to remove the desired volume of water. Samples will be collected within two hours of purging. If a well has been purged to near dryness, it will be allowed to recover completely before the sample is collected. If necessary, sampling within the two-hour limit may be exceeded to allow the well to recover sufficiently for sampling. In no case should the time of sampling exceed 24 hours after purging.

- **Install Pump:** Slowly lower the pump and/or tubing into the well to a depth corresponding to the top of the well screen or the top of the water column. Pumps should be lowered in such a manner that disturbance of the sediments will be kept at a minimum. Lowering the pump to within two feet above the bottom of the well should be avoided in order to prevent mobilization of sediment from the bottom. If less than two feet of water is present in the well prior to sampling, then the intake shall be centered in the water column. Record the depth to which the pump is lowered.
- **Purging:** Start pumping the well at approximately 0.5 gallons per minute. The water level should be monitored as frequently as feasible immediately after the start of purging. Ideally, a steady flow rate should be maintained which results in a stabilized water level. The goal should be to not induce a drawdown in excess of approximately 0.3 feet (or approximately 2 percent of saturated thickness in low permeability formations). Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to effectively stabilize the water level. However, care should be taken to maintain pump suction and to avoid entrainment of air in the tubing. The water level in the well should not drop below the top of the pump; therefore, pumping should cease before this occurs. If the recharge rate of the well is very low, care should be taken to avoid loss of pressure in the tubing line, cascading through the sand pack, or pumping the well dry. Record each adjustment made to the pumping rate, observation of

changes in appearance of the water collected (e.g., increased turbidity or change in color) and the water level measured immediately after each adjustment.

- **Field Parameters:** The following field parameters will be measured prior to, during and upon completion of well purging: temperature, dissolved oxygen, specific conductivity, turbidity, pH and ORP.

5.5.2 Sampling

Groundwater samples should be collected using a clean dedicated Teflon® bailer. After collection of the samples, the tubing shall be removed from the well and properly discarded. The depth of the temporary well should be measured and recorded and then the casing/screen should be removed. The temporary well point and borehole should be properly decommissioned within 48 hours of installation pursuant to N.J.A.C. 7:9D-2.1(a)5.

5.5.3 Purge Water Disposal

Purge water from wells that have been shown to be uncontaminated will be disposed of on the ground surface. Collection, containerization, and treatment of purge water will be required only if discharge of purge water to the ground would cause further contamination of previously uncontaminated soils or groundwater.

Section 6: Quality Assurance/Quality Control

Groundwater sampling details will be documented in the field. Field documentation will consist of a sampling chronology and notes in the site field book, groundwater sampling field data sheets (Attachment A) and laboratory chains-of-custody. Deviations from project-specific planning documents will be documented and explained in daily field notes. The project manager will be contacted to discuss project deviations. Field quality control can be maintained through 1) making sure employees are properly trained to conduct the work being implemented; and 2) performing routine field audits to evaluate how well employees are following procedures.

Section 7: Documentation and Recordkeeping

Field notes, Chains-of-Custody and Field Data Sheets will be submitted to the Project Manager or designate immediately following the field event for checking and revision purposes. The Project Manager or designate shall review and transmit the completed forms for incorporation into the project file.

References

- ASTM D4448-01(2019) "Standard Guide for Sampling Ground-Water Monitoring Wells"
- ASTM D6452-18(2023) "Standard Guide for Purging Methods for Wells Used for Ground-Water Quality Investigations"
- Hutchins, S. R., and S.D. Acree (2000) Ground water sampling bias observed in shallow, conventional wells. Ground Water Monitoring and Remediation, Vol. 20, No. 1, pp 86-93.
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- NJDEP (March 2024) Field Sampling Procedures Manual
- Puls, R.W., and C.J. Paul (1998) Discrete-level ground-water monitoring system for containment and remedial performance assessment objectives. Journal of Environmental Engineering. Vol. 124, No. 6; pp. 549-553.

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- USEPA (2010) Low Stress (low flow) purging and sampling procedure for the collection of ground water samples from monitoring wells. USEPA Region I. SOP No. GW 001; Revision 3.
- USEPA (1998) Ground water sampling procedure: Low stress (low flow) purging and sampling. USEPA Region II.
- Varlijen, M.D., M.J. Barcelona, J. Obereiner, and D. Kaminski (2006) Numerical simulations to assess the monitoring zone achieved during low-flow purging and sampling. *Ground Water Monitoring and Remediation*. Vol. 26, No.1; pp. 44-52.

Attachment 1: Low-Flow Groundwater Field Data Sheet



GROUNDWATER SAMPLING FIELD DATA SHEET

WELL ID: _____

1. PROJECT INFORMATION

Project Number: _____ Task Number: _____ Area of Concern: _____
Client: _____ Personnel: _____
Project Location: _____ Weather: _____

2. WELL DATA

Date Measured: _____ Time: _____ Temporary Well: ☐ Yes ☐ No

Casing Diameter: _____ inches Type: ☐ PVC ☐ Stainless ☐ Galv. Steel ☐ Teflon® ☐ Other: _____
Screen Diameter: _____ inches Type: ☐ PVC ☐ Stainless ☐ Galv. Steel ☐ Teflon® ☐ Other: _____
Total Depth of Well: _____ feet From: ☐ Top of Well Casing (TOC) ☐ Top of Protective Casing ☐ Other: _____
Depth to Static Water: _____ feet From: ☐ Top of Well Casing (TOC) ☐ Top of Protective Casing ☐ Other: _____
Depth to Product: _____ feet From: ☐ Top of Well Casing (TOC) ☐ Top of Protective Casing ☐ Other: _____
Length of Water Column: _____ feet Well Volume: _____ gal Screened Interval (from GS): _____

Note: 1-in well = 0.041 gal/ft 2-in well = 0.167 gal/ft 4-in well = 0.667 gal/ft 6-in well = 1.469 gal/ft

3. PURGE DATA

Date Purged: _____ Time: _____ Equipment Model(s) _____

Purge Method: ☐ Bailer, Size: _____ ☐ Bladder Pump ☐ 2" Sub. Pump ☐ 4" Sub. Pump
☐ Centrifugal Pump ☐ Peristaltic Pump ☐ Inertial Lift Pump ☐ Other: _____ 1. _____
Materials: Pump/Bailer ☐ Polyethylene ☐ Stainless ☐ PVC ☐ Teflon® ☐ Other: _____ 2. _____
☐ Dedicated ☐ Prepared Off-Site ☐ Field-Cleaned ☐ Disposable
Materials: Rope/Tubing ☐ Polyethylene ☐ Polypropylene ☐ Teflon® ☐ Nylon ☐ Other: _____ 3. _____
☐ Dedicated ☐ Prepared Off-Site ☐ Field-Cleaned ☐ Disposable 4. _____
Volume to Purge (minimum): _____ well volumes or _____ gallons
Was well purged dry? ☐ Yes ☐ No Pumping Rate: _____ gal/min Calibrated? ☐ Yes ☐ No

Time	Cum. Gallons Removed (gal)	pH ±0.1 su	Temp ±2°C	Spec. Cond. > of ±3% or ±10 µS/cm	ORP > of ±10% or ±20 mV	DO > of ±10% or ±0.2 mg/L	Turbidity ≤ 10 NTU	Water Level	Comments

