July 6, 2017  

Mr. Tom Crawford  
McWane Ductile-Ohio  
2266 South Sixth Street  
Coshocton, OH 43812  

Re: McWane Ductile-Ohio  
Director's Final Findings and Orders (DFFO)  
DFFO  
RCRA C - Hazardous Waste  
Coshocton County  
OHD004294849

Subject: Final Findings and Orders of the Director

Dear Sir:

Transmitted herewith are the Final Findings and Orders of the Director concerning the matter indicated for McWane Ductile-Ohio.

If you have any questions, please contact Andrea Smoktonowicz at (614) 644-3037.

Sincerely,

Tonya Andrews, Administrative Professional 3  
Division of Environmental Response & Revitalization

Enclosure

cc: Jeremy Carroll, DMWM, CO  
    Scott Hester, DMWM, CO  
    Mitch Mathews, DERR, CO  
    Teri Finfrock, Legal, CO  
    Joe Goicochea, DMWM, SEDO  
    Shawn Sellers, DERR, CO  
    Matt Boyer, DMWM, CO  
    Andrea Smoktonowicz, Legal
BEFORE THE
OHIO ENVIRONMENTAL PROTECTION AGENCY

In the Matter of:

McWane Ductile-Ohio
A Division of McWane, Inc.
2266 South Sixth Street
Coshocton, Ohio 43812

Respondent

Director’s Final
Findings and Orders

PREAMBLE

It is agreed by the parties hereto as follows:

I. JURISDICTION

These Director’s Final Findings and Orders (“Orders”) are issued to McWane Ductile-Ohio, a Division of McWane, Inc. (f/n/a Clow Water Systems Company (“Clow”)) (“Respondent”) pursuant to the authority vested in the Director of the Ohio Environmental Protection Agency (“Ohio EPA”) under Ohio Revised Code (ORC) §§ 3734.02(G), 3734.13 and 3745.01.

II. PARTIES BOUND

These Orders shall apply to and be binding upon Respondent and successors in interest liable under Ohio law. No change in ownership of Respondent or of the Facility shall in any way alter Respondent’s obligations under these Orders.

III. DEFINITIONS

Unless otherwise stated, all terms used in these Orders shall have the same meaning as defined in ORC Chapter 3734. and the rules promulgated thereunder.

IV. FINDINGS

Nothing in the findings shall be considered to be an admission by Respondent of any matter of law or fact. The Director of Ohio EPA has determined the following findings:

1. Pursuant to ORC § 3734.02(G) and OAC rule 3745-50-31, the Director may, by order, exempt any person generating, storing, treating, or disposing of hazardous
waste in such quantities or under such circumstances that, in the determination of the Director, it is unlikely that the public health or safety or the environment will be adversely affected thereby, from any requirement to obtain a permit or comply with other requirements of ORC Chapter 3734. Any such exemption shall be consistent with and equivalent to rules promulgated under the Resource Conservation and Recovery Act of 1976, 90 Stat. 2806, 42 U.S.C. § 6921 et seq., as amended.

2. Respondent is a “person” as defined in ORC § 3734.01(G) and OAC rule 3745-50-10(A).

3. Respondent owns and operates a ductile pipe manufacturing facility located at 2266 South Sixth Street, Coshocton, Coshocton County, Ohio (“Facility”). At the Facility, Respondent manufactures utility poles and ductile iron piping for use in underground water piping systems and in water treatment plants. Respondent’s generator identification number is OHD 004 294 849.

4. On December 28, 1993, Director’s Final Findings and Orders were issued to Clow, which required, inter alia, closure and post-closure of Clow’s hazardous waste surface impoundment (“1993 Orders”).

5. Respondent is subject to Ohio’s solid waste laws, including groundwater monitoring requirements in OAC rule 3745-27-10 for a former unpermitted and unlicensed open dump known as the “North Landfill” located at the Facility. By letter dated January 22, 1996, Ohio EPA concurred with Clow’s certification of the solid waste closure for the North Landfill. Clow was directed to comply with the post-closure care requirements of solid waste rule, OAC rule 3745-27-14, for the North Landfill.

6. By letter dated May 7, 1996, Ohio EPA accepted Clow’s proposal to divide its approved closure plan for the hazardous waste surface impoundment into two separate closure plans for two units: the hazardous waste surface impoundment (a/k/a Cell 1); and a separate, active, exempt-waste disposal cell (“Cell 2”).

7. Respondent is subject to Ohio’s hazardous waste laws regarding the hazardous waste surface impoundment and Cell 2.

8. On July 22, 1996, Clow submitted amended closure/post-closure plans for the hazardous waste surface impoundment and Cell 2. In addition, Clow submitted a post-closure and assessment monitoring plan (“PCAMP”) to address ground
water monitoring for the hazardous waste surface impoundment, Cell 2, and the solid waste landfill (the North Landfill).

9. On January 10, 1997, Ohio EPA received revised closure/post-closure plans for the hazardous waste surface impoundment and Cell 2, which Ohio EPA approved (with the PCAMP), on April 30, 1997.


11. Thus, Clow had been required to comply with two (2) separate (solid waste and hazardous waste) yet overlapping and, in large part, duplicative ground water monitoring rules that regulated the solid waste landfill, i.e., the North Landfill, and the hazardous waste management units, the hazardous waste surface impoundment and Cell 2.

12. By letter dated July 26, 2001, Clow discussed the desire among Clow and Ohio EPA to address in the CMP the ground water corrective measures for the North Landfill, the hazardous waste surface impoundment, and Cell 2 under the solid waste rule, OAC rule 3745-27-10.

13. On September 29, 2004, Clow submitted a CMP Supplement, attached hereto as Appendix A and incorporated herein, which addresses ground water corrective measures for the North Landfill, the hazardous waste surface impoundment, and Cell 2 using the solid waste rule, OAC rule 3745-27-10 (effective August 15, 2003). The CMP Supplement recommended a corrective measure of ground water pump and discharge. This corrective measure was installed in 2005.

The CMP Supplement included a Corrective Measures Groundwater Monitoring Plan ("CMGMP") for the sampling and analysis of ground water for the North Landfill, the hazardous waste surface impoundment, and Cell 2 in accordance with solid waste rule, OAC rule 3745-27-10, and the CMGMP. The CMP Supplement also included a Sampling and Analysis Plan ("SAP").

14. The CMP Supplement, including the CMGMP and the SAP, was approved by Ohio EPA in the 2004 Orders (defined below)

15. On November 30, 2004, Clow submitted to Ohio EPA amendments to its approved closure/post-closure plans for the hazardous waste surface impoundment and Cell 2. These amendments were approved by Ohio EPA in the 2004 Orders (defined below).
16. On December 6, 2004, Director's Final Findings and Orders were issued to Clow ("2004 Orders"). In the 2004 Orders, the Director found Clow exempt from the requirement to comply with the hazardous waste ground water monitoring and annual reporting requirements in OAC Chapters 3745-54, 3745-55, and 3745-65 for the hazardous waste surface impoundment and Cell 2 and that the exemption was unlikely to adversely affect the public health or safety or the environment. The 2004 Orders required Clow to instead comply with the solid waste rule, OAC rule 3745-27-10, for corrective measures and ground water monitoring for the North Landfill, Cell 2, and the surface impoundment. The 2004 Orders superseded the 1993 Orders.

17. The 2004 Orders also required Clow to submit closure certifications for the hazardous waste surface impoundment and Cell 2 within 60 days of completion of closure of Cell 2, maintain financial assurance for closure/post-closure care of the hazardous waste surface impoundment and Cell 2 in accordance with OAC rules 3745-55-42 through 3745-55-47, perform post-closure care of the North Landfill in accordance with OAC rule 3745-27-14, maintain financial assurance for post-closure care of the North Landfill in accordance with OAC rules 3745-27-16 and 3745-27-17, and maintain financial assurance for any corrective measures selected for the North Landfill in accordance with OAC rule 3745-27-18.

18. On February 13, 2009, Ohio EPA approved the closure certifications for the hazardous waste surface impoundment and Cell 2.

19. Respondent operates an NPDES permitted Waste Water Treatment Plant ("WWTP") at the Facility. Hazardous waste handled in the WWTP is subject to the WWTP exemption located in OAC rule 3745-54-01(G)(5). For a period of time, water from the WWTP was circulated to a concrete structure ("concrete cooling pond") and the water was used as non-contact cooling water for the manufacturing equipment. Over time, sludge had accumulated in the concrete cooling pond.

20. In July 2004, U.S. EPA inspected the Facility and the WWTP. In August of 2007, U.S. EPA indicated its position that the concrete cooling pond was not part of the WWTP and, as such, not subject to the WWTP exemption and was a surface impoundment not permitted to store hazardous waste.

21. On June 3, 2009, Director’s Final Findings and Orders ("2009 Orders") were issued to Clow wherein Clow was required to submit to Ohio EPA a
Closure/Post-Closure Plan for the concrete cooling pond ("Concrete Cooling Pond Closure Plan") that would comply with the administrative requirements of OAC Chapters 3745-65 and 3745-66 and the substantive requirements of OAC Chapters 3745-54 and 3745-55, including but not limited to, the ground water protection program in accordance with OAC rules 3745-54-90 through 3745-54-100.


23. Clow completed the closure of the concrete cooling pond pursuant to the Concrete Cooling Pond Closure Plan and submitted on March 29, 2012 a request to terminate the 2009 Orders.

24. On April 14, 2012, Ohio EPA terminated the 2009 Orders, leaving the 2004 Orders remaining as the only effective order.

25. Since 2012, the parties again discussed the fact that Clow/Respondent is presently required to comply with two (2) separate (solid waste and hazardous waste) yet overlapping and, in large part, duplicative ground water monitoring rules as: (i) the North Landfill, the hazardous waste surface impoundment, and Cell 2 are regulated under the solid waste ground water monitoring rule, OAC rule 3745-27-10 per the 2004 Orders; and (ii) the concrete cooling pond is regulated under the hazardous waste ground water post-closure monitoring rules under OAC rules 3745-54-90 and 3745-54-100 using, for monitoring purposes, ground water prediction limits from data gathered from wells up-gradient and down-gradient of the concrete cooling pond.

26. By a letter dated July 18, 2012, Clow provided a demonstration to Ohio EPA showing that the ground water prediction limits associated with the concrete cooling pond were unnecessarily more stringent due to statistical increases resulting from the natural variability of the wells up-gradient and down-gradient of the concrete cooling pond and Respondent questioned the need for monitoring ground water for the concrete cooling pond under the hazardous waste rules given the solid waste groundwater monitoring program already in place at the Facility.


28. On January 26, 2015, Clow changed its name to McWane Ductile-Ohio.
29. Thereafter, the parties agreed to amend the CMGMP to consider the North Landfill, the hazardous waste surface impoundment, Cell 2, and the concrete cooling pond as one unit under the solid waste ground water monitoring rule, OAC rule 3745-27-10.


31. On September 13, 2016, the ACMGMP was approved by Ohio EPA. The ACMGMP is attached hereto as Appendix B and is incorporated by reference.

32. The Director of the Ohio EPA has determined that regulating the North Landfill, the hazardous waste surface impoundment, Cell 2, and the concrete cooling pond as one unit under the solid waste ground water monitoring rule, OAC rule 3745-27-10, will be administratively effective and is unlikely to adversely affect public health or safety or the environment within the meaning of ORC § 3734.02(G).

33. The Director also finds that issuing Respondent an exemption from the requirement to comply with the hazardous waste ground water monitoring, biennial reporting, financial assurance, and post-closure care requirements in OAC Chapters 3745-54, 3745-55, 3745-65, and 3745-66 at the Facility is unlikely to adversely affect the public health or safety or the environment within the meaning of ORC § 3734.02(G).

34. On March 27, 2017, Respondent submitted to Ohio EPA an amended post-closure plan for the North Landfill, the hazardous waste surface impoundment, Cell 2, and the concrete cooling pond, which applies OAC rule 3745-27-14 for post-closure care, and it is hereby approved.

V. ORDERS

The 2004 Orders are hereby superseded and terminated and Respondent shall achieve compliance with ORC Chapter 3734. and the regulations promulgated thereunder as follows:

1. Respondent is hereby exempted from the requirement to comply with the ground water and biennial reporting requirements in OAC Chapters 3745-54, 3745-55, and 3745-65 for the hazardous waste surface impoundment, Cell 2, and the concrete cooling pond at the Facility. In lieu of compliance with these Chapters,
Respondent shall comply with these Orders and the requirements of OAC rule 3745-27-10 for the North Landfill, the hazardous waste surface impoundment, Cell 2, and the concrete cooling pond until the Director approves the certification of completion of the corrective measures in accordance with OAC rule 3745-27-10(F)(16).

2. Respondent shall continue to implement the selected corrective measure of ground water pump and discharge in accordance with the CMP Supplement (Appendix A) and as modified by the ACMGMP (Appendix B), OAC rule 3745-27-10, and these Orders for the North Landfill, the hazardous waste surface impoundment, Cell 2, and the concrete cooling pond.

3. In the event of a conflict between the CMP Supplement as set forth in Appendix A and OAC rule 3745-27-10, Respondent shall comply with the requirements of OAC rule 3745-27-10. When the corrective measure implemented by Respondent pursuant to these Orders causes attainment of the ground water concentration levels established by the CMP Supplement and as modified by the ACMGMP and OAC rule 3745-27-10, Respondent, at its option, may continue to perform said corrective measure for so long as Respondent may choose in order to maintain the ground water concentration levels that have been attained or to cause further reductions in said concentrations, rather than discontinue said corrective measures and return to detection monitoring.

4. Respondent shall implement the ACMGMP, attached hereto as Appendix B and incorporated herein, for the North Landfill, the hazardous waste surface impoundment, Cell 2, and the concrete cooling pond. In the event of a conflict between the ACMGMP and OAC rule 3745-27-10, as amended, Respondent shall comply with the requirements of OAC rule 3745-27-10.

5. With respect to the level of arsenic in ground water, if the corrective measure is working properly, concentrations of arsenic in ground water should stabilize and/or decrease with time. If there is a trend observed of arsenic levels increasing in ground water at the Facility boundary, Respondent shall provide an explanation/evaluation of such in the required monitoring reports. As long as Respondent continues to appropriately operate and maintain the corrective measures and follow the ACMGMP, Ohio EPA will consider Respondent to be in compliance with these Orders and OAC rule 3745-27-10. If corrective measures are deemed ineffective, the Director has the authority to require Respondent to undertake additional measures to eliminate or minimize further releases as required by OAC rule 3745-27-10.
6. In light of the ground water monitoring requirements of these Orders, Respondent need not comply with the PCAMP, which was approved on April 30, 1997, as referenced in Findings 8. and 9. of these Orders.

7. Respondent is hereby exempted from the requirement to comply with hazardous waste post-closure care requirements in OAC Chapters 3745-55 and 3745-66 for the hazardous waste surface impoundment, Cell 2, and the concrete cooling pond. Respondent shall comply with the post-closure care requirements of OAC rule 3745-27-14 and in accordance with Respondent’s post-closure plan dated March 23, 2017 and attached as Appendix C for the North Landfill, the hazardous waste surface impoundment, Cell 2, and the concrete cooling pond. The post-closure care period shall be at a minimum 30 years for each, or terminate on the following, unless otherwise agreed upon by the parties: November 20, 2025 for the North Landfill; February 13, 2039 for the hazardous waste surface impoundment and Cell 2; and November 25, 2039 for the concrete cooling pond.

8. Respondent is hereby exempted from the requirement to comply with hazardous waste financial assurance requirements in OAC Chapters 3745-55 and 3745-66 for the hazardous waste surface impoundment, Cell 2, and the concrete cooling pond. Respondent shall maintain financial assurance for post-closure care of the hazardous waste surface impoundment, Cell 2, the concrete cooling pond, and the North Landfill in accordance with the solid waste requirements of OAC rules 3745-27-16 and 3745-27-17 and financial assurance for any corrective measures implemented for the North Landfill, the hazardous waste surface impoundment, Cell 2, and the concrete cooling pond in accordance with the solid waste requirements of OAC rule 3745-27-18.

VI. TERMINATION

Respondent’s obligations under these Orders shall terminate when Respondent certifies in writing and demonstrates to the satisfaction of Ohio EPA that Respondent has performed all obligations under these Orders and the Chief of Ohio EPA’s Division of Materials and Waste Management acknowledges, in writing, the termination of these Orders. If Ohio EPA does not agree that all obligations have been performed, then Ohio EPA will notify Respondent of the specific obligations that have not been performed in a timely manner of Respondent’s submission, in which case Respondent shall have an opportunity to address any such deficiencies and seek termination as described above.

The certification shall contain the following attestation: “I certify that the information contained in or accompanying this certification is true, accurate and complete.”
This certification shall be submitted by Respondent to Ohio EPA and shall be signed by a responsible official of Respondent. For purposes of these Orders, a responsible official is a [e.g., corporate officer] who is in charge of a principal business function of Respondent.

VII. OTHER CLAIMS

Nothing in these Orders shall constitute or be construed as a release from any claim, cause of action or demand in law or equity against any person, firm, partnership or corporation, not a party to these Orders, for any liability arising from, or related to, the operation of Respondent's Facility.

VIII. OTHER APPLICABLE LAWS

All actions required to be taken pursuant to these Orders shall be undertaken in accordance with the requirements of all applicable local, state and federal laws and regulations. These Orders do not waive or compromise the applicability and enforcement of any other statutes or regulations applicable to Respondent.

IX. MODIFICATIONS

These Orders may be modified by agreement of the parties hereto. Modifications shall be in writing and shall be effective on the date entered in the journal of the Director of Ohio EPA.

X. NOTICE

All documents required to be submitted by Respondent pursuant to these Orders shall be addressed to:

Ohio Environmental Protection Agency
Southeast District Office
Division of Materials and Waste Management
2195 Front Street
Logan, Ohio 43138
Attn: DMWM Manager

and Ohio EPA Central Office at the following address:
XI. RESERVATION OF RIGHTS

Ohio EPA reserves its rights to seek civil or administrative penalties against Respondent for the violations of these Orders. Ohio EPA and Respondent each reserve all rights, privileges and causes of action, except as specifically waived in Section XII of these Orders.

XII. WAIVER

In order to resolve disputed claims, without admission of fact, violation or liability, and in lieu of further enforcement action by Ohio EPA for only the violations specifically cited in these Orders, Respondent consents to the issuance of these Orders and agrees to comply with these Orders. Compliance with these Orders shall be a full accord and satisfaction for Respondent's liability for the violations specifically cited herein.

Respondent hereby waives the right to appeal the issuance, terms and conditions, and service of these Orders, and Respondent hereby waives any and all rights Respondent may have to seek administrative or judicial review of these Orders either in law or equity.

Notwithstanding the preceding, Ohio EPA and Respondent agree that if these Orders are appealed by any other party to the Environmental Review Appeals Commission, or
any court, Respondent retains the right to intervene and participate in such appeal. In such an event, Respondent shall continue to comply with these Orders notwithstanding such appeal and intervention unless these Orders are stayed, vacated or modified.

XIII. EFFECTIVE DATE

The effective date of these Orders is the date these Orders are entered into the Ohio EPA Director's journal.

XIV. SIGNATORY AUTHORITY

Each undersigned representative of a party to these Orders certifies that he or she is fully authorized to enter into these Orders and to legally bind such party to these Orders.

IT IS SO ORDERED AND AGREED:

Ohio Environmental Protection Agency

Craig W. Butler
Director

IT IS SO AGREED:

McWane Ductile-Ohio, A Division of McWane, Inc.

Signature: [Signature]
Printed or Typed Name: [TOM CRAWFORD]
Date: 6-5-17
Corrective Measures Plan
Supplement

Clow Water Systems Company
Coshocton, Ohio

September 29, 2004

Joel A. Hunt
Senior Project Manager

Brian Sedgwick
Project Engineer
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Section 1
Introduction

1.1 Introduction
Clow Water Systems Company (Clow), a division of McWane, Inc., operates a ductile iron foundry in Coshocton, Coshocton County, Ohio (Figure 1). Three distinct but adjacent disposal facilities remain at the Clow site. These three disposal facilities are the solid waste landfill (closed in 1996), the hazardous waste surface impoundment (closed in 1995) and an exempt waste landfill (scheduled for closure in 2008). This Corrective Measures Plan Supplement (CMPS) combines the three units and addresses them as a single unit.