Purge data continued on next sheet? ☐

4. SAMPLING DATA

Method(s): ☐ Bailer, Size: _____ ☐ Bladder Pump ☐ 2" Sub. Pump ☐ 4" Sub. Pump
☐ Centrifugal Pump ☐ Peristaltic Pump ☐ Inertial Lift Pump ☐ Other: _____
Materials: Pump/Bailer ☐ Polyethylene ☐ Stainless ☐ PVC ☐ Teflon® ☐ Other: _____
☐ Dedicated ☐ Prepared Off-Site ☐ Field-Cleaned ☐ Disposable
Materials: Tubing/Rope ☐ Polyethylene ☐ Polypropylene ☐ Teflon® ☐ Nylon ☐ Other: _____
☐ Dedicated ☐ Prepared Off-Site ☐ Field-Cleaned ☐ Disposable
Depth to Water at Time of Sampling: _____ Field Filtered? ☐ Yes ☐ No
Sample ID: _____ Sample Date: _____ Sample Time: _____ # of Containers: _____
Duplicate Sample Collected? ☐ Yes ☐ No ID: _____ # of Containers: _____
Equipment Blank Collected? ☐ Yes ☐ No ID: _____ # of Containers: _____

Geochemical Analyses

Ferrous Iron: _____ mg/L
DO: _____ mg/L
Nitrate: _____ mg/L
Sulfate: _____ mg/L
Alkalinity: _____ mg/L

5. COMMENTS

Note: Include comments such as well condition, odor, presence of NAPL, or other items not on the field data sheet.



GROUNDWATER SAMPLING FIELD DATA SHEET

WELL ID: _____

3. PURGE DATA (continued from page ____)

[illegible]

Purge data continued on next sheet? ☐



Standard Operating Procedure

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Prepared by: Brown and Caldwell

Project Title: Standard Operating Procedures (BCNNJ-SOP-IDW4-0825)

SOP Version 4.1

Subject: Investigation-Derived Waste Handling

Date: July 10, 2026

Reviewed by:

A handwritten signature in black ink, appearing to read "Charles Meyn", positioned above a horizontal line.

Charles Meyn, P.G.
Principal Geologist/Hydrogeologist

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Section 1: Scope and Objectives

The objective of this standard operating procedure (SOP) is to establish consistent methods to handle and manage all Investigation-Derived Waste (IDW), including:

- **Non-Aqueous Waste** - Both hazardous and non-hazardous, e.g., soil cuttings, contaminated debris or equipment.
- **Water** - Water containing both hazardous and non-hazardous contaminant concentrations, e.g., well development water, purge water, rinse water from decontamination.
- **Liquid Waste** - Both hazardous and non-hazardous non-aqueous phase liquids (NAPL), e.g., NAPL removal from wells.
- **Personal Protective Equipment (PPE)** - e.g., gloves, spent respirator cartridges, chemical-resistant coveralls.

This SOP has been developed in conformance with the “Field Sampling Procedures Manual”, (NJDEP, 2024) and applicable American Society of Testing and Materials standards:

Section 2: Applicability

Investigation sampling activities may generate solid, liquid, and PPE waste. These IDW Handling Procedures SOP will be implemented primarily on-site.

This SOP does not describe the Brown and Caldwell legal requirements related to waste handling, subcontracting and the signing of manifests. Under no circumstances will a Brown and Caldwell employee act as an agent and/or sign manifests without explicit contractual authority that has been reviewed and approved by Brown and Caldwell corporate Legal Department. For additional information, The Brown and Caldwell Project Manager must contact the Legal Department.

Section 3: Responsibilities

The Project Manager, or designee, will have the responsibility to oversee and ensure that the IDWs are properly handled and managed in accordance with this SOP and any site-specific or project-specific planning documents. Field personnel will be accountable for the comprehension and implementation of this SOP during all field activities, as well as obtaining the appropriate field logbooks, forms, labels, records and equipment needed to complete the field activities. All BC personal who may act as an agent and/or sign manifests for a client must receive training in required hazardous materials shipping paperwork, labeling and placarding in accordance with 49 CFR parts 171-180.

Section 4: Definitions

Designated Waste: A solid or liquid waste which is not defined as hazardous, but which still may present a threat to groundwater, and which requires handling differently than a non-hazardous inert waste.

D.O.T (U.S. Department of Transportation): Typically referred to when specifying a type of container that is approved for transporting hazardous substances, either materials or waste, on public roads.



Hazardous Waste: Soil, liquid, or other wastes generated from site investigations that exhibit toxic (human or ecological effects), ignitable, corrosive, or reactive characteristics as defined by applicable state or federal regulation or which is otherwise classified as hazardous. Such waste requires special handling and documentation of disposal.

IDW (Investigation-Derived Waste): Typically, solid (e.g., soil) or liquid (e.g., groundwater, decontamination fluids) wastes resulting from implementation of field activities.

Non-Hazardous Waste: A waste that does not exhibit characteristics of a hazardous waste and which is not otherwise classified as hazardous. Non-hazardous waste can also be designated as inert waste.

PPE (Personal Protective Equipment): Worn by workers when potential for exposure to hazardous materials exists.

HASP (Health and Safety Plan): Plan written to coordinate and outline precautions that will be taken to initiate and monitor worker safety.

Section 5: Required Materials

The equipment and supplies required for implementation of this SOP include the following:

- **Containers for Waste** - e.g., 55-gallon open and closed top drums and material to cover waste to protect from weather (e.g., plastic covering). Alternatively, large volumes of waste may be contained in roll-off containers, as appropriate.
- **Equipment** - i.e., pumps, generators, oil/water interface level indicators, safety monitoring equipment
- **Hazardous/Non-Hazardous Drum Labels** – Waterproof.
- **Permanent Marking Pens**
- **Inventory Forms for Project File**
- **Miscellaneous Materials** - Plastic garbage bags, zip lock storage bags, roll of plastic sheeting.
- **PPE** - Steel-toed boots, chemical resistant gloves, coveralls, safety glasses, and any other PPE required in the site-specific HASP.

Section 6: Methods

The following methods are used to handle the IDW.

6.1 Labeling

Containers used to store IDW must be properly labeled. Two general conditions apply: 1) from previous studies or on-site data, waste characteristics are known to be either hazardous or non-hazardous; or 2) waste characteristics are unknown until additional data are obtained.

For situations where the waste characteristics are known, the waste containers should be packaged and labeled in accordance with state regulations and any federal regulations that may govern the labeling of waste (e.g., CFR, Title 40, Part 261).

The following information shall be placed on all non-hazardous waste labels:

- Description of waste (i.e., purge water, soil cuttings, floating product);
- Contact information (i.e., contact name and telephone number);
- Date when the waste was first accumulated.

The following information shall be placed on all hazardous waste labels:

- Description of waste (e.g., purge water, soil cuttings);
- Generator information (i.e., name, address, contact telephone number);
- EPA identification number (supplied by on-site client representative); and
- Date when the waste was first accumulated.

When the final characterization of a waste is unknown, a notification label should be placed on the drum with the terms “hazardous waste characterization pending analysis” and the following information included on the label:

- Description of waste (e.g., purge water, soil cuttings);
- Contact information (i.e., contact name and telephone number); and
- Date when the waste was first accumulated.

Once the waste has been characterized, the label should be changed as appropriate for a non-hazardous or hazardous waste. Waste labels should be constructed of a weatherproof material and filled out with a permanent marker to prevent being washed off or becoming faded by sunlight. In addition, when waste may be staged on site for a significant period of time, the label information should be duplicated on the side of the drum with a paint pen. It is recommended that waste labels be placed on the side of the container, since the top is more subject to weathering. However, when multiple containers are accumulated together, it also may be helpful to include labels on the top of the containers to facilitate organization and disposal.

Each container of waste generated shall be recorded in the field notebook used by the person responsible for labeling the waste. After the waste is transported off-site (see Sections 6.4 – 6.5 below), an appropriate record shall be made in the same field notebook to document proper disposition of IDW.

6.2 Types of Site Investigation Waste

Several types of wastes are generated during site investigations that may require special handling. These include solid, liquid, and used PPE, as discussed further below.

6.2.1 Non-Aqueous Waste

Soil cuttings and drilling mud generated during investigation activities shall be kept on-site in containers. Covers should be included on the containers and must be secured at all times and only open during filling activities. The containers shall be labeled in accordance with this SOP. An inventory containing the source, volume, and description of material put in the containers shall be logged on prescribed forms and kept in the project file.

6.2.2 Water

Groundwater generated during monitoring well development, purging, and sampling can be collected in truck-mounted containers and/or other transportable containers (i.e., 55-gallon drums). Lids or bungs on drums must be secured at all times and only open during filling or pumping activities. The containers shall be labeled in accordance with this SOP. Waste that is generated during equipment decontamination shall be collected in a separate container. All waste containers shall be properly accounted for through an inventory process.

6.2.3 Personal Protective Equipment (PPE)

PPE that is generated throughout investigation activities shall be placed in plastic garbage bags and stored in secure containers. The containers shall be properly sealed and labeled according to this SOP. If the solid or liquid waste is characterized as hazardous waste, then the associated PPE should also be disposed as hazardous waste. If not, all PPE should be disposed as non-hazardous waste at an appropriate facility. Trash that is generated as part of field activities may be disposed of in regular collection facilities as long as the trash was not exposed to hazardous media.

6.3 Waste Characterization

Prior to transport of waste off site by a certified hazardous waste hauler, the hazardous nature of the material will be properly characterized. Brown and Caldwell employees must coordinate with the waste disposal contractor to develop a characterization plan that fulfills the requirements of the waste hauler and final disposal facility. In some cases, previous waste characterization or other sampling data may be used to develop the characterization but often the waste must be sampled to establish the characterization. Waste characterization sampling should be conducted in accordance with the regulations of any involved state and federal agencies.

6.4 Waste Accumulation On Site

Solid, liquid, or PPE waste generated during investigation activities that are classified as non-hazardous or “characterization pending analysis” should be disposed of as soon as possible. Until disposal, such containers should be inventoried, stored as securely as possible, and inspected regularly, as a general good housekeeping practice.

Solid, liquid, or PPE waste generated during investigation activities that are classified as hazardous shall not be accumulated on-site longer than 90 days. All hazardous waste containers shall be stored in a secured storage area. The following requirements for longer-term hazardous waste storage areas must be implemented:

- Proper hazardous waste signs shall be posted as required by state regulations;
- Secondary containment to contain spills;
- Spill containment equipment must be available;
- Fire extinguisher; and
- Adequate aisle space for unobstructed movement of personnel.

Throughout the project, an inventory shall be maintained to itemize the type and quantity of the waste generated.

6.5 Waste Disposal

Solid, liquid, and PPE waste will be characterized for disposal through the use of generator knowledge, laboratory analytical data created from soil or groundwater samples gathered during the field activities, and/or composite samples from individual containers.

All waste generated during field activities will be stored, transported, and disposed of according to applicable state, federal, and local regulations. All wastes classified as hazardous will be disposed of at a licensed treatment storage and disposal facility or managed in other approved manners.

In general, waste disposal should be carefully coordinated with the facility receiving the waste. Facilities receiving waste have specific requirements that vary even for non-hazardous waste, and thus characterization should be conducted to support both applicable regulations and facility requirements.



6.6 Waste Transport

A state certified hazardous waste hauler shall transport all wastes classified as hazardous. Typically, the facility receiving any waste can coordinate a hauler to transport the waste. Shipped hazardous waste shall be disposed of in accordance with all RCRA/USEPA requirements. All waste manifests or bills of lading will be signed either by the client or the client's designee, which can in special circumstances be the project manager if acting as an authorized agent for the client. Under no circumstances will a Brown and Caldwell employee acts as an agent and/or sign manifests without explicit contractual authority that has been reviewed and approved by Brown and Caldwell corporate Legal Department.

References

U.S. EPA Guide to Management of Investigative-Derived Waste, Publication: 9345.3-03FS, April 1992.

Code of Federal Regulations, Title 40, Section 262.32, Standards Applicable to Generators of Hazardous Wastes, Subpart C – Pre-transport Requirements, Marking, periodically updated – use most current version.



Standard Operating Procedure

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Prepared by: Brown and Caldwell

Project Title: Standard Operating Procedures (BCNNJ-SOP-SH4-0825)

SOP Version 4.0

Subject: Sample Handling

Date: August 18, 2025

Reviewed by:

A handwritten signature in black ink, appearing to read "Charles Meyn", positioned above a horizontal line.

Charles Meyn, P.G.
Principal Geologist/Hydrogeologist

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Section 1: Scope and Objectives

The objective of this standard operating procedure (SOP) is to establish consistent methods to maintain sample custody and integrity, including:

- Sample Identification Procedures;
- Sample Custody, Packaging and Shipping Procedures; and
- Sample Documentation Procedures.

Section 2: Applicability

Identification, documentation, and strict custody of samples are essential steps to maintain the integrity of the environmental samples. The subsections below address sample identification, packaging, shipping, and documentation.

Section 3: Responsibilities

Project Manager, or designee, will have the responsibility for the appropriate sample handling and management in accordance with this SOP and other site-specific or project-specific planning documents. Field personnel will be accountable for the comprehension and implementation of this SOP during field activities, as well as obtaining the appropriate field logbooks, forms, labels, records and equipment needed to complete the field activities.

Section 4: Definitions

COC (Chain of Custody): The chronological documentation or paper trail, showing the custody, control, transfer, analysis, and disposition of samples.

D.O.T (U.S. Department of Transportation): Typically referred to when specifying a type of container that is approved for transporting hazardous substances, either materials or waste, on public roads.

IATA (International Air Transport Association): A trade association representing the airline industry world-wide.

PPE (Personal Protective Equipment): Worn by workers when potential for exposure to hazardous materials exists.

HASP (Health and Safety Plan): Plan prepared to coordinate and outline precautions that will be taken to initiate and monitor worker safety.