Periodic sampling of ground water monitoring wells located at the downgradient unit boundary of these combined units have consistently detected exceedances of background water quality. The CMPS has been prepared to address these exceedances in accordance with the solid waste requirements in Ohio Administrative Code (OAC) 3745-27-10; as in effect on the date of this submittal.¹

1.2 Purpose and Scope
The purpose of this CMPS is to demonstrate that pump and discharge meets the requirements of OAC 3745-27-10 (F)(2).

1.3 Organization of Report
This report is organized to correspond directly to paragraphs (a) through (e) of OAC 3745-27-10 (F)(2). Figures and tables are presented after the text. Supplemental materials provided in Appendices are as follows:

- Appendix A: References
- Appendix B: Proposed Declaration of Use Restriction
- Appendix C: Corrective Measures Ground Water Monitoring Plan
- Appendix D: Clow - Updated Capture Zone Analysis
- Appendix E: Sampling and Analysis Plan

¹ All references herein to the Ohio Administrative Code refer to the code in effect on the date of this submittal.
Section 2

Human Health and the Environment

Pursuant with OAC 3745-27-10 (F)(2)(a), the ground water pump and discharge alternative is protective of human health and safety and the environment.

The ground water pump and discharge alternative provides a high degree of overall protection, because the potential exposure of contaminated media by human and environmental receptors is eliminated by a combination of both source and institutional controls. A pumping system will control the source of continuing impact to downgradient ground water by capturing the ground water within the flow lines that are impacted as ground water migrates beneath the solid waste landfill. On-site ground water, that has already been impacted hydraulically downgradient of the pumping system, will be protected from potential human use by on-site institutional controls (such as a deed restriction preventing the potable use of ground water) until it naturally attenuates.

Off-site impacts are not expected to be significant since concentrations, at the property boundary, continue to be below concentration levels for all chemicals of concern. It is possible that the boundary well concentrations may temporarily increase before the concentration reductions from the pumping system reach the property boundary. It should be noted that for this corrective measure, the contaminant is transferred to another disposal facility, the local publicly-owned treatment works (POTW). No adverse human exposures are anticipated at the local POTW or as a result of by-products from the local POTW.
Section 3
Ground Water Concentration Standards

Pursuant with OAC 3745-27-10 (F)(2)(b), the ground water pump and discharge alternative would attain the proposed ground water concentration levels (discussed below) specified in accordance with paragraph (F)(7) of OAC 3745-27-10 by controlling the source of ground water impact. The pumping system will capture the impacted ground water within the induced flow lines beneath the solid waste landfill. The ground water downgradient of the pumping system should eventually meet the ground water concentration standards through natural attenuation.

3.1 Concentration Levels
In accordance with OAC 3745-27-10(F)(7) the proposed concentration levels were set at Maximum Contaminant Levels (MCLs) for antimony, arsenic, barium, cadmium, chromium (total), cyanide, 1,1-dichloroethane, fluoride, and nickel. The concentration levels for chloride, sodium, and zinc were based upon Secondary Maximum Contaminant Levels (SMCLs). The concentration level for lead was based on United States Environmental Protection Agency’s (USEPA’s) treatment-derived standard for tap water. The concentration levels for aluminum, copper, iron, manganese, nitrogen-ammonia, phosphorus, potassium, and sulfate were set at a value halfway between the highest site background value and the maximum statewide ambient values for sand and gravel as reported in Table 3. Ambient Network Data Summary (Ohio BPA, 2000).

Table 1 shows the concentration levels for each of the 21 chemicals of concern.
Section 4
Source(s) of Releases

Pursuant with OAC 3745-27-10 (F)(2)(C), the ground water pump and treat alternative would control the source(s) of releases to reduce or eliminate to the maximum extent practicable, further releases of waste-derived constituents into the environment. The recommended corrective measure, as described below, would meet the requirements of OAC 3745-27-10 (F)(2)(c).

4.1 Extraction with POTW Discharge

This remedial alternative is comprised of the following elements:

- Ground Water Extraction
- Sanitary Sewer Discharge/POTW Treatment
- Institutional Controls and Ground Water Monitoring

4.1.1 Ground Water Extraction

Contaminated ground water would be removed from the shallow, unconfined aquifer via extraction wells and conveyed to the sanitary sewer by means of underground piping. The extraction well locations are estimated to be spaced from 40 to 80 feet apart in a line approximately N145°E along the southwestern boundary of the North Landfill (Figure 2).

The extraction system design would consist of eight, 6-inch diameter extraction wells with 10-foot-long slotted screens, risers, pitless adapters, and equipped with electric submersible pumps. The wells are assumed to be approximately 35-feet deep and screened from approximately 3 to 13 feet below the typical low water table level. A generic extraction well construction diagram is presented as Figure 3.

The extraction wells are assumed to have an extraction rate of approximately 2 to 10 gallons per minute (gpm) per well for a total extraction rate of approximately 35 gpm. Based on flow modeling (RMT, 2004), this extraction well network will capture shallow groundwater from the entire profile of the solid waste North Landfill.

These individual well and total extraction rates are based on a capture zone analysis using Modflow, a three-dimensional ground water flow model (Appendix D). Modflow
simulations showed that this recovery well scenario would collect approximately the top 20 feet of ground water and have a capture zone wide enough to encompass the entire width of the North Landfill.

4.1.2 Sanitary Sewer Discharge/POTW Treatment

Extracted water will be added, as needed, to Clow's closed loop non-contact cooling water system. After obtaining a municipal wastewater discharge permit, untreated, extracted ground water, that cannot be consumptively used by Clow for non-contact cooling, would be directly discharged to the local sanitary sewer that, in turn, discharges to the City of Coshocton Wastewater Treatment Plant (POTW).

Buried conveyance lines would be used to convey ground water from the extraction wells to a central collection building where the individual well discharge would be combined and, in turn, conveyed to Clow's closed loop cooling system or to the point of final sanitary sewer discharge (constructed outfall manhole) via transfer pump. In order to protect the conveyance system lines from freezing, pipes would be installed within an engineered trench at a bed depth that would be below the anticipated frost line (approximately 3 feet).

The discharged ground water would be treated in the local POTW along with other wastewater received by the POTW. The POTW requires a regular effluent monitoring program as a permit condition. It is anticipated that the combined well effluent would be sampled and analyzed by the POTW for inorganics on a quarterly basis through an off-site manhole constructed specifically for this purpose.

4.1.3 Institutional Controls and Ground Water Monitoring

This alternative would also incorporate implementation of institutional controls. These controls, such as ground water use restrictions and ground water monitoring, would be used as the main mechanisms for eliminating the potential ground water exposure pathway while extraction is occurring. Proposed use restriction language is presented in Appendix B. Ground water monitoring will be in accordance with the Corrective Measures Ground Water Monitoring Plan in Appendix C.
Pursuant with OAC 3745-27-10 (F)(2)(d), the corrective measure selected by the Director will need to comply with the standards for management of wastes as specified in OAC 3745-27-10 (F) (13). The estimated implementation schedule is presented below.

- Initiation of Field Activities: Day 0
- Extraction Well Installation: Day 0 – 20
- Transfer Building Construction: Day 20 – 40
- Conveyance Line Construction: Day 10 – 60
- Outfall Construction: Day 50 – 60
- Extraction System Startup/Shakedown: Day 60 – 70
- Operational Period: Day 70 – until closure

Any permits, contract bids, etc. associated with the corrective measures will be applied for prior to the start of this schedule and acquired in a timely manner as to assure that the above schedule is adhered to as closely as possible.
Section 6

Corrective Measures Ground Water Monitoring Plan

Pursuant with OAC 3745-27-10 (F)(2)(e), this CMP supplement contains a Corrective Measures Ground Water Monitoring Plan that identifies specific ground water monitoring requirements to monitor the effectiveness of the corrective measures. The Corrective Measures Ground Water Monitoring Plan contains provisions

(i) for determining semiannually, the ground water remediation standards established in accordance with paragraph (F)(7) of this OAC 3745-27-10 are achieved for those contaminants determined to have been released to ground water;

(ii) for semi-annual monitoring for the presence above background levels of parameters numbered 1-66 of appendix R of this rule determined not to have been released to ground water; and

(iii) which meet the applicable provisions of paragraphs (B) to (D) of 3745-27-10.

The Corrective Measures Ground Water Monitoring Plan is presented as Appendix C.

6.1 Semi-annual Determination of Chemicals of Concern

For the Clow CMP, a concentration level is proposed for each landfill-derived constituent detected in ground water at a statistically significant level. A statistical comparison to background has established that 21 landfill-derived constituents have been consistently detected (a constituent detected in more than 50% of the sampling events in any one year at any one well) in statistically significant concentrations (exceeding calculated background) in the compliance point wells. These landfill-derived constituents (chemicals of concern) are

- Aluminum;
- Antimony;
- Arsenic;
- Barium;
- Cadmium;
- Chloride;
- Chromium (total);
- Copper;
- Cyanide;
- 1,1-Dichloroethane;
- Iron;
- Fluoride;
- Lead;
- Manganese;
- Nickel;
- Nitrogen, ammonia;
- Phosphorus;
- Potassium;
- Sodium;
- Sulfate; and
- Zinc.

Other monitored constituents are not statistically significant because they have not been consistently detected during post-closure assessment monitoring in compliance point wells or in wells further downgradient. The post-closure monitoring began in 1997 and has routinely analyzed ground water samples for 15 inorganic parameters, 20 metals, 59 volatile organic compounds (VOCs), 105 semi-volatile organic compounds (SVOCs), 31 pesticides and herbicides, and four radiological parameters.

### 6.2 Semi-annual Monitoring

Semi-annual monitoring will be performed to monitor for the presence, above background levels, of compounds numbered 1-66 of Appendix I of this rule. The Appendix I compounds are as follows:

<table>
<thead>
<tr>
<th>COMPOUND</th>
<th>CAS RN (note 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Antimony</td>
<td>See note 2</td>
</tr>
<tr>
<td>2) Arsenic</td>
<td>See note 2</td>
</tr>
<tr>
<td>3) Barium</td>
<td>See note 2</td>
</tr>
<tr>
<td>4) Beryllium</td>
<td>See note 2</td>
</tr>
<tr>
<td>5) Cadmium</td>
<td>See note 2</td>
</tr>
<tr>
<td>6) Chromium</td>
<td>See note 2</td>
</tr>
<tr>
<td>COMPOUND</td>
<td>CAS RN (note 1)</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>7) Cobalt</td>
<td>See note 2</td>
</tr>
<tr>
<td>8) Copper</td>
<td>See note 2</td>
</tr>
<tr>
<td>9) Lead</td>
<td>See note 2</td>
</tr>
<tr>
<td>10) Nickel</td>
<td>See note 2</td>
</tr>
<tr>
<td>11) Selenium</td>
<td>See note 2</td>
</tr>
<tr>
<td>12) Silver</td>
<td>See note 2</td>
</tr>
<tr>
<td>13) Thallium</td>
<td>See note 2</td>
</tr>
<tr>
<td>14) Vanadium</td>
<td>See note 2</td>
</tr>
<tr>
<td>15) Zinc</td>
<td>See note 2</td>
</tr>
<tr>
<td>16) Acetone</td>
<td>67-64-1</td>
</tr>
<tr>
<td>17) Acrylonitrile</td>
<td>107-13-1</td>
</tr>
<tr>
<td>18) Benzene</td>
<td>71-43-2</td>
</tr>
<tr>
<td>19) Bromochloromethane</td>
<td>74-97-5</td>
</tr>
<tr>
<td>20) Bromodichloromethane</td>
<td>75-27-4</td>
</tr>
<tr>
<td>21) Bromoform; Tribromomethane</td>
<td>75-25-2</td>
</tr>
<tr>
<td>22) Carbon disulfide</td>
<td>75-15-0</td>
</tr>
<tr>
<td>23) Carbon tetrachloride</td>
<td>56-23-5</td>
</tr>
<tr>
<td>24) Chlorobenzene</td>
<td>108-90-7</td>
</tr>
<tr>
<td>25) Chloroethane; Ethyl chloride</td>
<td>75-00-3</td>
</tr>
<tr>
<td>26) Chloroform; Trichloromethane</td>
<td>67-66-3</td>
</tr>
<tr>
<td>27) Dibromochloromethane; Chlorodibromomethane</td>
<td>124-48-1</td>
</tr>
<tr>
<td>28) 1,2-Dibromo-3-chloropropene; DBCP</td>
<td>96-12-8</td>
</tr>
<tr>
<td>29) 1,2 Dibromoethane; Ethylene dibromide; EDB</td>
<td>106-93-4</td>
</tr>
<tr>
<td>30) o-Dichlorobenzene; 1,2-Dichlorobenzene</td>
<td>95-50-1</td>
</tr>
<tr>
<td>31) p-Dichlorobenzene; 1,4-Dichlorobenzene</td>
<td>106-46-7</td>
</tr>
<tr>
<td>32) trans-1,4-Dichloro-2-butene</td>
<td>110-57-6</td>
</tr>
<tr>
<td>33) 1,1-Dichloroethane; Ethylidene chloride</td>
<td>75-34-3</td>
</tr>
<tr>
<td>34) 1,2-Dichloroethane; Ethylidene dichloride</td>
<td>107-06-2</td>
</tr>
<tr>
<td>35) 1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride</td>
<td>75-35-4</td>
</tr>
<tr>
<td>36) cis-1,2-Dichloroethylene; cis-1,2-Dichloro-ethane</td>
<td>156-59-2</td>
</tr>
<tr>
<td>37) trans-1,2-Dichloroethylene; trans-1,2-Dichloro-ethane</td>
<td>156-60-5</td>
</tr>
<tr>
<td>38) 1,2-Dichloropropane; Propylene dichloride</td>
<td>78-87-5</td>
</tr>
<tr>
<td>39) cis-1,3-Dichloro propane; 10061-01-5</td>
<td></td>
</tr>
<tr>
<td>40) trans-1,3-Dichloro propane; 10061-02-6</td>
<td></td>
</tr>
</tbody>
</table>
### APPENDIX I

<table>
<thead>
<tr>
<th>COMPOUND</th>
<th>CAS RN (note 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>41) Ethylbenzene</td>
<td>100-41-4</td>
</tr>
<tr>
<td>42) 2-Hexanone; Methyl butyl ketone</td>
<td>591-78-6</td>
</tr>
<tr>
<td>43) Methyl bromide; Bromomethane</td>
<td>74-83-9</td>
</tr>
<tr>
<td>44) Methyl chloride; Chloromethane</td>
<td>74-87-3</td>
</tr>
<tr>
<td>45) Methylene bromide; Dibromomethane</td>
<td>74-95-3</td>
</tr>
<tr>
<td>46) Methylene chloride; Dichloromethane</td>
<td>75-09-2</td>
</tr>
<tr>
<td>47) Methyl ethyl ketone; MEK; 2-Butanone</td>
<td>78-93-3</td>
</tr>
<tr>
<td>48) Methyl iodide; Iodomethane</td>
<td>74-88-4</td>
</tr>
<tr>
<td>49) 4-Methyl-2-pentanone; Methyl isobutyl ketone</td>
<td>108-10-1</td>
</tr>
<tr>
<td>50) Styrene</td>
<td>100-42-5</td>
</tr>
<tr>
<td>51) 1,1,1,2-Tetrachloroethane</td>
<td>630-20-6</td>
</tr>
<tr>
<td>52) 1,1,2,2-Tetrachloroethane</td>
<td>79-34-5</td>
</tr>
<tr>
<td>53) Trichloroethylene; Tetrachloroethene; Perchloroethylene</td>
<td>127-18-4</td>
</tr>
<tr>
<td>54) Toluene</td>
<td>108-88-3</td>
</tr>
<tr>
<td>55) 1,1,1-Trichloroethane; Methyl chloroform</td>
<td>71-55-6</td>
</tr>
<tr>
<td>56) 1,1,2-Trichloroethane</td>
<td>79-00-5</td>
</tr>
<tr>
<td>57) Trichloroethylene; Trichloroethene</td>
<td>79-01-6</td>
</tr>
<tr>
<td>58) Trichlorofluoromethane; CFC-11</td>
<td>75-69-4</td>
</tr>
<tr>
<td>59) 1,2,3-Trichloropropane</td>
<td>96-18-4</td>
</tr>
<tr>
<td>60) Vinyl acetate</td>
<td>108-05-4</td>
</tr>
<tr>
<td>61) Vinyl chloride</td>
<td>75-01-4</td>
</tr>
<tr>
<td>62) Xylenes</td>
<td>See note 3</td>
</tr>
<tr>
<td>63) Ammonia</td>
<td>7664-41-7</td>
</tr>
<tr>
<td>64) Chloride</td>
<td>16887006</td>
</tr>
<tr>
<td>65) Sodium</td>
<td>7440-23-5</td>
</tr>
<tr>
<td>66) Potassium</td>
<td>7440-09-7</td>
</tr>
</tbody>
</table>

**Notes:**

Note 1: Chemical Abstract Service registry number.

Note 2: Analysis for these compounds shall be representative of the quality background water that has not been affected by past or present operations at the sanitary landfill facility and representative of the quality of ground water passing directly downgradient of the limits of solid waste placement.

Note 3: Xylene (total); this entry includes o-xylene (CAS RN 96-47-6), m-xylene (CAS RN 108-38-3), p-xylene (CAS RN 106-42-3), and unspecified xylenes (dimethylbenzenes (CAS RN 1330-20-7).
In addition to the Appendix I list of compounds, semi-annual monitoring will include the following seven additional compounds that have been identified as chemicals of concern:

<table>
<thead>
<tr>
<th>COMPOUND</th>
<th>CAS RN (note 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>67) Aluminum</td>
<td>7429905</td>
</tr>
<tr>
<td>68) Iron</td>
<td>7439896</td>
</tr>
<tr>
<td>69) Manganese</td>
<td>7439965</td>
</tr>
<tr>
<td>70) Phosphorus</td>
<td>12185103</td>
</tr>
<tr>
<td>71) Sulfate</td>
<td>14808798</td>
</tr>
<tr>
<td>72) Cyanide</td>
<td>57125</td>
</tr>
<tr>
<td>73) Fluoride</td>
<td>7782414</td>
</tr>
</tbody>
</table>

Notes:
Note 1: Chemical Abstract Service registry number.

6.3 Other Applicable Provisions

The applicable provisions, that have not already been met, of OAC 3745-27-10 (B) monitoring wells/systems; OAC 3745-27-10 (C) statistics; and OAC 3745-27-10 (D) detection monitoring plan are addressed in the Corrective Measures Ground Water Monitoring Plan presented in Appendix C; the Ground Water Detection Monitoring Plan; and the Ground Water Sampling and Analysis Plan presented in Appendix E.
Section 7
Operational Monitoring

The operational monitoring parameters include all 21 chemicals of concern (below table) identified at the Clow facility during post-closure assessment monitoring.

Results for constituents of concern from sampling and analysis of L-4 and the combined extraction well effluent will also be plotted to help evaluate trends in the limit of solid waste placement wells.

Semi-Annual Operational Monitoring Parameter List
(Monitoring Wells D-2, D-3, D-8, D-9, D-10, L-4, L-6, S-4, and Combined EW Effluent)
Clow Water Systems Company
Coshocton, Ohio

<table>
<thead>
<tr>
<th>#</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aluminum</td>
</tr>
<tr>
<td>2</td>
<td>Antimony</td>
</tr>
<tr>
<td>3</td>
<td>Arsenic</td>
</tr>
<tr>
<td>4</td>
<td>Barium</td>
</tr>
<tr>
<td>5</td>
<td>Cadmium</td>
</tr>
<tr>
<td>6</td>
<td>Chloride</td>
</tr>
<tr>
<td>7</td>
<td>Chromium (total)</td>
</tr>
<tr>
<td>8</td>
<td>Copper</td>
</tr>
<tr>
<td>9</td>
<td>Cyanide</td>
</tr>
<tr>
<td>10</td>
<td>1,1-Dichloroethane</td>
</tr>
<tr>
<td>11</td>
<td>Fluoride</td>
</tr>
<tr>
<td>12</td>
<td>Iron</td>
</tr>
<tr>
<td>13</td>
<td>Lead</td>
</tr>
<tr>
<td>14</td>
<td>Manganese</td>
</tr>
<tr>
<td>15</td>
<td>Nickel</td>
</tr>
<tr>
<td>16</td>
<td>Nitrogen, ammonia</td>
</tr>
<tr>
<td>17</td>
<td>Phosphorus</td>
</tr>
<tr>
<td>18</td>
<td>Potassium</td>
</tr>
<tr>
<td>19</td>
<td>Sodium</td>
</tr>
<tr>
<td>20</td>
<td>Sulfate</td>
</tr>
<tr>
<td>21</td>
<td>Zinc</td>
</tr>
</tbody>
</table>
7.1.1 Off-Site Migration

The analytical results from downgradient monitoring wells (D-2, D-3, D-8, D-9, and D-10) will be evaluated to determine if any constituents of concern exceed concentration levels. If the evaluation indicates that constituents of concern are migrating off-site, the potentially affected landowners will be notified in accordance with OAC 37445-27-10 (E)(11).

7.1.2 Extraction Well Evaluation

Semi-annual static water levels will be evaluated to determine if each extraction well is operating properly. If excessive drawdown is observed in individual extraction wells, the pump will be pulled and inspected. Required maintenance of pumps and/or wells will be performed.

Based upon concentration trends, individual exterior extraction wells may be sampled for the 21 constituents of concern. If all of the constituents of concern are below their concentration level, the exterior well pump will be shut off and left off until the next sampling event. If constituents of concern are detected above concentration levels at this next sampling event, the exterior extraction well will be restarted and remain on until future sampling indicates that no constituents of concern are present above their concentration level. If constituents of concern are not detected above their concentration level, the pump will be left off and resampled during the next sampling event. The pump will be restarted based on any detection of a constituent of concern above its concentration level.

If the third sampling event confirms the absence of constituents of concern above their concentration levels, the pumps will be left off. Annual confirmation sampling for the constituents of concern will be performed at each well that has been shut off unless the new exterior extraction well has been sampled and the results show no detections of constituents of concern above concentration levels.

In summary, the criteria for early shutdown of individual extraction wells* is as follows:

- Decreasing trends in operational and/or performance monitoring wells.
- All COCs within the individual extraction well are below respective concentration levels.
- Extraction well temporarily shut off.
- All COCs in the extraction well remain below respective concentration levels for three consecutive events.
- Individual extraction well permanently shut down.
*Note, the criteria apply initially to wells on the periphery of the capture zone and then may progress towards wells within the case of the capture zone. Clow may request a return to detection monitoring following shutdown of all extraction wells if all COCs detected within unit boundary wells are below respective concentration levels for three consecutive years.
<table>
<thead>
<tr>
<th>CHEMICAL OF CONCERN</th>
<th>CONCENTRATION LEVEL (µg/L)</th>
<th>BASIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>525</td>
<td>Background Ambient Average</td>
</tr>
<tr>
<td>Antimony</td>
<td>6.0</td>
<td>MCL</td>
</tr>
<tr>
<td>Arsenic</td>
<td>50</td>
<td>MCL</td>
</tr>
<tr>
<td>Barium</td>
<td>2,000</td>
<td>MCL</td>
</tr>
<tr>
<td>Cadmium</td>
<td>5.0</td>
<td>MCL</td>
</tr>
<tr>
<td>Chloride</td>
<td>250,000</td>
<td>SMCL-aesthetic</td>
</tr>
<tr>
<td>Chromium (total)</td>
<td>100</td>
<td>MCL</td>
</tr>
<tr>
<td>Copper</td>
<td>180</td>
<td>Background Ambient Average</td>
</tr>
<tr>
<td>Cyanide</td>
<td>200</td>
<td>MCL</td>
</tr>
<tr>
<td>1,1-Dichloroethane</td>
<td>1,400</td>
<td>MCL</td>
</tr>
<tr>
<td>Fluoride</td>
<td>4,000</td>
<td>MCL</td>
</tr>
<tr>
<td>Iron</td>
<td>16,000</td>
<td>Background Ambient Average</td>
</tr>
<tr>
<td>Lead</td>
<td>15</td>
<td>Treatment Derived</td>
</tr>
<tr>
<td>Manganese</td>
<td>3,700</td>
<td>Background Ambient Average</td>
</tr>
<tr>
<td>Nickel</td>
<td>100</td>
<td>Ohio MCL</td>
</tr>
<tr>
<td>Nitrogen, ammonia</td>
<td>1,700</td>
<td>Background Ambient Average</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>6,000</td>
<td>Background Ambient Average</td>
</tr>
<tr>
<td>Potassium</td>
<td>31,000</td>
<td>Background Ambient Average</td>
</tr>
<tr>
<td>Sodium</td>
<td>120,000</td>
<td>SMCL-aesthetic</td>
</tr>
<tr>
<td>Sulfate</td>
<td>470,000</td>
<td>Background Ambient Average</td>
</tr>
<tr>
<td>Zinc</td>
<td>5,000</td>
<td>SMCL</td>
</tr>
</tbody>
</table>
SOURCE:
BASE MAP DEVELOPED FROM THE WILLS CREEK, OHIO
7.5 MINUTE U.S.G.S. TOPOGRAPHIC QUADRANGLE
MAP, DATED 1962, PHOTOREVISED 1985
APPROXIMATE SCALE IN FEET

CLOW WATER SYSTEMS COMPANY
COSHOCTON, OHIO

FIGURE 1
SITE LOCATION MAP

DRAWN BY: MJB
APPROVED BY: JAH
PROJECT NUMBER: 00-05809.09
FILE NUMBER: 58090901.DWG
DATE: AUGUST 2004
GROUNDWATER EXTRACTION WELL (TYP)

WELLHEAD COMPLETION (TYP)

CLOW WATER SYSTEMS
COSHOCTON, OHIO

NOT TO SCALE

CLOVER WATER SYSTEMS
COSHOCTON, OHIO

GENERAL EXTRACITION WELL CONSTRUCTION DIAGRAM

DRAWN BY: CM
APPROVED BY: BSS
PROJECT NUMBER: 5809.09
FILE NUMBER: 58090903.DWG
DATE: AUGUST 2004

FIGURE 3
North direction is to the left of the page. Scale is in feet.

Figure 4  Plan view of capture zone, North Landfill, Clow facility, eight wells pumping at a combined rate of 32 gpm
Appendix A

References


Appendix B

Proposed Use Restriction
ATTACHMENT A

USE RESTRICTION AGREEMENT

This Use Restriction Agreement ("Agreement") is entered into by Clow Water Systems Company, a Division of McWane, Inc., having offices at 2266 South Sixth Street, Coshocton, Ohio 43812 and the Ohio Environmental Protection Agency ("Ohio EPA"). This Agreement concerns [an approximately _____ (__) acre tract of real property OR parcels numbered _______] owned by Clow Water Systems Company, a Division of McWane, Inc. ("Owner") and located at 2266 South Sixth Street, Coshocton, Ohio 43812.

[Insert appropriate background information here].

For purposes of this Agreement, the Subject Property is defined in Exhibit A, which is a metes and bounds description of the Subject Property, attached hereto and incorporated by reference herein.

Now therefore, Owner and Ohio EPA (the "Parties") agree to the following:

1. **Intention of the Parties.** This Agreement touches and concerns the Subject Property in that it is intended to limit the use of the Subject Property and restrict certain activities from occurring on the Subject Property. It is also the intent of the Parties that the covenants, terms, conditions and restrictions of this Agreement be binding upon, and inure to the benefit of, the Parties and continue as a servitude running in perpetuity with the Subject Property. It is the further intention of the Parties that the ground water use restriction described herein be enforceable at law or in equity by Ohio EPA against Owner for as long as Owner shall own the Subject Property, and against any Transferee, as defined herein.

2. **Use Restrictions.** As part of the closure and corrective measures at the Subject Property and in consideration for the Director of Ohio EPA's forbearance to require unrestricted land use for the Subject Property, Owner agrees to impose and comply with the following restrictions:

   The ground water underlying the Subject Property or any portion of the Subject Property shall not be extracted for any potable use.

3. **Running with the Land.** The covenants, terms, conditions, and restrictions of this Agreement shall be binding upon, and inure to the benefit of, the Owner and the State of Ohio and their successors in interest and assigns and any Transferee, and shall run with the land, subject to termination and modification as described below.
The term "Transferee," as used in this Agreement, shall mean any future owner of any interest in the Subject Property, including, but not limited to, owners of an interest in fee simple, mortgagees, easement holders, and/or lessees.

4. **Modification and Termination of the Agreement.** The Owner or a Transferee may request modification or termination of this Agreement by submitting a written petition to the Director of Ohio EPA. Modification means any changes to the Agreement, including the use restrictions outlined in Section 2 above, or the elimination of one or more use restrictions when there is at least one use restriction remaining. Termination means the elimination of all use restrictions in Section 2 and all other obligations under this Agreement. The Director of Ohio EPA will evaluate a request for modification or termination of the Agreement based on a demonstration by the Owner or Transferee that the proposed modification or termination of this Agreement will not pose a risk to public health or safety or the environment.

The Director of Ohio EPA may request modification or termination of this Agreement in the event that the Director determines that risks posed by the Subject Property have substantially changed subsequent to the execution of this Agreement. Nothing in this Agreement shall restrict the Director from exercising any authority under applicable law in order to protect public health or safety or the environment.

This Agreement may only be modified or terminated by a written instrument duly executed by the Director of Ohio EPA and the Owner or the Transferee of the Subject Property or portion of the Subject Property, as applicable. Within thirty (30) days of executing a modification or termination of this Agreement, the Owner or Transferee shall record such modification or termination with the Coshocton County Recorder's Office, and shall provide a true copy of the recorded modification or termination to Ohio EPA.

5. **Enforcement.** Compliance with this Agreement may be enforced by a legal or equitable action brought in a court of competent jurisdiction by either Party to this Agreement. The use restrictions contained in Section 2 of this Agreement may be enforced by the Owner, the Director of Ohio EPA or his representative and any other party with legal standing by bringing a legal or equitable action in a court of competent jurisdiction. Failure to timely enforce compliance with this Agreement or the use restrictions contained herein by any party shall not bar subsequent enforcement by such party and shall not be deemed a waiver of the party's right to take action to enforce any non-compliance.

6. **Restatement of Use Restriction upon Conveyance.** Each instrument hereafter conveying any interest in the Subject Property or any portion of the Subject Property shall contain a restatement of the use restrictions contained in Section 2 of this Agreement, and provide the recorded location of this Agreement. The restatement shall be substantially in the following form:
THE INTEREST CONVEYED HEREBY IS SUBJECT TO A USE RESTRICTION AGREEMENT, DATED __________, 200_, RECORDED IN THE DEED OR OFFICIAL RECORDS OF THE COSHOCTON COUNTY RECORDER ON __________, 200_, IN [DOCUMENT ____, or BOOK ____, PAGE ____] IN FAVOR OF, AND ENFORCEABLE BY, THE STATE OF OHIO. THE AGREEMENT CONTAINS THE FOLLOWING USE RESTRICTIONS: THE GROUND WATER UNDERLYING THE SUBJECT PROPERTY OR ANY PORTION OF THE SUBJECT PROPERTY SHALL NOT BE EXTRACTED FOR ANY POTABLE USE.

7. **Authority.** Owner hereby covenants and warrants to and with the State of Ohio the following: that the Owner is lawfully seized in fee simple of the Subject Property; that the Owner has a good and lawful right and power to sell and convey it or any interest therein; that the Owner has identified and notified all other parties that hold any interest (e.g., encumbrance) in the Subject Property; that the use restrictions contained herein are compatible with such interests held by all other parties; and that the Owner will forever defend the title and quiet possession of the Subject Property.

8. **Severability.** If any provision of this Agreement is found to be unenforceable in any respect, the validity, legality, and enforceability of the remaining provisions shall not in any way be affected or impaired.

9. **Governing Law.** This Agreement shall be governed by and interpreted in accordance with the laws of the State of Ohio.

10. **Effective Date.** The effective date of this Agreement shall be the date upon which both the Owner and Ohio EPA have signed the Agreement.
The undersigned representative of Owner represents and certifies that he/she is authorized to execute this Agreement.

IT IS SO AGREED:

Clow Water Systems Company, a Division of McWane, Inc.

________________________
Signature of Owner

________________________
Printed Name and Title

________________________
Date

OHIO ENVIRONMENTAL PROTECTION AGENCY

Christopher Jones, Director

________________________
Date

State of __________________________: ss

County of __________________________: ss

Before me, a notary public, in and for said county and state, personally appeared __________________________, a duly authorized representative of __________________________, who acknowledged to me that he/she did execute the foregoing instrument on behalf of __________________________.

IN TESTIMONY WHEREOF, I have subscribed my name and affixed my official seal this ______ day of ______, 20____.

________________________
Notary Public

This instrument prepared by: __________________________
Appendix C
Corrective Measures Ground Water Monitoring Plan
Corrective Measures Ground Water Monitoring Plan

Clow Water Systems Company
Coshocton, Ohio

September 29, 2004
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   2.3 Well Development ................................................................................................. C-7
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<th>Description</th>
</tr>
</thead>
<tbody>
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</tr>
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</tr>
</tbody>
</table>
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This Corrective Measures Ground Water Monitoring Plan provides a basis to determine the effectiveness of the corrective measures pursuant to OAC 3745-27-10 (F)(2)(e), as in effect on the date of this submittal. It contains provisions:

- for determining semi-annually whether the ground water remediation standards established in accordance with OAC 3745-27-10 (F)(7) have been achieved for those contaminants determined to have been released to ground water;
- for semi-annual monitoring for the presence above background levels of parameters numbered 1-66 in OAC-3745-27-10 Appendix I determined not to have been released to ground water; and
- which meet the applicable provisions of OAC 3745-27-10 (B) to (D).

1 All references herein to the Ohio Administrative Code refer to the code in effect on the date of this submittal.
Section 2
Ground Water Monitoring System

2.1 General

A copy of the Corrective Measures Ground Water Monitoring Plan will be kept at the facility at all times and will be available for inspection. Currently, 27 wells are in-place around the Clow Water Systems Company (Clow) Landfill. Six of these wells will be used as ground water monitoring wells in the uppermost aquifer and an additional 18 ground water wells in the uppermost aquifer at the site will be used for static water level measurements. The three remaining wells have historically been dry and will be abandoned during installation of the extraction well system. A summary of the monitoring wells screened in the uppermost aquifer that will be used to generate a potentiometric surface map after each data collection event is presented in Table C-1. This table presents the purpose, location, current ground elevation, and well intake elevation for each well.

All 27 ground water well locations are illustrated on Figure C-1. Upgradient wells screened in the uppermost aquifer are A-6, D-6, and D-7. Sidegradient wells screened within the uppermost aquifer are B-0, B-5 and L-6. Downgradient wells screened in the uppermost aquifer are A-7, D-1, D-2, D-3, D-8, D-9, D-10, D-11, E-1, E-2, E-3, E-4, L-1, L-2, L-3, S-1, S-2, S-3, and S-4. Wells within the waste units are L-4 and L-5 (between the solid and hazardous waste units). Wells to be abandoned are D-1, D-11, and L-1.

A summary of wells by type is presented in Table C-1. In addition to the wells summarized in Table 1, eight purge wells will be located downgradient of the landfill boundary. Purge well construction is addressed in the Corrective Measures Plan Supplement (CPMS).

Static water level measurements will be conducted before sampling each of the 6 monitoring/effectiveness wells. In addition, static water level measurements will be made at 8 water level only wells to verify direction of ground water flow beneath the landfill. Pumping levels will be measured in each extraction well to help evaluate well performance.

If semiannual ground water elevation measurements and ground water flow calculations indicate that the monitoring wells at the site are insufficient to provide adequate ground water quality data or provide evidence of a release per OAC 3745-27-10 (B)(5), additional wells will be installed to satisfy these requirements.
2.2 Well Construction

Site monitoring wells were constructed with 2-inch or 3.75-inch ID Schedule 40 PVC casing, 10-foot or 15-foot PVC screens with 0.01-inch slot size, and locking, steel, 5-foot protective casings and locks or flush-mount protective casings and locks. The protective casings extend approximately 2.5 feet above ground surface (bgs) and are fitted with a slip-on cap and vent hole. Boring logs and construction diagrams for existing monitoring wells screened in the uppermost aquifer are provided as an attachment to the Ground Water Sampling and Analysis Plan presented as Appendix E of this CMPS.

The top of the PVC well casing or the top of the pump cap (applicable to wells with dedicated pumps only) were surveyed to within 0.01 foot at each monitoring well; the ground surface was surveyed to 0.01 foot. The survey results for all 24 ground water wells, with horizontal and vertical coordinates, are summarized in Table C-1.
Table C-1
Summary of Ground Water Wells Screened in the Uppermost Aquifer
Clow Water Systems Company
Coshocton, Ohio

<table>
<thead>
<tr>
<th>MONITORING WELL/BORING</th>
<th>TYPE</th>
<th>INSIDE DIAMETER (inches)</th>
<th>LOCATION</th>
<th>CURRENT GROUND SURFACE ELEVATION (feet NGVD)</th>
<th>TOP OF CASING ELEVATION (feet NGVD)</th>
<th>WELL INTAKE ELEVATION (feet NGVD)</th>
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<tr>
<td>A-6</td>
<td>Upgradient Monitoring</td>
<td>3.75</td>
<td>5388.94</td>
<td>5031.16</td>
<td>772.60</td>
<td>775.27</td>
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<td>A-7</td>
<td>Water Level</td>
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<td>4874.60</td>
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<td>B-0</td>
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<td>MONITORING WELL/BORING</td>
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<td>INSIDE DIAMETER (inches)</td>
<td>LOCATION</td>
<td>CURRENT GROUND SURFACE ELEVATION (feet NGVD)</td>
<td>TOP OF CASING ELEVATION (feet NGVD)</td>
<td>WELL INTAKE ELEVATION (feet NGVD)</td>
</tr>
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<td>4986.67</td>
<td>4145.71</td>
<td>765.26</td>
<td>767.76</td>
<td>735-725</td>
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<td>S-2 Downgradient Monitoring</td>
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<td>4216.77</td>
<td>766.22</td>
<td>768.57</td>
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<td>S-3 Water Level</td>
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<td>4741.48</td>
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<td>714-709</td>
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<td>S-4 Water Level</td>
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<td>4730.09</td>
<td>4594.58</td>
<td>768.73</td>
<td>769.08</td>
<td>703-698</td>
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<td>Each EW Pumping Water Level</td>
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<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Notes:
NS means not surveyed.
N/A means not applicable.
EW means extraction wells.
If additional wells are needed, all downhole drilling equipment will be cleaned prior to use in each boring location with a high-temperature high-pressure sprayer. Downhole soil sampling equipment will be cleaned before use with a high-temperature high-pressure sprayer. Between samples at a boring, the sampling equipment will be cleaned by scraping away soil, washing with a non-phosphate detergent, and rinsing in clean water.

Future wells will be installed in accordance with the following procedures. After the borehole is drilled, cleaned out, and the borehole is stabilized, the well riser pipe and screen are placed within the borehole. Filter sand is added either by gravity or tremie pipe and extends approximately 1 foot above the top of the well screen. A minimum of 3-foot seal of bentonite pellets is added by gravity above the sandpack. The remaining annular space is filled with a thick bentonite grout. Risers extend approximately 2 feet above the ground surface if not constructed as flush mount wells. The depth of the filter sand, bentonite seal, and annular space seal are carefully measured to 0.1 feet prior to the installation of the next layer. The risers have a vented cap. For permanent wells, a locking steel protective casing is stabilized in place with a square concrete pad sloping away from the casing. A weep hole is drilled at the base of the protective casing just above the concrete pad if not flush mount construction.