Section 5: Required Materials

The equipment and supplies required for implementation of this SOP include the following:

- **Sample Containers** – must be appropriate for the type of material being sampled (e.g. soil, groundwater) and the analyses being conducted.

- **Sample Labels** – attached to each sample container to provide sample identification and other sample information, e.g., date, time, analytical group. Must be sufficiently durable for the particular application.
- **Coolers** – foam insulated, hard plastic.
- **Permanent Marking Pens**
- **Chain of Custody Forms** – typically initiated from the analytical laboratory before the empty containers are shipped.
- **Miscellaneous Materials** - Plastic zipper food storage bags, ice and/or frozen ice-packs, other packing material, as appropriate
- **PPE** - chemical resistant gloves, safety glasses, and other PPE required in the site-specific HASP.

Section 6: Methods

The following methods are used to handle environmental samples.

6.1 Sample Identification

The method of identification of a sample depends on the type of measurement or analysis performed. When field screening measurements (e.g., pH, dissolved oxygen, or turbidity) are made, data are recorded directly in logbooks or on field investigation forms. Identifying information such as project name, station number, station location, date and time, name of sampler, field observations, remarks, or other pertinent information will be recorded.

Samples collected for laboratory analysis during the field investigation will be specifically designated for unique identification. Each sample will be designated by an alpha-numeric code which will identify the sampling location, type or depth (as necessary).

Aqueous and non-aqueous, e.g., soils, NAPL, samples collected as a part of the work will be assigned unique sample identifiers. The sample identifiers are required in order to identify and track each of the samples collected for analysis. Associated field QA/QC samples such as blind duplicates and field blanks will be further identified adding the date of collection to the sample name as shown below, and a number will be added sequentially to distinguish the samples, as needed.

Each of the samples will be identified by a unique alpha numeric code that indicates the particular sample type, location, and date. The format of the code is as follows:

Medium/Sample Type Code-Location Number

The three codes that make up the sample identifier are described as follows:

1. The medium/sample type codes listed below:
 - MW - Groundwater sample taken from a monitoring well;
 - SW – Surface Water sample
 - SED – Sediment sample;
 - DW – Drummed waste sample;
 - W – Waste sample;
 - SB – Soil Boring sample;
 - S – Soil sample;
 - SV – Soil Vapor sample;
 - FT – Fish Tissue sample;



- GT – Geotechnical sample;
 - INF – Influent sample;
 - EFF – Effluent sample;
 - FB – Field Blank sample;
 - DUP – Duplicate sample; or
 - MS/MSD – Matrix Spike/Matrix Spike Duplicate sample.
2. The location code will be keyed to the specific sample designation. For example, all samples taken from a monitoring well with a designation of MW-5 will have MW-5 in the sample name.
 3. If the sample will be collected from a location over time, such as from a monitoring well, staff gauge or treatment plant, then the date the sample was taken should also be included, in the following format: YYYYMMDD.

All samples must have these three codes in the sample name. If additional information is required, such as a site name, area of concern, or depth of sample, these designations can be incorporated into the sample name. The following is an example of a sample identifier that will be used for samples collected for geotechnical laboratory analysis:

An example soil sample name is as follows: “AOC1-SB-48B-10-12”, indicating that the soil sample was collected from Area of Concern 1 from the soil boring (SB) at location SB-48 from a depth of 10 to 12 feet below ground surface.

An example groundwater sample name is as follows: “MW-01-20130108”, indicating that the groundwater sample was collected from MW-01 on January 8, 2013.

6.2 Sample Custody, Packaging, and Shipping

Sample custody must be strictly maintained and carefully documented each time the sample material is collected, transported, received, prepared, and analyzed. Custody procedures are a necessary sample integrity procedure so that the samples collected during the field investigation are traceable from the time the samples are collected until they are disposed of and/or stored, and their derived data are used in the final report. Sample custody is defined as (1) being in the sampler’s possession; (2) being in the sampler’s view, after being in the sampler’s possession; (3) being locked in a secured container, after being in the sampler’s possession; and (4) being placed in a designated secure area. Sections 6.2.1, 6.2.2, and 6.2.3 document the on-site packaging and shipment procedures for sample custody in the field. The analytical and geotechnical laboratories will maintain custody after arrival of the samples through internal logging procedures, as indicated in Section 6.2.4.

6.2.1 Field Custody

Field custody procedures will be implemented for each sample collected. The field sampling team will be responsible for the care and custody of the samples until they are properly transferred or dispatched. To assure the integrity of the samples, the samples are to be maintained in a designated, secure area and/or custody sealed in the appropriate containers prior to shipment.

Each environmental sample will be properly identified and individually labeled. Labels will be filled out in indelible ink with at least the following information: field sample identification, date and time of sample collection, initials of sampler(s), analysis/test required, and preservation (as appropriate). The sample label will be securely attached to the sample container. For tasks requiring collection of undisturbed soil samples (i.e., Shelby Tube), an “up” arrow will be included on the sample container such that the container can be maintained in an upright position during storage and shipment.



Environmental samples being analyzed by the analytical laboratory will be properly packaged and shipped for analysis. Following labeling, the sample bottles will be enclosed in clear sealable plastic bags (e.g., Ziploc® bags), through which the identifying label is visible.

The sample containers, now sealed in bags, will then be placed in a hard plastic cooler and voids filled with either ice or packaging material (e.g., bubble wrap). Samples will be packed with sufficient ice (enclosed in double-bagged sealable plastic bags) to cool the samples to 0 to 6° Celsius per the EPA Method Update Rule (USEPA, 2024). Additionally, each iced cooler will be packed with a cooler temperature blank. Lastly, the cooler will be filled with adequate cushioning material to minimize the possibility of container breakage during transportation.

Samples destined for a geotechnical laboratory will be secured in a cooler or box and transported to the laboratory.

A COC form will be included with sample transfers/shipments to the analytical or geotechnical laboratory. The analytical laboratory will provide the COC forms to be completed for the analytical samples.

6.2.2 Sample Containers and Preservatives

Different combinations of containers and preservation techniques are required for the various samples, due in part to specified maximum allowable sample holding times for certain analyses. Information regarding containers and preservation requirements, including the need to cool samples, is generally provided in the project Quality Assurance Project Plan (QAPP) or can be requested from the laboratory to which the samples will be submitted.

Sample labels are required on sample containers for the primary purpose of sample identification. Specific field data need not be recorded on the labels as they will be recorded on field data sheets and/or in the field logbook. The sample labels will contain the following information:

- Sample identification (see Section 6.1);
- Depth of sample (if appropriate);
- Analysis/test to be performed;
- Preservative (if required);
- Project name and number;
- Date and time of sample collection; and
- Initials of sampler(s).

6.2.3 Sample Shipping Procedures

Shipment of samples to an analytical laboratory is typically required upon completion of sample collection, unless the laboratory can provide a courier. Packaging may be necessary in order to protect the sample containers, to maintain the samples at the proper temperature and to comply with applicable transportation regulations.

In general, samples are shipped using packaging that is supplied by the analytical laboratory. The packaging normally includes a shippable insulated box such as an ice cooler and contains protective internal packaging materials such as foam sleeves. Some laboratories use proprietary sample packaging with integral internal packaging. In either case, ice will be used to maintain the temperature of the samples.