2.3 Well Development

If new wells are installed, ground water monitoring wells will be developed by mild surging and pumping within 2 weeks of completion but no sooner than 48 hours after grouting is completed. Development will continue until turbidity, temperature, pH, and conductivity of development water stabilize so that each parameter exhibits a relative change of 10 percent or less after removal of two consecutive well casing volumes. At least 10 well casing volumes will be removed during development. Development data will be recorded on a Well Development Data Sheet, an example form is attached in Attachment A of Appendix E.

If a pump is used it will be decontaminated by submersing in and pumping through a soapy water solution, followed by a potable water rinse. If a bailer is used, it will be decontaminated by scrubbing with a brush and soapy water solution, followed by a potable water rinse. Development water will be collected in buckets of known volume (generally 5-gallon buckets), covered to minimize spilling, then transported to and deposited into the Clow water treatment system.

2.4 Well Abandonment

If wells in the program are abandoned, they will be properly plugged and abandoned according to the following procedures which are consistent with OAC 3745-27-09:
Monitoring wells not known to be constructed with an impermeable annular space seal will be abandoned by removing the protective cover pipe and the ground surface seal and by either breaking or pushing off the bottom cap and then completely removing the well casing. The well casing will be pulled out of the ground as the well is filled with bentonite grout by tremie pipe. If the well is greater than 100-feet deep, it will be sealed by a tremie pipe-pump method. The well casing may be removed by pulling the well casing out of the ground or by drilling out the well casing completely, using over-drilling methods. If the well casing is to be removed, the well will be sealed as the casing is removed.

If the monitoring well is constructed with an impermeable annular space seal and is not expected to pose a potential for interconnection between aquifers, the well can be abandoned by filling (as above) without removing the well casing. In this case, the well casing will be cut off at least 30 inches below the ground surface. In both cases, settling of the sealant material will be topped off.

Per the Ohio Environmental Protection Agency (Ohio EPA) Technical Guidance Manual for Hydrogeologic Investigation and Ground Water Monitoring (1995), proper abandonment of the monitoring wells will be documented and reported to the Ohio EPA Southeast District office (SEDO). The documentation will include the following:

- Well Identification
- Registration Number
- Owner
- Location
- Well Construction Details
- Date, time, and person responsible, and contractor/consultant performing the work
- Authority under which the abandonment was performed
- Procedures and materials (including predicted and actual volumes of grout, and an explanation of any discrepancies between them)
- Methods/procedures for disposal of any contaminated material

Additionally, a water sealing report will be filed with the Ohio Department of Natural Resources (ODNR), and a copy will be included with the abandonment report to the Ohio EPA SEDO.
Section 3
Monitoring Parameters

The monitoring parameters for the ground water monitoring program are listed in Table C-2.

The detection monitoring parameters include all of the parameters in OAC 3745-27-10, Appendix I and seven additional parameters detected previously identified as chemicals of concern (#67-#73 in Table C-2) at the Clow facility during post-closure assessment monitoring.

Table C-2
Semi-Annual Ground Water Detection Monitoring Parameter List
(Monitoring Wells A-6, D-6, L-2, L-3, S-1, and S-2)
Clow Water Systems Company
Coshocton, Ohio

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<td>2</td>
<td>Acrylonitrile</td>
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<td>3</td>
<td>Aluminum*</td>
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<td>4</td>
<td>Ammonia*</td>
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<tr>
<td>5</td>
<td>Antimony*</td>
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<tr>
<td>6</td>
<td>Arsenic*</td>
</tr>
<tr>
<td>7</td>
<td>Barium*</td>
</tr>
<tr>
<td>8</td>
<td>Benzene</td>
</tr>
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<td>9</td>
<td>Beryllium</td>
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<tr>
<td>10</td>
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<td>Bromodichloromethane</td>
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<td>Bromomethane</td>
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<td>Cadmium*</td>
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Notes:
* = Chemical of Concern.
Section 4

Sampling and Analysis Plan

A detailed description of the sampling and analysis plan is provided in the Clow Ground Water Sampling and Analysis Plan (Appendix E of this CMPS).
Section 5

Quality Assurance/Quality Control Plan

A detailed description of the Quality Assurance/Quality Control Plan is provided in the Clow Ground Water Sampling and Analysis Plan (Appendix E of this CMPS).
Section 6
Establishing Background Quality

Background upgradient ground water quality in the uppermost aquifer will be established at the site by analyzing ground water from upgradient wells A-6 and D-6. If water levels measured in site wells indicate that A-6 and D-6 are not upgradient, the wells included in the background database will be revised, and, if necessary, new well locations will be proposed.

The background value will be calculated annually from the background database for any of the monitoring parameters (Table C-2) that are not chemicals of concern and which are detected above laboratory reporting limits during the current year. The background database will be screened for outliers and trends. The background database will include the most recent eight rounds from each upgradient well.

For chemicals of concern, concentration levels have been established without use of background values except for aluminum, copper, iron, manganese, nitrogen-ammonia, phosphorus, potassium, and sulfate which were set at a value halfway between the highest site background value and the maximum statewide ambient values for sand and gravel as reported in Table 3. Ambient Network Data Summary (Ohio EPA, 2000). If the highest background value is exceeded for these parameters, the halfway value will be recalculated. The highest background values used in the calculations are shown below:

- Aluminum ...................... 3.3 mg/L
- Copper ......................... 0.14 mg/L
- Iron ............................ 2.19 mg/L
- Manganese ..................... 2.23 mg/L
- Nitrogen-ammonia ......... 0.25 mg/L
- Phosphorus ..................... 2.0 mg/L
- Potassium ...................... 5.68 mg/L
- Sulfate ......................... 293 mg/L
The parameters exceeding concentration levels in any given year will be evaluated in accordance with the following procedures. In accordance with OAC 3745-27-10 (C)(7), Clow will determine whether or not there is a statistically significant increase from the background data set for each of the these parameters. Within 75 days of completing the ground water sampling, Clow will submit the results of statistical analysis of the data. The analysis will be by one of the following methods:

- A Tolerance or Prediction Interval Test in which an interval for each parameter is established from the distribution of the background data, and the level of each parameter in each monitoring well is compared to the Upper Tolerance Limit or prediction limit.
- A Parametric Analysis of Variance followed by a multiple comparisons test to identify statistically significant evidence of contamination. This will include estimation and testing of the contrasts between each monitoring well’s mean and the background mean levels for each parameter.
- An Analysis of Variance based on ranks followed by a multiple comparison test to identify statistically significant evidence of contamination. This will include estimation and testing of the contrasts between each monitoring well’s median and the background median levels for each parameter.
- A control chart approach that gives control limits for each parameter.
- Another suitable statistical method selected from applicable tests will be submitted to the Ohio EPA for approval.

At this time, Clow uses a tolerance interval test. If at any time a different statistical method were chosen, the method would comply with the performance standards outlined in the Solid Waste Rules, OAC 3745-27-10(C)(6). The statistical evaluations will continue semiannually, and a trend analysis will be prepared annually for parameters exceeding concentration levels in any given year.

If all parameters in the four downgradient monitoring wells are below concentration levels for a given year, the purge wells will be turned off approximately 1 month before the next sampling event. They will be restarted after sampling results are received if all parameters are not still below Concentration Levels.
Upon these consecutive years where all parameters in the four downgradient monitoring wells are below Concentration Levels, Clow may request that the Director reinstate ground water detection monitoring as described in the *Ground Water Detection Monitoring Plan* of the *Corrective Measures Plan Supplement*. 
Section 8
Ground Water Effectiveness Evaluation

8.1 Purpose
The purpose of this outline is to provide a plan for evaluating the effectiveness of the ground water corrective measures.

8.2 Scope
Per OAC 3745-27-10(F)(e) this section describes specific ground water monitoring requirements to determine the effectiveness of the ground water corrective measures. The effectiveness of the ground water corrective measure will be assessed by determining the following:

■ Is hydraulic control of the leachate-derived constituents maintained by the purge well system?
■ Does the ground water effluent transferred to the publicly owned treatment works (POTW) meet pre-treatment standards?
■ What is the trend of the concentration of constituents of concern in wells at the limit of solid waste placement (downgradient monitoring wells: L-2, L-3, S-1, and S-2)
■ Are chemicals of concern migrating off-site in concentrations that exceed the concentration levels?
■ Are all extraction wells functioning properly or are they still necessary?

8.2.1 Hydraulic Control
Hydraulic control of the leachate-derived constituents will be evaluated by the following:

— Do the ground water level measurement agree with model results and indicate that the contaminated flow lines are being captured by the purge wells?
— Do the L-6 and S-4 show any constituents of concern that exceed concentration levels?

8.2.2 Ground Water Effluent
Samples will be taken on a quarterly basis by the POTW. The results from these analyses will be reviewed to verify that pre-treatment standards are being met and the total volume of effluent will be recorded each quarter.
8.2.3 Limit of Solid Waste Placement Wells

The trend in concentrations for constituents of concern exceeding concentration levels in limit of solid waste placement monitoring wells (L-2, L-3, S-1, and S-2) will be plotted annually for those parameters exceeding the concentration level. The concentration plots will show if the concentrations are increasing, stable, or decreasing.
Section 9
Submission of Results

All ground water elevation, sample analysis, and statistical analysis results generated in accordance with paragraphs OAC 3745-27-10 (B), (C), (D), and (F)(2)(e) of this rule shall be submitted to Ohio EPA not later than 75 days after sampling the wells. All ground water data and an accompanying text shall be submitted to Ohio EPA in a form specified by the director or his authorized representative. The data and accompanying text required to be submitted in accordance with this paragraph shall be placed in the operating record in accordance with OAC 3745-27-09.

The accompanying text shall consist of, at a minimum, the following:

1. Lab data sheets.
2. Field and laboratory quality assurance/quality control (QA/QC) data.
3. Chain of custody and sample receipt forms including preservation methods.
4. Data summary table(s).
5. Statistical analysis results and summary table(s) including the results from any test for normality.
6. The potentiometric maps required by paragraph (C)(3) of this rule.
7. A description of the analysis methods used including method detection limits, and practical quantitation limits for the constituents analyzed.

[Comment: The items requested in paragraph (C)(10) of this rule with the exception of paragraph (C)(10)(C) of this rule, may be submitted on an electronic format compatible with Ohio EPA software.]
Section 10
Post-Closure Ground Water Monitoring Plan

The Clow Ground Water Detection Monitoring Plan will also represent the post-closure ground water monitoring plan.
A capture zone analysis was conducted to evaluate how much groundwater and the location and number of recovery wells that would be needed to capture affected groundwater flowing beneath the North Landfill at the Clow facility in Coshocton, Ohio.

The groundwater flow system consists of a 130-foot thick permeable sand and gravel aquifer, with a hydraulic conductivity of approximately 0.15 cm/s (RMT 1987). Sampling at the existing monitoring well network has shown that only the upper portion of the aquifer is affected with constituents of concern, which are mainly inorganic. The width of the cross section of groundwater that flows beneath the North Landfill is approximately 600 feet. The gradient on the water table is approximately 0.00099 ft/ft, based on the May 2001 water table map.

A three-dimensional groundwater flow model (Modflow) was used in conjunction with a particle tracking model (Modpath) to calculate the capture zone associated with various recovery well scenarios. The model assumes homogenous conditions, and constant head values at the outer edges of the model domain. Five model layers were simulated, for the 130-foot thick aquifer. The edges of the model domain are approximately 800 feet north, 900 feet east, 1600 feet south, and 1300 feet west of the downgradient end of the North Landfill where the groundwater recovery well(s) would be installed. A 10:1 ratio of horizontal to vertical anisotropy of hydraulic conductivity was assumed, based on typical values for aquifers of this scale (Freeze and Cherry, 1979).

An earlier analysis conducted in March 2004 identified a scenario that was designed to minimize the number of recovery wells, with two well pumping at a combined rate 60 gpm.

In the current updated analysis that is presented here, the primary objective is to minimize the combined extraction rate of the groundwater extraction wells, while still capturing the entire width of the groundwater zone that extends beneath the North Landfill. A number of runs were made to identify the number and location of extraction wells that would result in sufficient extent of capture while minimizing the combined rate of extraction. The optimal recovery well scenario that was identified included the following:

- Eight wells pumping at a combined rate of 33 gpm (model run Clow13)

- The model results indicate that the eight extraction wells, shown on Figures 2 and 3, would have the following average rates of extraction (from northwest to southeast): 6, 2, 2, 2, 2, 3, 6, 10 gpm
These extraction rates are approximate, and are expected to be revised based on actual performance once the wells are installed and tested for effect on the hydraulic heads in the aquifer.

The results indicate that a system of eight extraction wells screened in the upper 15 feet of the aquifer and pumping at a combined rate of 33 gpm would be able to recover essentially the entire width of the groundwater flow that passes beneath the North Landfill (see the plan view of the landfill, extraction wells, and capture zone shown in Figures 1, 2, and 3). The extraction wells were simulated as screened across the upper portion of the aquifer. As shown in the profile view of the groundwater system in Figure 4, the extraction wells would capture the upper portion of the groundwater in the aquifer, to a depth of approximately 20 to 30 feet below the water table. By increasing the number of extraction wells, and reducing the spacing between wells, it is possible to decrease the overall rate of extraction while obtaining capture of essentially the entire width of the plume the passes beneath the North Landfill, for the upper portion of the groundwater system.

Following installation of the extraction well system, it is recommended that the results of this simulation be verified by monitoring the hydraulic heads in a number of monitoring wells surrounding the extraction wells. If necessary based on the response of the aquifer to pumping, the model may be refined to better simulate actual conditions, with a corresponding refinement of the recommended rates of extraction in order to achieve capture.


North direction is to the left of the page. Scale is in feet.

Figure 1  Plan view of capture zone, North Landfill, Clow facility, eight wells pumping at a combined rate of 32 gpm
North direction is to the left of the page. Scale is in feet. View is of same area as shown in Figure 1.

Figure 3  Simplified plan view of capture zone, North Landfill, Clow facility, showing locations of eight wells pumping at a combined rate of 32 gpm.
Figure 4  East – West profile view of capture zone, with 8 wells pumping at a combined rate of 33 gpm. Scale is in feet. Location of profile is shown on Figure 2.
Appendix E
Ground Water Sampling and Analysis Plan
Ground Water Sampling and Analysis Plan

Clow Water Systems Company
Coshocton, Ohio

September 29, 2004
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<td>Semi-Annual Ground Water Monitoring Parameter List (Monitoring Wells A-6, D-6, L-2, L-3, S-1, and S-2)</td>
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Attachment A Example Sampling Forms and Laboratory Information
Attachment B Monitor Well Information
This *Ground Water Sampling and Analysis Plan* (SAP) outlines the monitoring programs, as well as the purging and sampling requirements for the ground water that flows beneath the combined units. This SAP is a combined SAP and will serve as the SAP for both corrective measures effectiveness monitoring and detection monitoring.

### 1.1 Background

Clow Water Systems Company (Clow), a division of McWane, Inc., operates a ductile iron foundry in Coshocton, Ohio. The foundry facility contains one active and three closed waste management units (combined units). Ground water monitoring for the combined unit is regulated under solid waste rules, Ohio Administrative Code (OAC) 3745-27, as in effect on the date of this submittal.\(^1\)

The first closed waste management unit is the solid waste landfill that is located in the northeast corner of the Clow facility. A stockpile of calcium carbide desulfurization slag was also contained within the footprint of the landfill. This pile was removed and incorporated into the former surface impoundment closure. Closure plans for this landfill have been negotiated with the Ohio Environmental Protection Agency (Ohio EPA), and reconstruction of the landfill cover was implemented in 1993-1995.

The second closed waste management unit is the former surface impoundment and calcium carbide desulfurization slag treatment bunker. Closure of these units was conducted in 1994 and 1995 as a single waste management unit under the closure plan approved by the Ohio EPA in February 1994.

The third waste management unit is the new landfill for exempt foundry waste that was constructed adjacent to and above the closed surface impoundment during 1994 and 1995. The operational and post-closure ground water monitoring of this proposed landfill is integrated with the post-closure plan provided for the former surface impoundment.

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\(^1\) All references herein to the Ohio Administrative Code refer to the code in effect on the date of this submittal.
1.2 Monitoring Well Locations

The monitoring wells used for each program are summarized in Table E-1. The monitoring well locations are shown on Figure C-1 of the Corrective Measures Plan Supplement, Appendix C.

Table E-1
Summary of Monitoring Wells Used for Each Ground Water Program
Clow Water Systems Company
Coshocton, Ohio

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<thead>
<tr>
<th>MONITORING WELL NUMBER</th>
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Section 2
Analytical Parameters

The analytical parameters for the ground water monitoring program are listed in Table E-2. The parameter list is comprised of the parameters listed in Appendix I (OAC 3745-27-10(D)), with the addition of aluminum, iron, manganese, phosphorus, sulfate, cyanide, and fluoride. The parameters added to the Appendix I list were previously identified as chemicals of concern at the Clow facility during post-closure assessment monitoring between 1997 and 2004. Table E-2 includes the analytical methods for each parameter.

Ground water samples will be collected at each of the monitoring wells indicated in Section 1 of this report on a semiannual basis for the applicable monitoring plan.
Table E-2
Semi-Annual Ground Water Monitoring Parameter List
(Monitoring Wells A-6, D-6, L-2, L-3, S-1, and S-2)
Clow Water Systems Company
Coshocton, Ohio

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<td>61</td>
<td>Tetrachloroethene</td>
<td>SW-8260</td>
</tr>
<tr>
<td>62</td>
<td>Thallium</td>
<td>SW-6020</td>
</tr>
<tr>
<td>63</td>
<td>1,1,1-Trichloroethane</td>
<td>SW-8260</td>
</tr>
<tr>
<td>64</td>
<td>1,1,2-Trichloroethane</td>
<td>SW-8260</td>
</tr>
<tr>
<td></td>
<td>PARAMETER</td>
<td>METHOD</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>65</td>
<td>Trichloroethene</td>
<td>SW-8260</td>
</tr>
<tr>
<td>66</td>
<td>Trichlorofluoromethane</td>
<td>SW-8260</td>
</tr>
<tr>
<td>67</td>
<td>1,2,3-Trichloropropane</td>
<td>SW-8260</td>
</tr>
<tr>
<td>68</td>
<td>Toluene</td>
<td>SW-8260</td>
</tr>
<tr>
<td>69</td>
<td>Vanadium</td>
<td>SW-6010</td>
</tr>
<tr>
<td>70</td>
<td>Vinyl acetate</td>
<td>SW-8260</td>
</tr>
<tr>
<td>71</td>
<td>Vinyl chloride</td>
<td>SW-8260</td>
</tr>
<tr>
<td>72</td>
<td>Xylenes</td>
<td>SW-8260</td>
</tr>
<tr>
<td>73</td>
<td>Zinc</td>
<td>SW-6020</td>
</tr>
</tbody>
</table>
Table E-3
Semi-Annual Effectiveness Monitoring Parameter List
(Monitoring Wells D-2, D-3, D-8, D-9, D-10, L-5, L-6, S-4, and Combined EW Effluent)
Clow Water Systems Company
Coshocton, Ohio

<table>
<thead>
<tr>
<th></th>
<th>PARAMETER</th>
<th>METHOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aluminum</td>
<td>SW-6010</td>
</tr>
<tr>
<td>2</td>
<td>Ammonia</td>
<td>EPA-350.1</td>
</tr>
<tr>
<td>3</td>
<td>Antimony</td>
<td>SW-6020</td>
</tr>
<tr>
<td>4</td>
<td>Arsenic</td>
<td>SW-6020</td>
</tr>
<tr>
<td>5</td>
<td>Barium</td>
<td>SW-6020</td>
</tr>
<tr>
<td>6</td>
<td>Cadmium</td>
<td>SW-6020</td>
</tr>
<tr>
<td>7</td>
<td>Chloride</td>
<td>EPA-325.3</td>
</tr>
<tr>
<td>8</td>
<td>Chromium (total)</td>
<td>SW-6010</td>
</tr>
<tr>
<td>9</td>
<td>Copper</td>
<td>SW-6020</td>
</tr>
<tr>
<td>10</td>
<td>Cyanide</td>
<td>CLP-335.3</td>
</tr>
<tr>
<td>11</td>
<td>1,1-Dichloroethane</td>
<td>SW-8260</td>
</tr>
<tr>
<td>12</td>
<td>Fluoride</td>
<td>SW-8260</td>
</tr>
<tr>
<td>13</td>
<td>Iron</td>
<td>SW-6010</td>
</tr>
<tr>
<td>14</td>
<td>Lead</td>
<td>SW-6020</td>
</tr>
<tr>
<td>15</td>
<td>Manganese</td>
<td>SW-6020</td>
</tr>
<tr>
<td>16</td>
<td>Nickel</td>
<td>SW-6020</td>
</tr>
<tr>
<td>17</td>
<td>Phosphorus</td>
<td>CW-365.2</td>
</tr>
<tr>
<td>18</td>
<td>Potassium</td>
<td>SW-6010</td>
</tr>
<tr>
<td>19</td>
<td>Sodium</td>
<td>SW-6010</td>
</tr>
<tr>
<td>20</td>
<td>Sulfate</td>
<td>EPA-375.4</td>
</tr>
<tr>
<td>21</td>
<td>Zinc</td>
<td>SW-6020</td>
</tr>
</tbody>
</table>
Section 3

Water Level Measurements

During Corrective Measures Ground Water Monitoring, ground water elevations will be measured in all 24 site monitoring wells at least semiannually, prior to purging for the collection of ground water samples. Additionally, pumping levels will be measured in the eight ground water extraction wells. During Ground Water Detection Monitoring, ground water level elevations will be measured in fourteen wells. These are the sampled wells (A-6, D-6, L-2, L-3, S-1 and S-2) and B-5, L-4, L-5, L-6, S-4, D-2, D-3, and D-7. Measurements will be taken in all water table wells and piezometers within a single 24-hour period prior to the semiannual sampling events, and the first well measured will be re-measured after the last well to check for changes in water level due to ambient changes. Data from the water table monitoring wells will be used to determine the direction of ground water flow, and data from the piezometers will be used to evaluate vertical gradients, as necessary.