Regulations will be observed regarding the shipment of dangerous goods. Sample containers and certain field equipment may be defined as dangerous goods such that special requirements will be followed for their shipment. Air shipment of dangerous goods is regulated by the International Air Transport Association (IATA) as described in “Dangerous Goods Regulations” (IATA, 2025). IATA Regulations are updated annually.

Shipment by ground is regulated by the U.S. Department of Transportation (DOT; 49 CFR). Furthermore, individual shippers (e.g., Federal Express) or other countries (international shipments) may have additional requirements for dangerous goods shipment.

Environmental samples, (e.g., groundwater, soil, etc.) containing relatively low concentrations of contaminants, (regulated under 40 CFR) are currently exempt from Hazardous Goods regulations. 40 CFR 261.40(d) states, “A sample of solid waste or a sample of water, soil, or air which is collected for the sole purpose of testing to determine its characteristics or composition is not subject to this Part or Parts 262 through 267 or Part 124 of this chapter or to the notification requirements of Section 3010 of RCRA.” Sample containers will be packed to avoid inadvertent breakage and/or spillage during shipment.

Environmental samples that are known to be or suspected to be toxic, corrosive, flammable, or those which emit a noxious or anesthetic annoyance or discomfort to passengers and/or flight crews when shipped by air, will be packed, labeled and shipped in accordance with current IATA regulations. Refer to “Dangerous Good Regulations” (IATA, 2025), Section 3 - Classification.

Specific regulations exist (Shipment in Excepted Quantities) for the shipment of many reagents that are commonly used as preservatives and decontamination agents. Consequently, the shipment to the Site of “empty” sample containers containing small quantities of preservatives will be conducted in accordance with the regulations. The most significant limitations for the shipment of preservatives (IATA, 2025) involve those for nitric acid in which only small quantities (<0.5L) of low concentration (<20 percent) can be shipped in a given sample shipment.

If the analytical laboratory provides sample courier service directly from the Site or the samples are being delivered directly to the laboratory by Brown and Caldwell, the COC form will not be placed inside the cooler. The COC form must be signed by the receiver (e.g., the laboratory courier, or the laboratory sample custodian) when he/she accepts possession of the samples.

6.2.4 Laboratory Custody Procedures

Laboratory custody procedures are generally described in the specific laboratory’s SOPs.

6.3 Sample Documentation

The documentation generated for and associated with the field activities will be summarized (in tabulated form if possible) and placed in the project files.

6.3.1 Field Logbooks

The sampling team or individual performing a particular field investigation activity (e.g., soil or groundwater sampling) will be required to maintain a bound, weatherproof field logbook. Each logbook will be controlled and assigned a unique sequential identification by the sampling personnel. At a minimum, daily entries into the field logbooks will include the date, personnel at the Site, the proposed activities, weather, start/stop times of activities (including arrival and departure times), visitor’s names, community contacts, and other site-specific information determined by the sampling personnel to be noteworthy. Logbook entries should be made in permanent ink. Pertinent sampling information to be recorded in field logbooks includes information that is necessary to reconstruct the investigative/sampling operations. Documentation of sample activities in the field logbook will be completed immediately after sampling at the location of sample collection. As noted in Section 6.3.2, pre-printed forms may be used in conjunction with the logbook. Logbook entries will contain sample information, including sample number, collection time, location, descriptions, field measurements, and other site- or sample-specific observations. Difficulties with sample recovery and other field observations (e.g., staining, visible contamination, etc.) must be noted if encountered. Field difficulties/problems, and deviations from the Work Plan, QAPP and/or other Site plans (with justification) must also be included in the field logbook.



If photographs are taken as part of the documentation procedure, the name of the photographer, date, time, and a description of the photo (including direction and scale, if applicable) will be entered sequentially in the field logbook as the photographs are taken. Once downloaded, the photographs will be numbered in correspondence to the logbook numbers, and the above information will be placed in a photographic log filed with the photographs.

The field logbooks will have the name of the Site and project written on the cover and inside the cover. The date, page number and initials of the primary field note transcriber will be written atop each page during the day the entries are made. Corrections to the logbooks will consist of a single strike line through the incorrect entry, the new accurate information, the initials of the corrector, and the date of amendment. Blank spaces/pages in the logbooks will be crossed out with a single strike mark and signed by the person making the notation.

6.3.2 Field Investigation Forms

In addition to field logbooks, field team members may use appropriate forms applicable to the field activities being performed. For example, during purging and sampling of monitoring wells, a monitoring well data sheet may be completed for each well. The field sampling forms will include the following information:

- Sampling location;
- Date and time;
- Sample collection method;
- Sample description;
- Field meter calibration data; and
- General comments (weather conditions, etc.).

A field form for groundwater sampling will include the following additional information:

- Condition of the well;
- Static water level (depth to water);
- Depth to the bottom of the well;
- Calculated well volume;
- Purging method (if appropriate);
- Field parameters measured during purging; and
- Actual purged volume (if appropriate);

A field form for soil vapor sampling will include the following additional information:

- Name of the sampler;
- Location of the sample point;
- Helium leak detection percent result;
- Purge volume and time;
- Container ID;
- Flow controller ID;

- Start and end sampling date and time;
- Vacuum pressure of container at start and end of sampling; and
- Ambient air temperature and barometric pressure at start and end of sampling.

6.3.3 On-Site Screening Analysis Records

Field screening data (e.g., PID, liquid level measurements, temperature, turbidity, etc.) will be reported by Site personnel in field logbooks and/or on field investigation forms associated with the sampling event.

Documents and/or raw data generated during on-site field screening sample analyses will become part of the on-site field screening analyses record.

PID equipment may be used for environmental field screening and also for HASP-required air monitoring in the work zone. While these may utilize the same equipment, it is essential that field personnel recognize that the two uses are very different. Accordingly, it is necessary for PID field records of environmental screening and work zone air monitoring be maintained separately in the field books and also be specifically notated.

References

IATA (2025) Dangerous Goods Regulations, Edition 66.

USEPA (2024) Clean Water Act Methods Update Rule for the Analysis of Effluent. 40 CFR Part 136, Federal Register, Vol. 89, No. 74, Tuesday, April 16, 2024, Final Rule.



Technical Memorandum

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Prepared by: Brown and Caldwell

Project Title: Standard Operating Procedures (BCNNJ-SOP-VLAD4-0825)

SOP Version 4.0

Subject: Verification of Laboratory Analytical Data in EQUIS

Date: August 18, 2025

Reviewed by:

A handwritten signature in black ink, appearing to read "Charles Meyn", written over a light blue rectangular background.

Charles Meyn, P.G.
Principal Geologist/Hydrogeologist

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Section 1: Scope and Objectives

The objective of this standard operating procedure (SOP) is to establish consistent methods associated with data verification. Data verification is the process of providing completeness and accuracy checks maintained in Brown and Caldwell (BC) databases through a comparison to laboratory work products, specifically certified laboratory reports. The laboratory work products containing analytical data are generally provided in two formats; a Portable Document Format (pdf) laboratory report and an Electronic Data Deliverable (EDD). The pdf laboratory report is a representation of the data report that is signed by the laboratory, certifying the contents of the document. The EDD is not signed or otherwise certified and therefore must be processed by BC as it is loaded into the database and before it is reported to our clients. Experience has shown that EDDs and other digital laboratory data products, e.g., on-line reporting tools, frequently contain errors in comparison to the certified report.