Since dedicated bladder pumps have been installed in each of the monitoring wells in the ground water monitoring program, depth to bottom measurements will be made only when pump maintenance or well maintenance allows. Historical well depth measurements will be used for well volume calculations, as needed. Historical well construction information is included in Attachment B.

All ground water level measurements and depth to bottom measurements will be made using a reference point established on the well casing, or on the wellhead assembly for the detection network wells that are equipped with dedicated pumps. The reference point will consist of an indelible mark on the highest point of the well casing, or on the wellhead assembly for wells equipped with dedicated pumps.

A battery-operated water level indicator is the primary device for water level measurements. The indicator is a self-contained instrument equipped with a cable and sensor that activates a buzzer and a light when it comes in contact with the water. The depth to water is read from permanent 0.01-foot increment markings on the cable. Depth to water is measured to the nearest 0.01 foot. Depth to bottom measurements will be made using a popper tape, which consists of a nylon coated steel tape with a cup-shaped steel weight attached to the end.
Section 4
Ground Water Sample Collection

4.1 General Purging and Sampling Procedures

Sampling of the ground water wells will consist of the following steps:

1. Record water level measurements at all monitoring wells within a single 24-hour period, prior to semi-annual sampling. The first well measured will be re-measured for water level to check for changes due to ambient changes.

2. Note the condition of the wells and dedicated pumps, and implement corrective actions for any deficiencies as applicable.

3. Conduct well purging as described below. The upgradient wells will be purged and sampled first, followed by the downgradient wells.

4. Collect samples for laboratory and field analyses as described below.

Monitoring wells are equipped with dedicated sampling pump systems (Well Wizard™ bladder pump or equivalent). The pumps are installed near the midpoint of the screened interval.

4.1.1 Purging Procedures

Ground water samples from the site monitoring wells will be collected using a low-flow pumping technique. This sampling method involves purging the well with the pump intake set at the desired sampling depth, at a rate that does not mobilize naturally non-mobile colloidal matter, does not create excessive drawdown, minimizes pressure changes in the purged water, and does not appreciably change the oxidation-reduction (redox) state of the sample. This sampling method minimizes the disturbance of the sample, thereby reducing sampling artifacts, and improves the consistency and quality of the ground water sample results. In addition, the low-flow sampling method significantly reduces the volume of potentially contaminated purge water generated during the sampling process.

Since the actual pumping rates and purge volumes required to stabilize the water chemistry at each well will vary as a function of the ground water elevation and the hydraulic properties of each well at the time of sampling, the purge rate and volume will be determined in the field during each sampling event. A table of typical pump
settings for each well is presented in Attachment B. These settings can be used as a guide for each well but the actual pump setting should be determined in the field.

Monitoring wells are screened in relatively permeable sediment will be purged at a flow rate ranging from 0.25 to 1 liter per minute. The pumping rate for each well is dependent on the hydraulic properties of the formation the well is screened across, and will be determined in the field to be the highest flow rate attainable without creating drawdown greater than 0.3 foot, or at a minimum of 0.25 liter per minute. The minimum flow rate is set at 0.25 liter/minute, as this is the minimum flow rate necessary for accurate measurements through the flow-through cell. At no time during low-flow purging will the flow rate exceed 1 liter per minute.

A Geotech Model P3 flow-through cell (or equivalent) equipped with temperature, pH, and specific conductance electrodes will be connected to the discharge tubing from the pump. Grab samples from the pump discharge will be collected for turbidity analysis using a HACH 2100P turbidity meter (or equivalent). Measurements of field parameters will be recorded at intervals of a maximum of one reading per liter purged (e.g., at 250 milliliter/minute field parameters will not be recorded at intervals less than once every 4 minutes) until the well stabilizes. Stabilization criteria are included in Subsection 4.2 of this SAP. Samples will be collected from each well immediately following stabilization. The sample will be collected from the pump discharge after the flow-through cell has been disconnected.

In the event that the aquifer transmissivity is too low to yield sufficient water to limit drawdown to 0.3 foot at the lowest specified pumping rate (0.25 liter/minute), the pumping rate will be increased to the maximum flow rate obtainable (approximately 1.2 liters/minute) in order to purge the well dry. Field measurements will be collected during purging at the frequency described above, until the well runs dry. Wells that purge dry will be sampled when sufficient water has re-entered the well, as described in Subsection 4.1.2 of this SAP. An additional aliquot of water will be removed at the time of sampling to collect final field measurements.

Monitoring wells that cannot sustain a flow rate of at least 0.25 liter/minute with no more than 0.3 foot of drawdown, and which cannot be purged dry at the maximum pumping rate, will be purged at the maximum obtainable flow rate until a minimum of four well volumes of water have been removed. Field measurements will be recorded during purging at the frequency described above, until the field parameters are stable (as described in Subsection 4.2), or a minimum of four well volumes of water have been removed. The well volume will be calculated using the historical depth to bottom measurements (Attachment B) and the depth to water collected prior to purging.
Samples will be collected from each well immediately following purging. The sample will be collected from the pump discharge after the flow-through cell has been disconnected.

4.1.2 Sampling Procedures

Immediately after the well has been purged, samples will be collected. If the well is pumped dry, the well will be sampled when a sufficient volume of water has re-entered the well. With the exception described in the paragraph below, all sampling will be performed within 24 hours of purging, or as soon as enough water has entered the well to fill the sampling pump and at least one 1-Liter sample bottle (approximately 1.6 feet of water above the top of the pump in a 2-inch diameter monitoring well). The list of parameters and analytical methods is provided in Table E-2.

If a well will not yield enough ground water within 24 hours to fill all of the bottles required for that round, additional sampling will be performed within the next 24-hour period (or as soon as enough water has entered the well to fill the sampling pump and at least one 1-Liter bottle); this cycle will continue until all bottles are filled. Sampling personnel will check and document the water level measurements at the well daily as long as the sampling cycle continues. Each set of bottles filled within a 24-hour period will be given a unique sample date and time, and will be shipped with the rest of that day’s samples.

The procedure for the sampling of the monitoring wells is as follows:

1. Verify that a sufficient number of pre-cleaned vials and pre-cleaned bottles are available for each sampling location and that each is properly labeled. The sample containers will be pre-cleaned by the manufacturer and tested to meet or exceed the analyte specifications provided in United States Environmental Protection Agency (USEPA) guidance documents. The certificates for the lot-by-lot analysis of these containers, performed by the manufacturer, will be maintained on file by the laboratory.

2. Immediately fill the sample bottle by allowing the water stream to strike the inner wall of the bottle to minimize formation of air bubbles. Do not alter the flow rate from the stabilized flow rate, but the pump discharge pressure may be reduced in order to reduce splashing and reduce the risk of overfilling the sample bottles. Do not rinse the sample bottle. Fill the sample bottle, with a minimum of splashing.

Fill the bottles in the following order:
- Volatile organic compounds (VOCs)
- Dissolved metals
- Ammonia, phosphorus
- Chloride, fluoride, sulfate
- Cyanide

3. See Table E-4 for requirements for containers, filtering, preservatives, and holding times for sample collection.

4. Collect blind duplicate samples at the rate of one for every 10 (or fewer) samples. No field equipment blanks will be collected, because all sampling equipment will be dedicated.
### Table E-4
Ground Water Sampling and Analysis Plan
Clow Water Systems Company
Coshocton, Ohio

Ground Water Sample Containers, Preservatives, and Holding Times

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>CONTAINERS</th>
<th>PRESERVATIVE</th>
<th>HOLDING TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOCs</td>
<td>(3) 40-mL glass vials</td>
<td>HCl to pH &lt;2, Cool to 4°C</td>
<td>14 days</td>
</tr>
<tr>
<td>Total metals</td>
<td>(1) 1-L HDPE bottle</td>
<td>HNO₃, to pH &lt; 2</td>
<td>6 months</td>
</tr>
<tr>
<td>Ammonia, Phosphorus</td>
<td>(1) 500-mL HDPE bottle</td>
<td>H₂SO₄, to pH &lt;2, Cool to 4°C</td>
<td>28 days</td>
</tr>
<tr>
<td>Chloride, Fluoride, Sulfate</td>
<td>(1) 250-mL HDPE bottle</td>
<td>Cool to 4°C</td>
<td>28 days</td>
</tr>
<tr>
<td>Cyanide</td>
<td>(1) 250-mL HDPE bottle</td>
<td>NaOH to pH &gt;12, Cool to 4°C</td>
<td>14 days</td>
</tr>
<tr>
<td>pH, specific conductance, turbidity, temperature</td>
<td>Parameters measured in field</td>
<td>None</td>
<td>Measure immediately</td>
</tr>
</tbody>
</table>

Note:
Volume requirements are laboratory-specific and may be adjusted if laboratory requirements change.

H₂SO₄ = sulfuric acid
NaOH  = sodium hydroxide
HNO₃  = nitric acid
4.2 Field Analysis

The following steps are taken so that the analytical data gathered in the field are both valid and unbiased:

- Field technicians are trained in the use of each piece of equipment.
- Preventive maintenance programs are carried out on a scheduled basis.
- Spare components are taken into the field in case of equipment failure or damage.
- Instruments are calibrated on a daily basis and rechecked at various times throughout the day.
- Standard forms are used to document field activities (Attachment A).
- Readings and calibrations are documented.
- QC checks of field notes are performed.

The accuracy, sensitivity, and precision of the field analytical techniques (pH, temperature, turbidity, and specific conductance) are dependent upon the specifications for the instruments used, as well as the QC techniques employed during their use. Temperature, specific conductance, pH, and turbidity data are collected from field measurements.

Measurement of Field Parameters — Temperature, specific conductance, and pH will be measured utilizing a continuous flow-through cell and instrument bank (Geotech P3 or equivalent) that will be connected to the sampling discharge port for each well. Dedicated probes that measure temperature, specific conductivity, and pH will be inserted into the flow-through cell body. Stability readings will be recorded at intervals of a maximum of one reading per liter purged until the well stabilizes. Turbidity will be measured using a portable nephelometric turbidimeter (HACH 2100P or equivalent). Ground water grab samples will be collected from the discharge point of the pump and measured for turbidity using the same sampling interval described above.

Purging will be considered complete, and stabilization reached, when three of the four following conditions have been reached for three consecutive readings:

- **Temperature**: three consecutive readings within ± 0.5°C
- **pH**: three consecutive readings within ± 0.2 Standard Units (SU)
- **Specific conductance**: three consecutive readings (temperature corrected) within ± 5 percent
- **Turbidity**: three consecutive readings within ± 10 percent, or two consecutive readings below 10 NTU
Temperature will be measured in degrees Celsius and recorded to the nearest 0.1°C. Specific conductivity will be measured in micromhos/centimeter (μmhos/cm) and will be recorded to the nearest 5 units. pH will be measured in SU and will be recorded to the nearest 0.1 SU. Turbidity results will be expressed in NTUs and recorded to two significant figures. All meters will be utilized in accordance with the manufacturers' specifications.

Specific conductivity, pH, and turbidity meters used to measure field parameters will be calibrated in the field at the beginning and end of each day of sampling, and approximately every 4 hours during the sampling process. Calibration results will be submitted with the laboratory results from each sampling event.

4.3 Equipment Decontamination

4.3.1 Water Level Indicator
1. Rinse probe with soapy (phosphate-free soap) water.
2. Rinse with deionized water (ASTM Type II).
3. Air-dry.

4.3.2 Turbidity Meter, pH, Temperature, Conductivity Probes, and Flow-Through Cell
1. Rinse with deionized water.

4.4 Disposal of Well Purge Water

When background monitoring wells (A-6 and D-6) are purged prior to sampling, all purged ground water will be collected, containerized, and thin spread on the ground surface in the vicinity of the monitoring well from which it came.

When non-background monitoring wells are purged prior to sampling, all purged ground water will be collected, containerized, and disposed in the plant wastewater treatment system. Specifically, purged water will be collected in buckets of known volumes (generally 5-gallon buckets); covered to minimize spilling; then transported to, and deposited in, the Clow wastewater treatment system.
4.5 Field Records

Daily field activities will be recorded in a field notebook. The sample collection notebook will contain forms for general notes (including weather conditions and a daily summary of the work performed), pH and conductivity calibration logs, low-flow ground water sampling stabilization logs, water sample logs, and water level data forms. Examples of these forms are attached in Attachment A.

Entries into the field notebook and sample collection and measurement forms will be legibly written and will provide a clear record of field activities. Entries will be made in waterproof ink, in language that is objective and factual. Errors will be indicated by drawing a single line through the text, such that the text in error remains legible. Errors addressed in this manner will be initialed and dated by the person making the correction. The person taking notes in the field book will sign and date each page.
The current ground water quality monitoring program parameters and analytical procedures are provided in Table E-2. The wells will be sampled semiannually. Holding time and preservation requirements for the various parameters are listed in Table E-4.

Clow will use NELAP certified laboratories. The appropriate Quality Assurance Project Plan (QAPP) for the chosen laboratory by Clow will be forwarded to Ohio EPA separately.

The Ohio EPA will be formally notified of any changes to the laboratories selected to perform ground water analyses. The analytical procedures for the monitoring parameters are provided in Table E-2.

The laboratory will perform at least the following QC checks (Table E-5):

- **Spikes**
  - Laboratory control spikes, one per analytical batch of up to 20 samples
  - Sample spikes, one per analytical batch up to 20 samples (inorganic only)
  - MSs/MSDs, one per analytical batch of up to 20 samples

- **Blanks (method/preparation)** for each analytical batch

- **Calibration standards**
  - Organics: initial calibrations and continuing calibrations as presented in laboratory approved SOPs.
  - Inorganics: initial calibrations and calibration verifications at a frequency of every 10 samples
Table E-5
Laboratory Quality Control Samples

<table>
<thead>
<tr>
<th>ORGANICS</th>
<th>METALS</th>
<th>WET CHEMISTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trip blank</td>
<td>Laboratory preparation blanks</td>
<td>Laboratory preparation blanks</td>
</tr>
<tr>
<td>(1 per each cooler containing VOCs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laboratory method blanks</td>
<td>Laboratory control spike (LCS) results</td>
<td>LCS results</td>
</tr>
<tr>
<td>MS/MSD recoveries (1 in 20)</td>
<td>Spike recoveries (1 in 20)</td>
<td>Spike recovery (1 in 20)</td>
</tr>
<tr>
<td></td>
<td>Laboratory duplicate results (1 in 20)</td>
<td>Laboratory duplicate results (1 in 20)</td>
</tr>
<tr>
<td></td>
<td>Recovery test results (1 in 10 graphite furnace AA only)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chain-of-Custody for all samples</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Case Narratives for all samples/analyses</td>
<td></td>
</tr>
</tbody>
</table>
- Serial dilutions (inorganic, ICP), one per analytical batch of up to 20 samples
- Recovery tests (inorganic, GFAA), one per analytical batch up to 20 samples

The following QC deliverables will be included with each data package:
- Laboratory preparation blank results
- Laboratory control spike (LCS) results
- Sample spike recoveries (1 in 20) for inorganic parameters
- Laboratory duplicate results (1 in 20) for inorganic parameters
- Recovery test results (1 in 10 graphite furnace AA only)
- Chain-of-custody for all samples
- Case narratives for all samples/analyses (as appropriate)
Section 6
Quality Assurance/Quality Control Plan

6.1 Data Quality Objectives

Data quality objectives (DQOs) are qualitative and quantitative statements that specify the quality of the data required to support decisions during the investigative activities. Since DQOs are based on the end uses of the data to be collected, different data uses may require different levels of data quality. There are five analytical levels, which address various data uses and the Quality Assurance/Quality Control (QA/QC) effort and methods required to achieve the desired level of quality.

Data collected for this investigation are categorized as follows:

- **Screening (DQO Level 1)** – This provides the lowest data quality, but the most rapid results. On-site data, including pH, conductivity, and other real-time monitoring data, will be generated using Level 1 data quality.

- **Confirmational (DQO Level 4)** – This provides the highest level of data quality. For this investigation, confirmational data will be used for monitoring the ground water quality. These analyses require analytical and data validation procedures in accordance with USEPA-recognized protocol.

6.2 Quality Assurance Objectives

The overall QA objective is to ensure that the data are of known and acceptable quality. The data must be sufficiently precise and accurate to be used for the purposes indicated in the work plan.

To achieve the overall DQOs, proper sample handling and analysis, and data-handling procedures will be followed. This document describes the specific objectives for analytical accuracy, precision, sensitivity, completeness, representativeness, and comparability.

6.2.1 Accuracy, Precision, and Sensitivity of Analysis

The fundamental QA objective, with respect to accuracy, precision, and sensitivity of laboratory analytical data, is to achieve the QC acceptance criteria of the analytical protocols. The definitions of the above-mentioned parameters are provided as follows:
**Accuracy**

Accuracy is the proximity of a measurement to the true value. Both field and analytical accuracy will be monitored through initial and continuing calibration of instruments. In addition, the data from the matrix spikes, and blanks will be used to assess the accuracy of the laboratory analytical data.

The accuracy of laboratory results will be assessed for compliance with the method-specific QC criteria using the analytical results of method/preparation blank, matrix spike/matrix spike duplicate samples, and field trip blanks.

**Precision**

Precision is the level of agreement among multiple measurements of the same parameters. The goal is to maintain an acceptable level of analytical precision. Checks for analytical precision include the analysis of MS/MSDs, laboratory duplicates, and field duplicates.

The precision of laboratory analysis will be assessed by comparing the analytical results between MSs/MSDs for organics analysis, and laboratory duplicate analyses for inorganics analysis. The relative percent difference (\%RPD) will be calculated for each pair of duplicate analyses.

**Sensitivity**

Method Detection Limits (MDLs) and Practical Quantitation Limits (PQLs) are measures of the analytical procedure's sensitivity for the detection and quantitation of analytes, respectively.

The achievement of MDLs depends on instrument sensitivity and matrix effects. Therefore, it is important to monitor the instrument sensitivity to ensure the quality of the data through constant instrument performance. The instrument sensitivity will be monitored through the analysis of a method blank, a calibration check sample, and laboratory control samples, etc. The laboratory performs periodic MDL studies for each analyte.

### 6.2.2 Completeness, Representativeness, and Comparability

**Completeness**

Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be
obtained under normal conditions. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

\[
\text{completeness} = \left( \frac{\text{number of valid measurements}}{\text{total number of measurements}} \right) \times 100
\]

It is expected that the laboratory will provide data meeting QC acceptance criteria for 95 percent or more of all samples tested. The completeness of laboratory and field requirements is 90 percent or better.

**Representativeness**

Representativeness expresses the degree to which the data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter that is dependent upon the proper design of the sampling program and the proper laboratory protocol. Representativeness will be satisfied by ensuring that the SAP is followed, proper sampling techniques are used, and proper analytical procedures are followed. Representativeness will be assessed by the analysis of selected field duplicate samples.

**Comparability**

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends upon the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as documented in the SAP, are expected to provide comparable data.

Field analysis QA/QC has been described above. Any deviations in the procedures from this SAP and any difficulties encountered while sampling will be documented in the field. All field data sheets are also checked by qualified staff upon their return to the office.

Project-specific field QC checks include the following:
- Blind field duplicates
- Trip blanks

Blind field duplicate ground water samples are collected at the rate of one for every 10 samples. Trip blanks will consist of 40-mL glass vials filled at the laboratory with reagent grade water. The trip blanks will accompany all VOC bottles shipped to the field and will be returned to the
laboratory with the samples at a rate of one trip blank per cooler containing VOCs. No field equipment blanks will be collected because all purging and sampling will be performed with dedicated equipment.

- The handling and processing of all samples and QA/QC procedures by the laboratory are described in detail in the laboratory Quality Assurance Manual and the laboratory SOPs.

6.3 Chain-of-Custody Procedures

The possession of samples must be traceable from the time of collection through the use of chain-of-custody procedures. Specific chain-of-custody forms must accompany all sample shipping containers to document the transfer of the shipping containers and samples from the field to the laboratory receiving the samples for analysis. The procedures to be implemented are as follows:

1. Prepare sample containers with pre-applied labels by the laboratory and with chain-of-custody seals on the shipping containers.
2. Identify and label each sample in the field with indelible ink. Sample labels will contain the sample type, sample location, date and time of sample collection, initials of the sampler(s), and the sample preservative, if any. An example bottle label is included in Attachment A.
3. Complete chain-of-custody forms in the field to indicate sample identification, number of containers filled, sampling date, sampling time, sample collector, and sample preservation, if applicable. This information will also be noted in the field notes. The analytical parameters requested and the analytical methods will be submitted to the laboratory under separate cover prior to the start of each sampling event. Examples of this documentation are included in Attachment A.
4. Package shipping containers with samples, chain-of-custody forms, and ice packs. Each set of sample shipping containers to be shipped together is assigned at least one chain-of-custody form, which travels with the shipping containers.
5. Seal and ship containers to the appropriate laboratory. Custody seals will be placed on sample coolers if a common carrier is used. Common carriers or intermediate individuals shall be identified on the chain-of-custody form, and copies of all bills-of-lading will be retained.
6. Receive and check shipping containers in the laboratory for broken seals or damaged sample containers. If no problems are noted, samples are logged into the laboratory, and the chain-of-custody form is completed. The person relinquishing the samples to the facility or agency should request the representative's signature acknowledging sample receipt. If the representative is unavailable or refuses to sign, this is noted in the "Received By" space.
7. Include copies of the chain-of-custody form with the analytical data.
An example of a chain-of-custody form is shown in Attachment A. If an error is discovered on a sample chain-of-custody form, the person who made the error should correct it when possible. Corrections or insertions are made by crossing out the incorrect information and inserting the correction needed. The date and the initials of the person making the correction will be written beside the correction. The procedure applies to words or figures inserted or added to a previously recorded statement. Completed chain-of-custody forms will be placed in a plastic bag, sealed, and taped to the inside cover of the shipping container. After icing the samples, the coolers will be sealed, dated, and shipped to the laboratory using an overnight delivery service or lab courier. Once the samples are received in the laboratory, they are handled and processed in accordance with the laboratory Quality Assurance Manual.

A separate sample receipt is prepared whenever samples are split. The receipt is marked to indicate with whom the samples are being split. The person relinquishing the samples should request a signature acknowledging sample receipt. If a signature is unavailable, this is noted on the receipt and in the field notebook.

If a chain-of-custody form is lost in shipment, a written statement will be prepared by the person who collected the samples listing the samples that were reported on the lost form and describing when and how the samples were collected. The statement should include information such as field log book entries regarding the sample.

The laboratory assigns a unique, serially numbered identifier to each sample received by the laboratory. The laboratory then follows the sample through the laboratory sample handling, analysis, storage, and reporting processes by means of a standardized tracking report.

6.4 Data Validation Procedures

Data validation will be accomplished by a party independent of the laboratory generating the data. The data reviewer will conduct a review of the data for compliance with the established QC criteria based on the spike, duplicate, and blank results provided by the laboratory. Data validation will determine whether the procedures specified in this work plan were implemented, the DQOs specified in this work plan were attained, specified Quantitation Limits were achieved, and sample holding times were met. An evaluation of data accuracy, precision, sensitivity, and completeness will be performed according to the following guidance documents:

- National Functional Guidelines for Organic Data Review – Multimedia, Multiconcentration (USEPA, October 1999)

The procedures used to evaluate data include the following items:
The data reviewer will identify any out-of-control data points and data omissions and will interact with the laboratory to correct data deficiencies.

Decisions to repeat sample collection and analyses may be made by the Project Manager based on the extent of the deficiencies and their importance in the overall context of the project.

All sample results generated for the Clow site will be computerized in a format organized to facilitate data review and evaluation. The computerized data set will include the data flags provided by the laboratory as well as additional flags and comments of the data reviewer (Table E-6). The laboratory-provided data flags will include items such as: (1) concentration below required Quantitation Limit; (2) estimated concentration due to poor spike recovery; and (3) concentration of chemicals also found in laboratory blank.
Table E-6  
Ground Water Monitoring Plan for Clow Water Systems Company  
Data Validation Qualifiers  
Coshocton, Ohio

<table>
<thead>
<tr>
<th>ANALYTE</th>
<th>ORGANIC CHEMICAL DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>Analyte is present in associated trip blank.</td>
</tr>
<tr>
<td>j</td>
<td>When specific QC criteria are outside the established control limits, the reported concentration or Quantitation Limit is approximate and may or may not represent the actual concentration or limit of quantitation necessary to accurately and precisely measure the analyte in the sample.</td>
</tr>
<tr>
<td>u</td>
<td>Analyte is present at less than 10 times the concentration in associated field atmospheric blank (b) and/or laboratory method blank (B) for common laboratory contaminants, or less than 5 times the blank concentration of other compounds and is therefore qualified as nondetectable (u) according to USEPA data validation procedures (USEPA, 1994 and 1999).</td>
</tr>
<tr>
<td>r</td>
<td>The results are rejected due to serious questions about the ability to determine the presence or absence of the analyte in the sample.</td>
</tr>
</tbody>
</table>
The data reviewer will assess the usability of results against the DQOs.

The data validation report will address the following items:

- Overall quality and usability of the data
- Evaluation of QC data, including precision, accuracy, and completeness of the data
- Potential sample contamination due to blank contributions
- Assessment of laboratory and field records
- Actions regarding specific QC criteria exceedences
Attachment A

Example Sampling Forms and Laboratory Information
Example Field Forms
GENERAL NOTES (Page 1 of 2)

PROJECT NAME: __________________________
PROJECT NUMBER: ________________________
TIME ARRIVED ON-SITE: __________________

DATE: __________________
AUTHOR: ________________
TIME LEFT SITE: ____________

WEATHER:

WORK/SAMPLING PERFORMED:

PROBLEMS ENCOUNTERED/ CORRECTIVE ACTIONS TAKEN:

COMMUNICATIONS:
Name/Representing:
Subject/Comments:

QC'd by: __________________

27.87 0000:RTH:gen0304.frm
GENERAL NOTES - EQUIPMENT SUMMARY

WATER LEVEL MEASUREMENTS WERE COLLECTED WITH:

Name and Model Number of Instrument
Serial Number (if applicable)

DEPTH TO BOTTOM OF WELL MEASUREMENTS WERE COLLECTED WITH:

Name and Model Number
Serial Number (if applicable)

BURGLING METHOD:

Name and Model Number of Pump or Type of Bailier
Serial Number (if applicable)

BURGE WASTE DISPOSAL METHOD:

NAME AND MODEL NUMBER OF PUMP OR TYPE OF BAILIER
Serial Number (if applicable)

PH/CONDUCTIVITY MEASUREMENT TECHNIQUE:

FILTERATION METHOD:

Name and Model Number of Device
Serial Number (if applicable)

Filter Type
Tubing Type

DECONTAMINATION AND FIELD BLANK WATER SOURCE:

Potable Water Source (if applicable)
DI Water Source

Signed
Date
QC'd By
Date

REV 01/14/94
**pH AND CONDUCTIVITY METER CALIBRATION LOG**

**Project Name:**

**Project Number:**

**Sampler:**

---

**pH METER**

<table>
<thead>
<tr>
<th>Model</th>
<th>Serial No.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Meter Check</th>
<th>Buffer Check</th>
<th>Slope Reading</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

Buffer Lot Numbers: pH 4: __________ pH 7: __________

---

**CONDUCTIVITY METER**

<table>
<thead>
<tr>
<th>Model</th>
<th>Serial No.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Instrument Zero</th>
<th>Red Line</th>
<th>Reading of Calibration Soln</th>
<th>Temp. of Calibration Soln</th>
<th>Corrected* Cond. @ 25°C</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
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</table>

Conductivity Calibration Solution Lot Number: __________

Problems/Corrective Actions:

---

* FORMULA FOR TEMPERATURE NORMALIZING CONDUCTIVITY: \( SC + (1 + (0.0191 \times (T - 25))) = Cond \) @ 25°C

**NOTE:** METER CHECKS AND CALIBRATIONS MUST BE PERFORMED A MINIMUM OF 4X/DAY.

Signed __________ Date __________ QC'd By __________ Date __________
LOW-FLOW GROUNDWATER SAMPLING
STABILIZATION LOG

<table>
<thead>
<tr>
<th>PROJECT NAME:</th>
<th>WELL NUMBER:</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECT NUMBER:</td>
<td>WELL DIAMETER:</td>
</tr>
<tr>
<td>DATE:</td>
<td>SAMPLER:</td>
</tr>
<tr>
<td>Type Of Pump Used:</td>
<td></td>
</tr>
<tr>
<td>Pumping Rate (gallon/minute):</td>
<td></td>
</tr>
<tr>
<td>Water level before purging (nearest 0.01 ft. below reference point)</td>
<td>+ T/</td>
</tr>
<tr>
<td>Depth to bottom of well (obtained from well logs)</td>
<td>+ T/</td>
</tr>
<tr>
<td>Calculated volume of water in casing</td>
<td></td>
</tr>
<tr>
<td>Weather conditions</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: STABILIZATION TEST IS COMPLETE WHEN 3 SUCCESSIVE READINGS ARE WITHIN THE FOLLOWING LIMITS: pH - ±0.1 pH; COND. - ±5%, TEMP (CORRECTED); TEMP. - ±0.5°C; TURBIDITY ±10%

Signed ___________________________ Date ________ QC'd By ___________________________ Date ________

http://home.streamline.com/semisys/semisysa/1-179.doc 04/21/99 2:30 PM
# WATER SAMPLE LOG

**744 Heartland Trail** Madison, WI 53717-8923  
**P. O. Box 8263** (Zip: 53708-8923)  
(608) 831-4444  
FAX: (608) 831-3334

<table>
<thead>
<tr>
<th>PROJECT NAME</th>
<th>PREPARED</th>
<th>CHECKED</th>
<th>PROJECT NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>By:</td>
<td>By:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Date:</td>
<td>Date:</td>
<td></td>
</tr>
</tbody>
</table>

**SAMPLE NO.:**  
**WELL DIAMETER:** □ 2" □ 4" □ Other  
**WELL MATERIAL:** □ PVC □ SS □ Iron □ Other  
**SAMPLE TYPE:** □ GW □ WW □ SW □ DW □ Leachate □ Other

**PURGING**  
**TIME:**  
**WELL VOLUME:** _____ gallons  
**TOTAL VOLUME REMOVED:** _____ gallons  
**ODOR:** □ None □ Other  
**COLOR:**  
**TURBIDITY:** □ None □ Moderate □ Slight □ Very  
**DISPOSAL METHOD:** □ Ground □ POTW □ Drum □ Other

**SAMPLE**  
**TIME:**  
**DATE:**  
**ODOR:** □ None □ Other  
**COLOR:**  
**TURBIDITY:** □ None □ Moderate □ Slight □ Very  
**pH:**  
**CONDUCTIVITY:** umhos/cm  
**TEMPERATURE:** °C  
**COMMENTS:**  
**CORRECTED CONDUCTIVITY:** $SC = \{1 + [0.0191 \times (T - 25)]\}$

**FILTRATE (0.45 µm)**  
□ NOT APPLICABLE  
**ODOR:** □ None □ Other  
**COLOR:**  
**COMMENTS:**

**BOTTLES FILLED**  
**PRESERVATIVE CODES:**  
A - None B - HNO3 C - H2SO4 D - NaOH E - HCL F -  
**Number** | **Size** | **Type** | **Preservative** | **Filtered** | **Number** | **Size** | **Type** | **Preservative** | **Filtered**
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**CHAIN-OF-CUSTODY NUMBER:**  
**DATE SHIPPED:**  
**METHOD:**  
**AIRBILL NUMBER:**  
**SIGNED:**  
**DATE:**  

F-186 (REV 1/9/97)
WATER LEVEL DATA

<table>
<thead>
<tr>
<th>Well Location</th>
<th>Time</th>
<th>Reference Elev (MSL)</th>
<th>Depth to Water (feet)</th>
<th>Depth to Bottom (feet)</th>
<th>Water Elev (MSL)</th>
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</thead>
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</tbody>
</table>

* All Water Levels Must Include Reference Point and Tape Correction factor, i.e., 1.1 + 0.00 T/PVC.

Signed ____________________________    Date ____________    QC'd By ____________________________    Date ____________
Example COC and Bottle Label
<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Date Sampled</th>
<th>Time Sampled</th>
<th>G = Grab</th>
<th>C = Composite</th>
<th>Field Filtered</th>
<th>S. S. Sedge</th>
<th>S. S. Bulk</th>
<th>S. S. Soil So</th>
<th>SW - Swastewater</th>
<th>HW - Hard Water</th>
<th>HW - Groundwater</th>
<th>Other Ion</th>
<th>Preservative</th>
<th>Analyze For:</th>
</tr>
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</tbody>
</table>

**Special Instructions:**

<table>
<thead>
<tr>
<th>Laboratory Comments:</th>
</tr>
</thead>
</table>

- Initial Lab Temperature: 
- Received Lab Temperature:  
- Custody Seals:  
- Bottles Supplied by TestAmerica:  
- Sample Containers Intact?:  
- Method of Shipment:
NO TREATMENT

Black Print

HNO₃ PRESERVED

Metals
Red Print

NaOH PRESERVED

Cyanide
Orange Print

H₂SO₄ PRESERVED

Yellow Print

HCl PRESERVED

VOC's - This label goes on outside of baggy that holds set of 3 - 40 ml vials.

Light Blue Print
Attachment B
Monitoring Well Information
Well Information
## Well Information Summary

**Clow Water Systems Company**  
Coshocton, Ohio

### MONITORING WELL/BORING

<table>
<thead>
<tr>
<th>INSIDE DIAMETER (inches)</th>
<th>LOCATION</th>
<th>CURRENT GROUND SURFACE ELEVATION (feet NGVD)</th>
<th>TOP OF CASING ELEVATION (feet NGVD)</th>
<th>WELL INTAKE ELEVATION (feet NGVD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-6 3.75</td>
<td>5388.94</td>
<td>5031.16</td>
<td>772.60</td>
<td>775.27</td>
</tr>
<tr>
<td>A-7 3.75</td>
<td>4874.60</td>
<td>3700.36</td>
<td>762.50</td>
<td>764.33</td>
</tr>
<tr>
<td>B-0 3.75</td>
<td>7481.93</td>
<td>4890.23</td>
<td>778.90</td>
<td>778.84</td>
</tr>
<tr>
<td>B-5 2.00</td>
<td>4393.76</td>
<td>4810.13</td>
<td>770.25</td>
<td>771.86</td>
</tr>
<tr>
<td>D-2 2.00</td>
<td>4770.38</td>
<td>3830.67</td>
<td>764.62</td>
<td>767.17</td>
</tr>
<tr>
<td>D-3 2.00</td>
<td>4767.21</td>
<td>3823.61</td>
<td>764.74</td>
<td>767.29</td>
</tr>
<tr>
<td>D-6 2.00</td>
<td>5281.03</td>
<td>5016.57</td>
<td>774.44</td>
<td>774.74</td>
</tr>
<tr>
<td>D-7 2.00</td>
<td>5266.28</td>
<td>5015.26</td>
<td>774.62</td>
<td>774.92</td>
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<tr>
<td>D-8 2.00</td>
<td>4494.46</td>
<td>3226.57</td>
<td>758.19</td>
<td>758.40</td>
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<tr>
<td>D-9 2.00</td>
<td>4501.86</td>
<td>3226.23</td>
<td>758.14</td>
<td>758.34</td>
</tr>
<tr>
<td>D-10 2.00</td>
<td>4808.32</td>
<td>3260.40</td>
<td>757.72</td>
<td>758.07</td>
</tr>
<tr>
<td>E-1 2.00</td>
<td>5411.54</td>
<td>3574.85</td>
<td>750.65</td>
<td>753.40</td>
</tr>
<tr>
<td>E-2 2.00</td>
<td>3899.93</td>
<td>3166.12</td>
<td>756.91</td>
<td>759.87</td>
</tr>
<tr>
<td>E-3 2.00</td>
<td>4582.16</td>
<td>4082.67</td>
<td>794.05</td>
<td>796.87</td>
</tr>
<tr>
<td>E-4 2.00</td>
<td>4289.35</td>
<td>4199.74</td>
<td>788.86</td>
<td>791.24</td>
</tr>
<tr>
<td>L-2 2.00</td>
<td>5307.47</td>
<td>4233.95</td>
<td>760.92</td>
<td>763.46</td>
</tr>
<tr>
<td>L-3 2.00</td>
<td>5113.56</td>
<td>4332.88</td>
<td>768.17</td>
<td>770.21</td>
</tr>
<tr>
<td>L-4 2.00</td>
<td>5204.16</td>
<td>4498.11</td>
<td>770.16</td>
<td>772.59</td>
</tr>
<tr>
<td>L-5 2.00</td>
<td>5274.22</td>
<td>4686.71</td>
<td>769.14</td>
<td>771.49</td>
</tr>
<tr>
<td>L-6 2.00</td>
<td>5692.36</td>
<td>4447.89</td>
<td>750.46</td>
<td>752.78</td>
</tr>
<tr>
<td>S-1 2.00</td>
<td>4986.67</td>
<td>4145.71</td>
<td>765.26</td>
<td>767.76</td>
</tr>
<tr>
<td>S-2 2.00</td>
<td>4819.74</td>
<td>4216.77</td>
<td>766.22</td>
<td>768.57</td>
</tr>
<tr>
<td>S-3 3.75</td>
<td>4741.48</td>
<td>4214.41</td>
<td>784.29</td>
<td>784.58</td>
</tr>
<tr>
<td>S-4 3.75</td>
<td>4730.09</td>
<td>4594.58</td>
<td>768.73</td>
<td>769.08</td>
</tr>
</tbody>
</table>

**Notes:**
- NS means not surveyed.
- N/A means not applicable.
Well Construction Diagrams/Boring Logs
ATTACHMENT 1

SOIL BORING LOGS
# LOG OF TEST BORING

**BORING No.** E-1  
**SHEET No.** 1 OF 2  
**PROJECT Name** CLOW WATER SYSTEMS  
**LOCATION** COSHOCTON, OHIO  
**PROJECT No.** 115.92  
**INSTALLATION** 12/18/96  
**SURFACE ELEV.**  
**BOREHOLE DIA.** 8 IN.