Regulatory agencies often require that analytical data used for remedial decision making to go through a verification and validation process. The responsibility for this is placed on a third party, typically defined as the consultant or third party entity. A consultant is the preferred third party due to expertise about project specifics and constituents being analyzed. Other party designations as defined by the United States Environmental Protection Agency (USEPA) are as follows; the first party is the responsible party; the second party is the laboratory performing the analyses.

In addition to the fact that EDDs are not signed or otherwise certified, and that the USEPA requires a verification process, laboratory EDDs must also be verified for the following reasons:

- Laboratory EDDs are often not prepared or reviewed by a chemist; and
- The laboratory is often required to provide multiple formats of varying complexity, which provide opportunities for error.

Common errors include using the incorrect analyte code, mapping the project quantitation limit (PQL) to the reporting limit (RL) field, and providing duplicate results coded as reportable. These types of errors can lead to reporting erroneous information and may cause incorrect decisions to be made. The quality of our work is an essential ingredient to our success.

The verification process varies depending on the size of the project, and how the data are stored. Regardless of storage, electronic data must be reviewed against the pdf laboratory report. Checking the laboratory report for completeness is also required. If the laboratory report is incorrect, it is the consultant's responsibility to notice and take corrective action. The consultant is responsible if the error is passed on to the client.

Section 2: Responsibilities

The Database Manager, or designee, will be responsible for maintaining compliance with the requirements of the SOP.

Section 3: Procedure

After the laboratory EDD is uploaded into the EQuIS database, an output, Data Validation EDD (DVEDD) is generated for the reviewer to edit during the verification process. The DVEDD contains the fields that will



need to be verified. Below are instructions specific to performing data verification on data stored in the EQUIS database.

1. Open the DVEDD file for the laboratory Sample Delivery Group (SDG) to be checked. Create a new file by selecting “save as” from the file menu and adding your initials to the original DVEDD file.
 - a. For example, a DVEDD file named JB12345 being reviewed by Jane Smith Doe should be saved as, and renamed to JB12345-JSD.
2. Open the associated pdf laboratory report.
3. Check in the laboratory report that there are results for all analyses for all samples listed on the Chain of Custody (COC).
4. Check that the “lab_sample_id” field in the DVEDD file matches the samples listed in the laboratory report.
5. Check the “sample_type_code” for proper sample type coding. The following are valid values and definitions:
 - a. N – Normal field sample
 - b. FD – Field duplicate sample
 - c. LR – Laboratory replicate
 - d. TB – Trip Blank
 - e. EB – Equipment blank
 - f. FB – Field blank
6. Check that the “analytic_method” field matches the analytical methods for each sample as found in the pdf laboratory report.
7. Check the “basis” field for proper coding. Water samples should have “NA.” Soil and sediment samples should have a “D” if the associated results are dry weight corrected and a “W” if they are wet weight. Soil results should almost always be dry weight corrected. If this is not the case, contact the laboratory to confirm designation. This designation must match what it says in the pdf report.
8. Check that the “chemical_name” field in the DVEDD matches the analytes in the pdf report or that they are synonyms. This may require looking up chemical abstract numbers and/or chemical names on-line.
9. The “result_text” and “result_numeric” in the DVEDD should be null for non-detects. For detects, the two fields should match with the exception that the “result numeric” field does not preserve trailing zeros.
10. The “method_detection_limit” field should be populated with the laboratory’s standard detection limits for the method and should match the detection limits for the laboratory blank.
11. The “reporting_detection_limit” field should be populated with the sample specific detection limits. This detection limit has been adjusted for dilutions and sample preparation factors. These numbers should match the reporting limits provided in the laboratory report for each sample.
12. The “quantitation_limit” field should be populated with the sample specific PQL. These numbers should match the PQLs provided in the laboratory report for each sample.
13. Check that the “result_unit” and “detection_limit_unit” fields match the pdf laboratory report for each result.
14. Check the “reportable_result” field. This should generally be populated with “Yes.” However, if the laboratory performed multiple dilutions or re-analyses and provided more than one result for a given sample and parameter, then only one result should have a “yes.” Any additional results should be coded as “No.”

15. Check the “detect_flag” field. This should be a “Y” if the result is detected and an “N” if it is not detected.
16. Check the “lab_qualifiers” field. This should match the qualifiers that are provided in the pdf laboratory report for each result. Generally, this should be a “U” for non-detects and a “J” for results detected between the RL and the PQL. The laboratory may apply other qualifiers as well.
17. The “validator_qualifiers” field is to be populated after the results have been validated. Any qualifiers applied by a data validator should be entered here. If a validation report has been produced, these qualifiers need to match the validation report.
18. The “approval_code” field is populated by reason codes. These letter and number codes represent the reasons that the result has been qualified. Detected results between the RL and PQL should have a “T.” Temporarily identified compounds (TICs) should have an “A” in this field. Additional qualifiers may be added during validation. If a validation report has been produced, these codes should match the reasons for qualification. BC Valid Reason Codes for Data Validation should be used and are provided separately.
19. The “interpreted_qualifiers” field represents the final data qualifier. This qualifier takes into account both the laboratory and validator’s input and represents the qualifiers that will be associated with the final reported result.
20. The “validated_yn” field should be populated with “N” if the data has not been validated or the validation qualifiers have not been added to the DVEDD file. If the data has been validated, then this field should be populated with a “Y.” Change entries as appropriate.
21. The “sys_sample_code” should be populated with the field sample name appended with the sample date. Verify that the association between this and the laboratory sample ID in the “lab_sample_id” field matches the association in the pdf laboratory report.
22. The “parent_sample_code” should only be populated for field duplicates and should contain the “sys_sample_code” of the parent sample.
23. The “analysis_date” field should be populated with the correct analysis date provided in the pdf laboratory report.
24. The “fraction” field defines whether the result is for the total or dissolved fraction of a water sample. For soil samples, it should be populated with “N” for not applicable. For water samples, a “T” for total and a “D” for dissolved should be used.
25. The “result_type_code” should be populated by a “TRG” for target compounds and “TIC” for tentatively identified compounds.
26. The “dilution” field should be populated with the dilution factor for that result. This should match the pdf laboratory report.
27. The “sample_date” field should be populated with the sampling date for that sample result and should match the COC.
28. The “matrix_code” defines the type of sample. The following are common valid values:
 - a. WG – groundwater
 - b. WS - surface water
 - c. SO – soil
 - d. SE – sediment
 - e. AA – ambient air
 - f. AI – indoor air
 - g. GS – soil vapor

This should match the COC.

Remember to save the file after all changes have been made and inform the database manager that the file is ready.

ATTACHMENT E

Post-Closure Plan

BASF QUEENSBURY SECURE LANDFILL – POST-CLOSURE PLAN

The following steps outline post-closure care requirements for the BASF Queensbury Secure Landfill. Post-closure inspection forms are included as Attachment A.