**PROJECT NAME** CLOW WATER SYSTEMS  
**LOCATION** COSHOCTON, OHIO  
**CONTRACTOR** FRONTZ DRILLING  
**INSTALLATION** 12/18/96  
**SURFACE ELEV.**  
**BOREHOLE DIA.** 8 IN.

## SAMPLING NOTES

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<th>INTERVAL NO.</th>
<th>INTERVAL TYPE</th>
<th>NO.</th>
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## VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS

- **GRANULAR MATERIAL CLASSIFICATION**
- **INTERVAL RECOVERY PID DEPTH**
- **GENERAL OBSERVATIONS**
  - 1: GRAVEL (PARKING LOT)
  - 2: POORLY-GRAD ED SAND (SP), w/ silt, low plasticity, brown, soft, moist.
  - 3: AS ABOVE
  - 4: WELL-GRAD ED SAND (SW), lt. brown, wet.

## GENERAL NOTES

- **DATE STARTED** 12-18-96
- **DATE COMPLETED** 12-18-96
- **RIG** ACKER SOIL MAX
- **CREW CHIEF** ROB HAMILTON
- **LOGGED** A. OJEDA
- **CHECKED** EVH

## WATER LEVEL OBSERVATIONS

- **DATE STARTED** 12-18-96
- **DATE COMPLETED** 12-18-96
- **RIG** ACKER SOIL MAX
- **CREW CHIEF** ROB HAMILTON
- **LOGGED** A. OJEDA
- **CHECKED** EVH
**LOG OF TEST BORING**

**BORING NO.** E-1  
**SHEET NO.** 2 OF 2  
**PROJECT NO.** 115.92  
**LOCATION** COSHOCTON, OHIO  
**PROJECT NAME** CLOW WATER SYSTEMS  
**INSTALLATION** 12/18/96  
**SURFACE ELEV.**  
**CONTRACTOR** FRONTZ DRILLING  
**BOREHOLE DIA.** 8 IN.  
**DRILLING METHOD** 4 1/4" HSA

<table>
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**SAMPLING NOTES**

- No split spoon taken due to 7 feet of sand heave in auger.

Hydropunch sample E-1-A collected at 27 feet.

**VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS**

AS ABOVE

Hydropunch sample E-1-B collected at 37 feet.

BORING TERMINATED AT 39 FEET.
**LOG OF TEST BORING**

**PROJECT NAME:** CLOW WATER SYSTEMS  
**LOCATION:** COSHOCTON, OHIO  
**CONTRACTOR:** FRONTZ DRILLING  
**DRILLING METHOD:** 4 1/4" HSA

---

### SAMPLING NOTES

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### VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS

1. **LEAN CLAY (CL),** high plasticity, high toughness, brown, stiff, moist.
2. **AS ABOVE**
3. **POORLY-GRADED GRAVEL WITH SILT AND SAND (GP-GM),** brown (10 yr 5/3), moist.
4. **WELL-GRADED SAND (SW),** top portion silty, brown, wet.
5. **AS ABOVE**
6. Hydropunch sample E-2-A collected at 27 feet.

- No split spoon sample collected due to sand heave.

**WELL-GRADED SAND (SW),** wet.

**BORING TERMINATED AT 37 FEET.**

---

**GENERAL NOTES**

**DATE STARTED:** 12-20-96  
**DATE COMPLETED:** 12-23-96  
**RIG:** ACKER SOIL MAX  
**CREW CHIEF:** ROB HAMILTON  
**LOGGED:** A. OJEDA  
**CHECKED:** EVH

---

**WATER LEVEL OBSERVATIONS**

**WHILE DRILLING:**  
**AT COMPLETION:** 20.0 ft. BGL  
**AFTER DRILLING:**

**CAVE-IN:** DATE/TIME  
**WATER:** DATE/TIME
# LOG OF TEST BORING

**BORING NO.** E-3  
**PROJECT NAME** CLOW WATER SYSTEMS  
**LOCATION** COSHOCTON, OHIO  
**CONTRACTOR** FRONTZ DRILLING  
**DRILLING METHOD** 4 1/4" HSA

## SAMPLING NOTES

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## VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS

1. **WELL-GRADED SAND WITH GRAVEL (SW), brown (7.5 YR 4/4), moist.**
2. **AS ABOVE**
3. **AS ABOVE**
4. **POORLY-GRADED SAND (SP), medium grained, brown (7.5 YR 4/4), moist.**

## GENERAL NOTES

- **DATE STARTED:** 12-12-96  
- **DATE COMPLETED:** 12-13-96  
- **RIG:** ACKER SOIL MAX  
- **CREW CHIEF:** ROB HAMILTON  
- **LOGGED:** A. OJEDA  
- **CHECKED:** EVH  
- **WATER LEVEL OBSERVATIONS:**  
  - **WHILE DRILLING:** 59.0 ft. BGL  
  - **AT COMPLETION:** 58.0 ft. BGL  
  - **AFTER DRILLING:**
    - **CAVE-IN:** DATE/TIME  
    - **WATER:** DATE/TIME
## LOG OF TEST BORING

**PROJECT NAME**
CLOW WATER SYSTEMS

**LOCATION**
COSHOCTON, OHIO

**CONTRACTOR**
FRONTZ DRILLING

**DRILLING METHOD**
4 1/4" HSA

**BORING NO.**
E-3

**SHEET NO.**
2 OF 3

**PROJECT NO.**
115.92

**INSTALLATION**
12/13/96

**SURFACE ELEV.**

**BOREHOLE DIA.**
8 IN.

### SAMPLING NOTES

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<td>WELL GRADED GRAVEL WITH SAND (GW), brown, (7.5 YR 5/4), moist.</td>
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<td>7 SS</td>
<td>57</td>
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<td>35</td>
<td>WELL GRADED SAND WITH GRAVEL (SW), coarse sand, brown, moist.</td>
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<td>8 SS</td>
<td>50/3</td>
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<td>9 SS</td>
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<td>45</td>
<td>POORLY GRADED SAND (SP), lt. brown (7.5 YR 6/3), medium grained, moist.</td>
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<tr>
<td>10 SS</td>
<td>55</td>
<td>24</td>
<td>50</td>
<td>WELL-GRADED SAND (SW), fine-coarse grained, lt. brown, moist.</td>
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**LOG OF TEST BORING**

**BORING NO.** E-3  
**PROJECT NAME** CLOW WATER SYSTEMS  
**LOCATION** COSHOCTON, OHIO  
**CONTRACTOR** FRONTZ DRILLING  
**DRILLING METHOD** 4 1/4" HSA  
**SURFACE ELEV.**  
**INSTALLATION** 12/13/96  
**BOREHOLE DIA.** 8 IN.

**PROJECT NAME** CLOW WATER SYSTEMS  
**LOCATION** COSHOCTON, OHIO  
**CONTRACTOR** FRONTZ DRILLING  
**DRILLING METHOD** 4 1/4" HSA  
**SURFACE ELEV.**  
**INSTALLATION** 12/13/96  
**BOREHOLE DIA.** 8 IN.

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**VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS**

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<td>15</td>
<td>SS</td>
<td>27</td>
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**AS ABOVE**  
**AS ABOVE, wet.**  
Hydropunch sample E-3-A collected at 63 feet.  
**AS ABOVE, trace gravel.**  
**AS ABOVE**  
Hydropunch sample E-3-B collected at 73 feet.  
**AS ABOVE**  
**BORING TERMINATED AT 77 FEET.**
**LOG OF TEST BORING**

**PROJECT NAME**  
CLOW WATER SYSTEMS

**LOCATION**  
COSHOCTON, OHIO

**CONTRACTOR**  
FRONTZ DRILLING

**DRILLING METHOD**  
4 1/4" HSA

---

**SAMPLING NOTES**

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**VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS**

1. **GRASS / SANDY TOPSOIL**

2. **FILL, WELL-GRADED SAND WITH GRAVEL (SW), medium-coarse sand, fine gravel, red-brown, moist.**

3. **POORLY-GRADED SAND (SP), v. fine grained, brown, moist.**

4. **WELL-GRADED SAND (SW), some fine gravel, medium sand, lt. brown, moist.**

5. **WELL-GRADED SAND WITH GRAVEL (SW), medium-coarse sand, fine-medium gravel, lt. brown, dry.**

---

**GENERAL NOTES**

- **DATE STARTED:** 12-16-96
- **DATE COMPLETED:** 12-17-96
- **RIG:** CME 550 ATV
- **CREW CHIEF:** MIKE O'BRIAN
- **LOGGED:** A. OJEDA
- **CHECKED:** EVH

---

**WATER LEVEL OBSERVATIONS**

- **WHILE DRILLING:**
  - **DATE/TIME:**
  - **DEPTH:**
- **AT COMPLETION:**
  - **DATE/TIME:** 53.0 ft. BGL
- **AFTER DRILLING:**
  - **DATE/TIME:**
  - **DEPTH:**
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<td>AS ABOVE, with fine gravel, dry.</td>
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<td>AS ABOVE</td>
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<td>AS ABOVE, dry, little gravel.</td>
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### LOG OF TEST BORING

**BORING NO.** E-4  
**SHEET NO.** 3 OF 3

**PROJECT NAME** CLOW WATER SYSTEMS  
**LOCATION** COSHOCTON, OHIO  
**INSTALLATION** 12/17/96  
**SURFACE ELEV.**  
**BOREHOLE DIA.** 8 IN.

**CONTRACTOR** FRONTZ DRILLING  
**DRILLING METHOD** 4 1/4" HSA

---

### SAMPLING NOTES

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<td>A</td>
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<td>Hydropunch sample E-4-A collected at 58 feet.</td>
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<td>AS ABOVE, with gravel, wet.</td>
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<td>Hydropunch sample E-4-B collected at 58 feet.</td>
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**BORING TERMINATED AT 80 FEET.**
# LOG OF TEST BORING

**BORING NO.** E-5  
**SHEET NO.** 1 OF 3  
**PROJECT NO.** 115.92  
**LOCATION** COSHOCTON, OHIO  
**CONTRACTOR** FRONTZ DRILLING  
**INSTALLATION** N/A  
**SURFACE ELEV.** N/A  
**BOREHOLE DIA.** 8 IN.

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**SAMPLING NOTES**

**INTERVAL RECOVERY PID VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS**

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<td>FILL, WELL-GRADED SAND (SW), brown, moist.</td>
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<td>FILL, POORLY-GRADED SAND WITH GRAVEL (SP), black. (Foundry Waste)</td>
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<tr>
<td>3</td>
<td>WELL-GRADED SAND (SW), brown, moist.</td>
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</tr>
<tr>
<td>4</td>
<td>POORLY-GRADED SAND (SP), coarse grained, lt. brown. (7.5 YR 6/3)</td>
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</tr>
<tr>
<td>5</td>
<td>WELL-GRADED SAND WITH GRAVEL (SW), lt. brown, moist.</td>
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**GENERAL NOTES**

DATE STARTED 12-10-96  
DATE COMPLETED 12-11-96  
RIG ACKER SOIL MAX  
CREW CHIEF ROB HAMILTON  
LOGGED A. OJEDA CHECKED EVH

**WATER LEVEL OBSERVATIONS**

WHILE DRILLING  
AT COMPLETION  
AFTER DRILLING  
CAVE-IN: DATE/TIME DEPTH  
WATER: DATE/TIME DEPTH
# LOG OF TEST BORING

**BORING NO.** E-5  
**SHEET NO.** 2 OF 3  
**PROJECT NO.** 115.92  
**LOCATION** COSHOCTON, OHIO  
**INSTALLATION** N/A  
**SURFACE ELEV.**  

**CONTRACTOR** FRONTZ DRILLING  
**DRILLING METHOD** 4 1/4" HSA  
**BOREHOLE DIA.** 8 IN.

<table>
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<tr>
<th>INTERVAL NO.</th>
<th>TYPE</th>
<th>RECOVERY</th>
<th>PID</th>
<th>DEPTH</th>
<th>GENERAL OBSERVATIONS</th>
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<tr>
<td>5</td>
<td>SS</td>
<td>50/1 12</td>
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<td>WELL-GRADED GRAVEL WITH SAND (GW), with cobbles.</td>
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<td>AS ABOVE, cobble fragment in splitspoon.</td>
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<tr>
<td>7</td>
<td>SS</td>
<td>19 19</td>
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<td>AS ABOVE, lt. brown, moist.</td>
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<tr>
<td>8</td>
<td>SS</td>
<td>27 24</td>
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<td>40</td>
<td>AS ABOVE, moist, laminated.</td>
</tr>
<tr>
<td>9</td>
<td>SS</td>
<td>17 24</td>
<td></td>
<td>45</td>
<td>AS ABOVE</td>
</tr>
<tr>
<td>10</td>
<td>SS</td>
<td>34 24</td>
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<td>50</td>
<td>AS ABOVE</td>
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**PROJECT NAME** CLOW WATER SYSTEMS  

**NOTE:** Visual classification and general observations.
## LOG OF TEST BORING

<table>
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<th>TYPE</th>
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<td>HP</td>
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<tr>
<td>C</td>
<td>HP</td>
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<td></td>
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**VISUAL CLASSIFICATION**

- Center plug wet at 54.6 feet (lbs).
- **WELL-GRADED SAND (SW)**, brown, wet.
  - Hydropunch sample E-5-A collected at 57 feet.
- **AS ABOVE**
- **AS ABOVE**
  - Hydropunch sample E-5-B collected at 67 feet.
- **WELL-GRADED SAND WITH GRAVEL (SW)**
  - **WELL-GRADED SAND (SW)**, trace gravel, lt. brown, wet.
- **AS ABOVE**, without gravel.
  - Hydropunch sample E-5-C collected at 77 feet
- **BORING TERMINATED AT 79 FEET.**
**LOG OF TEST BORING**

**BORING NO.** LH-3  
**PROJECT NO.** 11563  
**DATE COMPLETED** FEB 20 91  
**RIG** 1-Rand TH-60  
**CREW CHIEF** M. Santas  
**LOGGED** R. Graham  
**CHECKED**

---

### SAMPLING NOTES

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<th>TYPE</th>
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### VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS

- **SAND and GRAVEL** with some clay, very dark brown 10YR 2/2, dense, nonplastic, moist, Hnu=0ppm, no odor, (SP) (Fill).

- As above, moist, no odor, Hnu=0ppm, (Fill).

- **SAND and GRAVEL** with little clay, very dark brown 10YR 2/2, well graded, medium dense, nonplastic, moist, Hnu=0ppm, (Fill).

- Fine grained **SAND** with little silt, Yel. Br. 10YR 5/8, poorly graded, m. dense, nonplastic, moist, Hnu=0ppm, no odor (SP) (Fluvial Sand).

- Fine grained **SAND**, as above, Hnu=0ppm, moist, no odor (SP).

- Fine grained **SAND** and **SILT**, Yel. Br. 10YR 5/8, m. dense, nonplastic, moist, Hnu=0ppm, no odor, (SM) (Lacustrine).

- Medium grained **SAND**, Yel. Br. 10YR 5/8, poorly graded, m. dense, nonplastic, moist, no odor, Hnu=0ppm, (SP) (Fluvial Sand).

- M. to c. **SAND** with trace fine gravel, brownish yellow 10YR 6/8, poorly graded, m. dense, nonplastic, moist, Hnu=0ppm, no odor, (SP) (Fluvial Sand).

- Fine grained **SAND** and **SILT**, yellowish brown 10YR 5/8, poorly graded, m. dense, nonplastic, moist, Hnu=0ppm, no odor (SM) (Lacustrine Sandy Silt).

- Coarse **SAND** and **GRAVEL**, dark yellowish brown 10YR 3/4, well graded, very dense, nonplastic, moist, Hnu=0ppm, no odor (SW) (Fluvial Sandy Gravel).

As above but saturated.

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### GENERAL NOTES

- **DATE STARTED** FEB 20 91  
- **DATE COMPLETED** FEB 20 91

---

### WATER LEVEL OBSERVATIONS

- **WHILE DRILLING** 18.0 Ft.

---

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<th>DEPTH</th>
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</thead>
<tbody>
<tr>
<td>DATE/TIME</td>
<td>DEPTH</td>
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<td>----------</td>
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**Visual Classification and General Observations**

- Empty spoon, gravel in tip.
- End of Boring at 25 Ft.
**LOG OF TEST BORING**

**Boring No.** L-2  
**Sheet No.** 1 of 2

**Project Name:** CLOW WATER SYSTEMS  
**Location:** COSHOCTON, OHIO  
**Project No.:** 115.92  
**Installation:** 12/20/97

**Drilling Method:** 4 1/4” HSA  
**Surface Elev.:**  
**Borehole Dia.:** 8 IN.

---

### Sampling Notes

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<th>Recovery N</th>
<th>Recovery IN</th>
<th>PID ppm</th>
<th>Depth</th>
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<td>10</td>
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<td>3</td>
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<td>SS</td>
<td>6</td>
<td>22</td>
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</table>

### Visual Classification and General Observations

- **Grass**
- **Fill, Poorly-Graded Sand (SP),** black, moist. (Foundry Sand)
- **As Above**
- **As Above, wet.**
- **As Above**
- **Lean Clay (CL),** high plasticity, high dry strength, high toughness, dark greenish-gray, very stiff, moist.  
- **As Above**

Note: Boring ceased on 12/16/96 at 26 ft. due to presence of clay. Drilling continued at same location on 12/19/96, and soil sampling continued at 25 ft.

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**General Notes**

- **Date Started:** 12-5-96  
- **Date Completed:** 12-20-96  
- **Rig:** CME 550 ATV  
- **Crew Chief:** MIKE O'BRIAN  
- **Logged by:** A. OJEDA  
- **Checked by:** EVH

**Water Level Observations**

- **While Drilling:**  
- **At Completion:**  
- **After Drilling:**  

---

**Water**: Date/Time  
**Depth**: Date/Time

---

**Cave-In**: Date/Time  
**Depth**: Date/Time
LOG OF TEST BORING

BORING NO. L-2
SHEET NO. 2 OF 2
PROJECT NO. 115.92
INSTALLATION 12/20/97
SURFACE ELEV.

PROJECT NAME CLOW WATER SYSTEMS
LOCATION COSHOCTON, OHIO
CONTRACTOR FRONTZ DRILLING
DRILLING METHOD 4 1/4" HSA

SAMPLING NOTES

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<th>INTERVAL NO.</th>
<th>TYPE</th>
<th>RECOVERY</th>
<th>PID</th>
<th>DEPTH</th>
<th>VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS</th>
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<tbody>
<tr>
<td>8</td>
<td>SS</td>
<td>29</td>
<td>24</td>
<td>35</td>
<td>WELL-GRADED SAND WITH GRAVEL (SW), wet.</td>
</tr>
<tr>
<td>A</td>
<td>HP</td>
<td></td>
<td></td>
<td>40</td>
<td>Hydropunch sample L-2-A collected at 32 feet.</td>
</tr>
<tr>
<td>9</td>
<td>SS</td>
<td>24</td>
<td>20</td>
<td>45</td>
<td>WELL-GRADED SAND (SW), lt. gray, trace gravel, wet.</td>
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<tr>
<td>10</td>
<td>SS</td>
<td>8</td>
<td>24</td>
<td>50</td>
<td>AS ABOVE, no gravel.</td>
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<tr>
<td>B</td>
<td>HP</td>
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<td>Hydropunch sample L-2-B collected at 42 feet.</td>
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<tr>
<td>C</td>
<td>HP</td>
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<td>60</td>
<td>Hydropunch sample L-2-C collected at 52 feet.</td>
</tr>
</tbody>
</table>

BORING TERMINATED AT 54 FEET.
**LOG OF TEST BORING**

**BORING NO.** L-3  
**SHEET NO.** 1 OF 3  
**PROJECT NO.** 115.92  
**LOCATION** COSHOCTON, OHIO  
**INSTALLATION** 12/10/96  
**CONTRACTOR** FRONTZ DRILLING  
**DRILLING METHOD** 4 1/4" HSA  
**SURFACE ELEV.** 8 IN.