1. Several concrete monuments with inscribed plaques have been installed around the perimeter of the secured area. These monuments shall be formally inspected on a quarterly basis for any damage or defacement and repairs shall be made if necessary. Any damage so severe as to be readily apparent on routine visits or post-closure inspections to the landfill shall be reported and remedied immediately.
2. The existing perimeter fence and two locking gates shall be maintained in serviceable condition. Both gates shall be kept closed and locked except when personnel are on site. The fencing, gate and lock shall be thoroughly examined on a quarterly basis for signs of damage or deterioration, and any damage requiring immediate repair shall be reported immediately.
3. The ground cover on the site shall be maintained by mowing and reseeding as required. Personnel conducting quarterly inspections shall look for and report any signs of burrowing rodent damage, bare spots, erosion of cover or ditches, and cracking. Repairs shall be made as needed.
4. The operation of the pumps in the concrete leachate sump shall be maintained. Leachate is held in the concrete sump and measured manually with a dip stick attached to a tape measure. When the depth of leachate in the sump approaches the permitted maximum sump level, a leachate pickup will be scheduled. On the day of the pickup, the leachate sump pump will be manually turned on and the leachate will be pumped directly into 55-gallon drums provided by the waste disposal contractor and sent for off-site disposal at a licensed facility. At least one 55-gallon drum will be kept onsite and staged on a temporary spill containment platform for emergency use as needed.
5. The depth of leachate in the concrete sump will be measured on a monthly basis to ensure the maximum leachate level of 30 cm has not been exceeded. The leachate depth will be measured by use of a measuring tape attached to a dip stick. The leachate depth will be measured and recorded on the inspection form. To ensure consistent readings, the dip stick with measuring tape will be dedicated to the site. In addition, the measurement will be taken at the northeast corner of the sump to allow for consistent measurement. The reference point will be identified on the sump using indelible ink or paint.
6. Since the cover seal prevents additional rainwater from entering the encapsulated waste, leachate flows should continue to decrease over time and should eventually cease. The leachate production rate shall be monitored on a monthly basis to determine when leachate flow ceases. This shall be accomplished by measuring the depth of liquid in the leachate collection sump. Once a determination has been made that leachate flow has ceased, the leachate pumps shall be monitored on a quarterly basis.
7. When, and if, leachate generation ceases, the landfill sump pumps shall be abandoned in place.
8. The ground water monitoring wells shall be sampled in accordance with this Permit and BASF's approved Groundwater Monitoring Plan. Samples shall be tested for the required parameters by a NYSDOH ELAP certified laboratory.
9. The gas vents shall be inspected for signs of damage or deterioration on a quarterly basis. It is not expected that any significant amount of gas will be generated and vented, but the inspection shall be performed as a precaution.

BASF QUEENSBURY SECURE LANDFILL – POST-CLOSURE PLAN

Any issues or abnormalities identified by personnel during routine inspections or site visits to the landfill shall be reported immediately and corrected as soon as repairs can be scheduled. The name, address and phone number of the office to contact concerning this facility during the post-closure care period is:

BASF Corporation
227 Oak Ridge Parkway
Toms River, NJ 08755
Phone: 914-557-6009
Email: steve.havlik@basf.com
Attn: Steve Havlik, Site Manager & Senior Remediation Specialist

Attachment A: Post-Closure Inspection Forms

POST-CLOSURE QUARTERLY SITE INSPECTION CHECKLIST
BASF CORPORATION SECURE LANDFILL
JENKINSVILLE ROAD, QUEENSBURY, NEW YORK

Inspected by: _____

Date: _____

Time: _____

Weather Conditions: _____

Landfill Cover System

Erosion	_____ YES	_____ NO
Holes or Cracks in Cover	_____ YES	_____ NO
Ponded Water or Wet Areas	_____ YES	_____ NO
Burrowing Rodents	_____ YES	_____ NO
Sparse Vegetation/Bare Soil	_____ YES	_____ NO
Brush or Other Woody Vegetation	_____ YES	_____ NO
Excessive Weeds in Grass	_____ YES	_____ NO
Grass Mowed	_____ YES	_____ NO
Settlement: Elevations Taken?	_____ YES	_____ NO

Comments: _____

Gas Vents

Deterioration or Damage	_____ YES	_____ NO
Riser out of Plumb	_____ YES	_____ NO
Birds, Rodents, or Insects in Riser Pipe	_____ YES	_____ NO

Comments: _____

POST-CLOSURE QUARTERLY SITE INSPECTION CHECKLIST
BASF CORPORATION SECURE LANDFILL
JENKINSVILLE ROAD, QUEENSBURY, NEW YORK

Drainage Ditches

Erosion	_____	YES	_____	NO
Obstructions	_____	YES	_____	NO
Sediment Accumulation	_____	YES	_____	NO
Evidence of Surcharging	_____	YES	_____	NO
Presence of Brush	_____	YES	_____	NO

Comments: _____

Site Access Road

Erosion	_____	YES	_____	NO
Plowed and Sanded	_____	YES	_____	NO

Comments: _____

Fencing

Gates and Locks	_____	YES	_____	NO
Fence Fabric	_____	YES	_____	NO
Posts	_____	YES	_____	NO
Top Tension Wire	_____	YES	_____	NO
Barbed Wire	_____	YES	_____	NO

Comments: _____

POST-CLOSURE QUARTERLY SITE INSPECTION CHECKLIST

BASF CORPORATION SECURE LANDFILL
JENKINSVILLE ROAD, QUEENSBURY, NEW YORK

Monitoring Wells

Capped and Locked _____ YES _____ NO

Casing Damage _____ YES _____ NO

Comments: _____

Property Monuments

Readily Visible _____ YES _____ NO

Evidence of Damage or Movement _____ YES _____ NO

Comments: _____

Leachate Sump

Concrete Sump: Water Depth _____ Inches

Maximum Permitted Depth 11.81 Inches

Pump Operation: Concrete Sump _____ OK _____ OTHER

Discharge Piping Conditions _____ OK _____ OTHER

Sump Electrical Panel: Panel Box Condition _____ OK _____ OTHER

Door Locked _____ YES _____ NO

Circuit Breakers Checked _____ YES _____ NO

Comments: _____

POST-CLOSURE QUARTERLY SITE INSPECTION CHECKLIST

BASF CORPORATION SECURE LANDFILL
JENKINSVILLE ROAD, QUEENSBURY, NEW YORK

Main Electric Panel

Panel Box Condition	_____	OK	_____	OTHER
Circuit Breakers Checked	_____	YES	_____	NO
Door Locked	_____	YES	_____	NO

Comments: _____

Inspector's Signature: _____ Date: _____

LIST OF APPENDICES

Appendix A: Monitoring Well Inspection Logs

Appendix B: Bi-Weekly Site Inspection Forms

Groundwater Monitoring System Inspection
BASF Corporation Secure Landfill
Jenkinsville Road Facility, Queensbury, New York
NYSDEC Permit Number 5-5234-00149/00002

Well Designation _____

Date of Inspection _____ (MM/DD/YYYY)

Time of Inspection _____ (Military Time)

Inspector's Name _____

Item	Types of Problems	Status**		Comments/Recommended Action
		U	A	
Well Condition	* Well I.D. Readable on Outer Casing			
	* Integrity of Security Casing			
	* Corrosion			
	Total Depth (if applicable)			
	Inner Casing/Screen Integrity			
	Measuring Point Visibility			
	Siltation (if applicable)			
	Recharge Rate (generalized)			
	Dedicated Sampling Device			
	* Other			
Security	* Lock in Place			
	Lock Functional			
	* Other			

* Quarterly Inspection Item

** U/A = Unacceptable/Acceptable



**BASF QUEENSBURY NEW YORK CLOSED LANDFILL
POST-CLOSURE INSPECTION FORM BI-WEEKLY SITE VISITS**

Date: _____
Inspector: _____
Arrive: _____
Exit: _____

Condition of Final Cover	Damage or Eroded (Y/N)	_____
	Burrowing Rodent Damage (Y/N)	_____
Settlement of Final Cover	Differential Settlement Visible (Y/N)	_____
Condition of Run-off Control	Erosion to Drainage Ditches (Y/N)	_____
Condition of Perimeter Fence	Damage to Fence (Y/N)	_____
Condition of Gates and Locks	Damaged or Corroded (Y/N)	_____
Condition of Signs – Perimeter Signs	Damaged, Missing, or Illegible (Y/N)	_____
Condition of Signs – Container Signs	Damaged, Missing, or Illegible (Y/N)	_____
Condition of Vents	Damaged or Deteriorated (Y/N)	_____
Condition of Concrete Monuments	Damaged or Deteriorated (Y/N)	_____
Condition of Monitoring Wells	Damaged or Deteriorated (Y/N)	_____
Concrete Sump		
Water Depth	_____ Inches (Max. Permitted Depth = 11.81 Inches)	
Exhaust Fan	Operational (Y/N)	_____
Primary Pump No. 1	Operates in Hand Mode (Y/N)	_____
Secondary Pump No. 2	Operates in Hand Mode (Y/N)	_____
CMP Sump (French Drain)		
Pump No. 3	Operates in Hand Mode (Y/N)	_____
Condition of Hoist/Gantry	Operational (Y/N)	_____
Drums	Number: _____ Condition Acceptable (Y/N)	_____
Schedule of Leachate Shipping	Date of Last Shipment: _____	
	Date of Anticipated Next Shipment: _____	

Repair Needs Observed:

Repairs Pending:

Repairs Completed this Visit:

Notes:

ATTACHMENT F
Environmental Easement
(to be provided and
approved during the
Permit period)

ATTACHMENT G
Site Management Plan
(to be provided and
approved during the
Permit period)

ATTACHMENT H
Post-Closure Cost
Estimate

500 North Franklin Turnpike
Suite 314
Ramsey, New Jersey 07446

T: 201.574.4700



June 29, 2026

Mr. Stephen K. Havlik
Toms River Site Manager &
Senior Remediation Specialist
BASF Corporation
227 Oak Ridge Parkway
Toms River, New Jersey 08755

Subject: 2026 Post-Closure Cost Estimate
BASF Closed Queensbury Landfill, Queensbury, New York
NYSDEC Permit No. 5-5234-00149/0000
EPA ID No. NYD000818419

Dear Steve:

Brown and Caldwell Associates (BCA) has prepared the enclosed Post-Closure Cost Estimate (post-closure estimate) for the BASF Jenkinsville Road Closed Landfill located in Queensbury, New York.

The landfill is owned by the Town of Queensbury and operated by BASF Corporation (BASF). BASF currently maintains an irrevocable standby Letter of Credit in the amount of \$1,470,508 for the post-closure care of the landfill.

This post-closure estimate was prepared to assess whether the current Letter of Credit is adequate for proper post-closure maintenance activities. This updated 2026 estimate reflects the 2025 pricing for related operation and maintenance tasks adjusted by a 1.028 inflation factor derived from the most recent Implicit Price Deflator for Gross National Product. The post-closure cost estimate includes the updated cost estimate for a 30-year period per 6CRR-NY 360.22(b)(3)(iv) as well as a 20% contingency.

Post-closure activities include:

- Administrative Tasks:
 - Project management, meetings, response to regulatory requests and office related tasks
 - Preparation of Annual Report
 - Five-year permit renewal
- Field and Supporting Tasks:
 - Operation and maintenance of the leachate collection system (pumps, electrical maintenance, repairs, and replacement)
 - Routine inspections of landfill and groundwater monitoring well network
 - Annual groundwater monitoring of the following five compliance wells: MW-2C, MW-4D, MW-8A, MW-15A, and MW-17A
 - Leachate disposal (hazardous liquid)

- Routine site maintenance activities including the following: mowing, snow plowing, trimming, road maintenance, and brush removal, as needed
- Three-year well evaluation completed at the five monitoring wells where routine chemical monitoring is performed
- Five-year periodic elevation survey of the monitoring well network by a New York State (NYS) licensed surveyor

Details of the updated cost estimate are provided on the attached table. The current Letter of Credit maintained by BASF will need to be increased to cover the updated 30-year cost estimate.

If you have any questions, please do not hesitate to call either of us.

Very truly yours,

Brown and Caldwell Associates



Thomas Parel
Project Manager



Jeffrey R. Caputi, P.E.
Vice President

cc: Scott Nelson, Brown and Caldwell
Julie Kotowski, Brown and Caldwell

Attachments

Post-Closure Cost Estimate
BASF Corporation Secure Landfill
Queensbury, NY

Item	2025 Annual Cost
Project Management, Regulatory Reporting and Administrative Tasks	
Project management, mobilization, meetings, site utilities, health and safety	\$8,500
Preparation of Annual Monitoring Report	\$7,900
5-year permit	\$700
Field and Supporting Tasks	
Routing O&M Activities	\$7,900
Post-Closure Site Inspections	\$8,000
Annual Sampling Event	\$6,000
Leachate Disposal Cost (F039)	\$2,000
3-Year Well Inspection	\$200
5-year Well Survey	\$500
2025 Cost Subtotal	\$41,700
2026 Post-Closure Cost Estimate ¹	\$42,881
30-year Post-Closure Cost Estimate	\$1,286,417
Contingency (20%)	\$257,283
30-year Post-Closure Cost Estimate Plus Contingency	\$1,543,701

Notes:

1. 2026 Post-Closure Cost estimate was calculated using actual maintenance costs for 2025 adjusted by a 1.028 inflation factor derived from the most recent Implicit Price Deflator for Gross National Product.

ATTACHMENT I

Other Laws

ATTACHMENT I OTHER LAWS

The Facility holds a permit that was issued pursuant to the Resource Conservation & Recovery Act and the New York State Environmental Conservation Law.

Other laws applicable or potentially applicable to site operations include the Clean Water Act, the Clean Air Act, the Safe Drinking Water Act, the Federal Insecticide, Fungicide, Rodenticide Act, the Comprehensive Environmental Response, Compensation, and Liability Act, and the Superfund Amendments and Reauthorization Act of 1986. The site is currently in compliance with applicable provisions of these statutes.