### SAMPLING NOTES

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<td>SS</td>
<td>11</td>
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</tr>
<tr>
<td>4</td>
<td>SS</td>
<td>34</td>
<td>7</td>
<td>20</td>
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</table>

### VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS

1. **FILL, POORLY GRADED SAND (SP), medium-coarse grained, black, moist.**
2. **AS SAME**
3. **AS ABOVE, with Slag.**
4. **AS ABOVE**

### GENERAL NOTES

- **DATE STARTED:** 12-6-96
- **DATE COMPLETED:** 12-10-96
- **RIG:** CME 550 ATV
- **CREW CHIEF:** MIKE O'BRIAN
- **LOGGED:** A. OJEDA  
- **CHECKED:** EVH

### WATER LEVEL OBSERVATIONS

- **WHILE DRILLING**
- **AT COMPLETION:** 32.0 ft. BGL
## LOG OF TEST BORING

**BORING NO.** L-3  
**SHEET NO.** 2 OF 3  
**PROJECT NO.** 115.92  
**INSTALLATION DATE** 12/10/96  
**LOCATION** COSHOCTON, OHIO  
**CONTRACTOR** FRONTZ DRILLING  
**DRILLING METHOD** 4 1/4" HSA  
**SURFACE ELEV.**  
**BOREHOLE DIA.** 8 IN.

### SAMPLING NOTES

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<th>INTERVAL NO.</th>
<th>INTERVAL TYPE</th>
<th>RECOVERY N</th>
<th>PID (IN)</th>
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<tr>
<td>5</td>
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<td>AS ABOVE</td>
</tr>
<tr>
<td>6</td>
<td>SS</td>
<td>43</td>
<td>12</td>
<td>30</td>
<td>AS ABOVE</td>
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</table>
| 7            | SS            | 3          |          | 35    | WELL-GRADED SAND WITH GRAVEL (SW), reddish-brown, wet.  
Hydropunch sample L-3-A collected at 37 feet. |
| A            | HP            |            |          |       | AS ABOVE                                      |
| 8            | SS            | 16         | 24       | 40    | AS ABOVE                                      |
| 9            | SS            | 12         | 24       | 45    | AS ABOVE. 17 feet heaving sands washed out with potable water prior to collecting soil sample.  
Hydropunch sample L-3-B collected at 47 feet. |
| B            | HP            |            |          | 50    | AS ABOVE                                      |

### WELL CONSTRUCTION NOTES
**LOG OF TEST BORING**

**BORING NO.** L-3  
**SHEET NO.** 3 OF 3

**PROJECT NAME** CLOW WATER SYSTEMS  
**LOCATION** COSHOCTON, OHIO  
**CONTRACTOR** FRONTZ DRILLING  
**DRILLING METHOD** 4 1/4" HSA

**PROJECT NO.** 115.92  
**INSTALLATION** 12/10/96  
**SURFACE ELEV.**  
**BOREHOLE DIA.** 8 IN.

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<tr>
<td>C</td>
<td>HP</td>
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**VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS**

POORLY-GRADED SAND (SP), trace gravel, fine-grained sand, gray, wet.

Hydropunch sample L-3-C collected at 57 feet.

BOTTOM OF BORING 60 FEET.
### LOG OF TEST BORING

**BORING NO.: L-4**  
**PROJECT NO.: 115.92**  
**SITE NAME: CLOW WATER SYSTEMS**  
**LOCATION: COHOCTON, OHIO**  
**INSTALLATION DATE: 12/9/96**  
**SURFACE ELEV.: 4 1/4" HSA**  
**DRILLING METHOD: 4 1/4" HSA**  
**BOREHOLE Dia.: 8 IN.**  

---

#### SAMPLING NOTES

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<td>SS</td>
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<tr>
<td>5</td>
<td>SS</td>
<td>34</td>
<td>22</td>
<td>25</td>
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#### VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS

- **INTERVAL 1**:  
  - **Sample Type**: FILL, LEAN CLAY (CL)  
  - **Notes**: with coarse sand, some slag, moist.

- **INTERVAL 2**:  
  - **Sample Type**: AS ABOVE

- **INTERVAL 3**:  
  - **Sample Type**: FILL, WELL-GRADED SAND (SW),  
    - **Notes**: yellowish-brown, (10 YR 5/4), moist.
  - **Sample Type**: FILL, POORLY GRADED SAND, black. (Foundry Sand)

- **INTERVAL 4**:  
  - **Sample Type**: AS ABOVE w/ slag, brown & black, moist.

- **INTERVAL 5**:  
  - **Sample Type**: AS ABOVE, with clay, black & gray, v. hard.

---

**GENERAL NOTES**

- **DATE STARTED**: 12-5-96  
- **DATE COMPLETED**: 12-9-96  
- **RIG**: ACKER SOIL MAX  
- **CREW CHIEF**: ROB HAMILTON  
- **LOGGED**: A. OJEDA, CHECKED: EVH

---

**WATER LEVEL OBSERVATIONS**

- **WHILE DRILLING**:  
  - **DATE/TIME**: 30.0 ft. BGL
- **AT COMPLETION**:  
  - **DATE/TIME**: DEPTH
- **AFTER DRILLING**:  
  - **DATE/TIME**: DEPTH
- **CAVE-IN**: DATE/TIME DEPTH
- **WATER**: DATE/TIME DEPTH
**LOG OF TEST BORING**

**PROJECT NAME**: CLOW WATER SYSTEMS

**LOCATION**: COSHOCTON, OHIO

**CONTRACTOR**: FRONTZ DRILLING

**DRILLING METHOD**: 4 1/4" HSA

**SURFACE ELEV.**: 8 IN.

**BOREHOLE DIA.**: 8 IN.

---

**INTERVAL NO.** | **TYPE** | **RECOVERY** | **PID** | **DEPTH** | **VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS**
--- | --- | --- | --- | --- | ---
8 | SS | 38 | 20 | 35 | AS ABOVE, no clay, black, wet.
7 | SS | 35 | 22 | 37 | AS ABOVE
8 | SS | 66/7 | 22 | 40 | POORLY-GRADED SAND (SP), medium grained, black.
A | HP | 15 | 22 | 45 | WELL-GRADED SAND (SW), dk. gray (10 YR 4/1), wet.
9 | SS | 19 | 24 | 50 | AS ABOVE, fine to coarse sand, dk. gray, wet.
B | HP |  |  | 55 | 
10 | SS |  |  |  | 

**BORING TERMINATED AT 55 FEET.**
## LOG OF TEST BORING

**PROJECT NAME:** CLOW WATER SYSTEMS  
**LOCATION:** COSHOCTON, OHIO  
**CONTRACTOR:** FRONTZ DRILLING  
**DRILLING METHOD:** 4 1/4" HSA

### SAMPLING NOTES

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<th>PID ppm</th>
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### VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS

- **GRASS**
- **FILL, WELL-GRADED SAND WITH GRAVEL (SW),** v. dark brown (7.5 YR 2.5/2), moist.
- **AS ABOVE,** w/ brick fragments mixed w/ coal fragments, mostly v. dark brown, v. cohesive, moist.
- **AS ABOVE**
- **AS ABOVE**
- **GRAVELLY LEAN CLAY WITH SAND (CL),** v. dark brown, v. stiff to hard, moist.
- **LEAN CLAY WITH SAND (CL),** trace silt, sand is fine grained, moderate plasticity, medium toughness, dark brown, firm, moist.

### GENERAL NOTES

- **DATE STARTED:** 12-3-96  
- **DATE COMPLETED:** 12-4-96  
- **RIG:** ACKER SOIL MAX  
- **CREW CHIEF:** ROB HAMILTON  
- **LOGGED:** A. OJEDA  
- **CHECKED:** EVH

### WATER LEVEL OBSERVATIONS

- **WHILE DRILLING**
- **AT COMPLETION**
- **AFTER DRILLING**
- **CAVE-IN:** DATE/TIME  
- **WATER:** DATE/TIME  
- **DEPTH**
# LOG OF TEST BORING

**BORING NO.** L-5  
**SHEET NO.** 2 OF 2  
**PROJECT NO.** 115.92  
**LOCATION** COSHOCTON, OHIO  
**INSTALLATION** 12/5/96  
**CONTRACTOR** FRONTZ DRILLING  
**SURFACE ELEV.**  
**BOROHEOLE DIA.** 8 IN.  

**PROJECT NAME** CLOW WATER SYSTEMS  
**PROJECT NO.** 115.92  
**INSTALLATION** 12/5/96  
**CONTRACTOR** FRONTZ DRILLING  
**DRILLING METHOD** 4 1/4" HSA  

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**VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS**

- **POORLY-GRADED SAND WITH SILT AND GRAVEL (SP-SM), brown (10 YR 4/3), moist.**
- **WELL-GRADED SAND (SW), medium grained, yellowish-brown (10 YR 5/6), moist.**

AS ABOVE, trace gravel, brown (7.5 YR 4/3), wet.

Hydropunch sample L-5-A collected at 37 feet.

AS ABOVE, no gravel, trace coarse sand.

AS ABOVE

Hydropunch sample L-5-B collected at 47 feet.

AS ABOVE, trace silt, brown (10 YR 4/3), wet.

AS ABOVE, coarse sand at 56-57 feet.

Hydropunch sample L-5-C collected at 57 feet.

BORING TERMINATED AT 60 FEET.
## LOG OF TEST BORING

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### VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS

- **Grass**
  - WELL- GRADED SAND (SW), with some silt, dk. brown, moist.
  - POORLY- GRADED SAND (SP), fine grained to medium grained, reddish-brown (5 YR 4/4), moist.
  - No Recovery

- **AS ABOVE, wet.**
  - AS ABOVE, fine grained, trace silt, brown (7.5 YR 4/3), wet.

Hydropunch sample L-6-A collected at 22 feet.

### GENERAL NOTES

- **DATE STARTED**: 12-12-96
- **DATE COMPLETED**: 12-13-96
- **RIG**: CME 550 ATV
- **CREW CHIEF**: MIKE O'BRIAN
- **LOGGED**: A. OJEDA, CHECKED: EVH

### WATER LEVEL OBSERVATIONS

- **WHILE DRILLING**: 
- **AT COMPLETION**: 
- **AFTER DRILLING**: 
- **CAVE-IN**: DATE/TIME, DEPTH
- **WATER**: DATE/TIME, DEPTH
**LOG OF TEST BORING**

**BORING NO.** L-6  
**SHEET NO.** 2 OF 2  
**PROJECT NO.** 115.92  
**INSTALLATION** 12/13/97  
**SURFACE ELEV.**  
**BOREHOLE DIA.** 8 IN.

**PROJECT NAME** GLOW WATER SYSTEMS  
**LOCATION** COSHOCTON, OHIO  
**CONTRACTOR** FRONTZ DRILLING  
**DRILLING METHOD** 4 1/4" HSA

### SAMPLING NOTES

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**VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS**

- **WELL-GRADED SAND (SW), lt. brown (7.5 YR 6/3), wet.**
- **AS ABOVE**
- **Hydropunch sample L-6-B collected at 32 feet.**
- **AS ABOVE**
- **AS ABOVE**
- **Hydropunch sample L-6-C collected at 42 feet.**
- **BORING TERMINATED AT 44 FEET.**
### LOG OF TEST BORING

**Project Name:** CLOW WATER SYSTEMS  
**Location:** COSHOCTON, OHIO  
**Contractor:** FRONTZ DRILLING  
**Drilling Method:** 4 1/4" HSA BOREHOLE DIA. 8 IN.  

#### Sampling Notes

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#### Visual Classification and General Observations

- **Grass, Topsoil**
- **Fill, Poorly Graded Sand (SP),** mixed with foundry sand, brown and gray, moist.
- **As Above**
- **As Above**
- **Lean Clay (CL),** with some silt and fine sand, lt. yellow-brown (10 YR 6/4), moderate plasticity, medium toughness, moist.

#### General Notes

- **Date Started:** 12-17-96
- **Date Completed:** 12-19-96
- **Rig:** CME 550 ATV
- **Crew Chief:** MIKE O'BRIAN
- **Logged by:** A. OJEDA  
- **Checked:** EVH

#### Water Level Observations

- **While Drilling:** 30.0 ft. BGL
- **At Completion:** 30.0 ft. BGL
- **After Drilling:**
  - **Cave-In:** Date/Time:  
  - **Depth:**
  - **Water:** Date/Time:  
  - **Depth:**
## LOG OF TEST BORING

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### VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS

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- **POORLY GRADED SAND (SP),** medium-grained, brown and gray mottled

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- **WELL GRADED SAND (SW),** light brown (7.5 YR 6/3), wet.

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- **BOTTOM OF BORING 40 FEET**

---

**PROJECT NAME:** CLOW WATER SYSTEMS  
**LOCATION:** COSHOCTON, OHIO  
**CONTRACTOR:** FRONTZ DRILLING  
**DRILLING METHOD:** 4 1/4" HSA  
**BOREHOLE DIA.:** 8 IN.
## LOG OF TEST BORING

**BORING NO.** S-2
**PROJECT NO.** 115.92
**DATE COMPLETED** 12-10-96
**DATE INTAKE** 12-10-96
**DATE LOGGED** 12-10-96

### SAMPLING NOTES

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### VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS

- **GRASS**
- **FILL, POORLY-GRADED SAND (SP), some gravel and silt, medium-grained sand, it. brown, moist.**
- **SILT (ML), trace gravel, gray, sl. plasticity, moist.**
- **POORLY-GRADED SAND WITH GRAVEL (SP), medium sand, fine gravel, it. brown, dry to moist.**
- **AS ABOVE**
- **AS ABOVE, moist, dry at bottom.**

### GENERAL NOTES

- **DATE STARTED** 12-10-96
- **DATE COMPLETED** 12-10-96
- **RIG** CME 550 ATV
- **CREW CHIEF** MIKE O'BRIAN
- **LOGGED** VANHEYDE
- **CHECKED** EVH
# Log of Test Boring

**Project Name:** CLOW WATER SYSTEMS  
**Location:** COSHOCTON, OHIO  
**Contractor:** FRONTZ DRILLING  
**Drilling Method:** 4 1/4" HSA

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**Visual Classification and General Observations:**

- **Well-Graded Sand with Gravel (SW),** medium-fine sand, medium-fine gravel, lt. brown, wet.

- **As above, wet.**

- Hydropunch sample S-2-A collected at 39 feet.

- **As above**

- **As above**

- Hydropunch sample S-2-B collected at 48 feet.

- **As above**

- **As above**

- Hydropunch sample S-2-C collected at 58 feet.

- **Boring terminated at 60 feet.**
# Log of Test Boring

**Project Name:** CLOW  
**Location:** Coshocton, Ohio  
**Contractor:** Layne N.W.  
**Drilling Method:** Dual Tube  

**Boring No.:** D-6  
**Sheet No.:** 1 of 1  
**Project No.:** 115.70  
**Installation:** 03/30/93  
**Surface Elev.:** 773.1  
**Borehole Dia.:** 6 IN.

## Sampling Notes

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**Visual Classification and General Observations**

See boring log for D-7.

---

**General Notes**

- **Date Started:** MAR 30 93  
- **Date Completed:** MAR 30 93  
- **Rig:** IR TH-60  
- **Crew Chief:** M. Santas  
- **Logged:** R. Graham  
- **Checked:**

**Water Level Observations**

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**LOG OF TEST BORING**

**F-203 (R 01-87)**

**PROJECT NAME:** CLOW  
**LOCATION:** Coshocton, Ohio  
**CONTRACTOR:** Lavine N.W.  
**DRILLING METHOD:** HSA 4 1/4"  
**BOREHOLE DIA.:** 6 IN.

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**VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS**

- **INTERVAL A:** GRAB, silty clay (CL), plastic, yellowish brown 10YR 5/6, soft (Topsoil).
- **INTERVAL B:** Sandy clay (CL), slightly plastic, yellowish brown 10YR 5/6, stiff, alluvium gravel at 6.5'.
- **INTERVAL C:** Poorly graded sand (SP), with silt, nonplastic, brownish yellow 10YR 6/8, medium dense, alluvial.
- **INTERVAL D:** Well graded gravel with sand (GW), trace clay, dark yellowish brown 10YR 4/6, medium dense, fluvial material.
- **INTERVAL E:** Well graded gravel with sand (GW), with some clay, dark yellowish brown 10YR 4/6, dense, fluvial.
- **INTERVAL F:** Well graded gravel with sand (GW), with some clay, yellowish brown 10YR 5/4, medium dense, fluvial.

**GENERAL NOTES**

- **DATE STARTED:** MAR 29 93  
- **DATE COMPLETED:** MAR 30 93  
- **RIG:** IR TH-60  
- **CREW CHIEF:** M. Santas  
- **LOGGED:** R. Graham  
- **CHECKED:**

**WATER LEVEL OBSERVATIONS**

- **WHILE DRILLING:** Ft.  
- **AT COMPLETION:** Ft.  
- **AFTER DRILLING:**
  - CAVE-IN: DATE/TIME  
  - WATER: DATE/TIME
### Visual Classification and General Observations

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<td>G</td>
<td>SS</td>
<td>12</td>
<td></td>
<td></td>
<td>Poorly graded sand (SP), with trace silt and gravel, yellowish brown 10YR 5/4, medium dense, fluvial sand.</td>
</tr>
<tr>
<td>H</td>
<td>SS</td>
<td>33</td>
<td></td>
<td>35</td>
<td>Well graded sand with gravel (SP), yellowish brown 10YR 5/6, medium dense, fluvial sand.</td>
</tr>
<tr>
<td>I</td>
<td>GRAB</td>
<td>W</td>
<td></td>
<td>40</td>
<td>Poorly graded sand (SP), pale brown 10YR 6/3.</td>
</tr>
<tr>
<td>J</td>
<td>GRAB</td>
<td>W</td>
<td></td>
<td>50</td>
<td>Well graded gravel with sand (GW), pale brown 10YR 6/3, fluvial.</td>
</tr>
<tr>
<td>K</td>
<td>GRAB</td>
<td>W</td>
<td></td>
<td>60</td>
<td>Well graded gravel with sand (GW), pale brown 10YR 6/3, fluvial.</td>
</tr>
<tr>
<td>INTERVAL NO.</td>
<td>TYPE</td>
<td>RECOVERY</td>
<td>MOISTURE</td>
<td>DEPTH</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>L GRAB</td>
<td></td>
<td>W</td>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M GRAB</td>
<td></td>
<td>W</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N GRAB</td>
<td></td>
<td>W</td>
<td>90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sampling Notes**

WELL GRADED GRAVEL WITH SAND (GW), gravel is round, grayish brown 10YR 5/2, fluvial.

WELL GRADED GRAVEL WITH SAND (GW), dark grayish brown 10YR 4/3, round, fluvial.

WELL GRADED GRAVEL WITH SAND (GW), dark grayish brown 10YR 4/2, fluvial.
LOG OF TEST BORING
F-203 (R 01-87)

BORING NO. D-7
SHEET NO. 4 OF 4
PROJECT NO. 11570
INSTALLATION 03/30/93
SURFACE ELEV. 776.6
BOREHOLE DIA. 6 IN.

PROJECT NAME CLOW
LOCATION Coshocton, Ohio
CONTRACTOR Layne NW.

DRILLING METHOD HSA 4 1/4"

<table>
<thead>
<tr>
<th>INTERVAL NO.</th>
<th>TYPE</th>
<th>RECOVERY</th>
<th>MOISTURE</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>O GRAB</td>
<td></td>
<td>W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P GRAB</td>
<td></td>
<td>W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q GRAB</td>
<td></td>
<td>W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R GRAB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS

WELL GRADED SAND WITH GRAVEL (SW), pale brown 10YR 6/3, fluvial.

LEAN CLAY (CL), plastic, light brownish gray 10YR 6/3, lacustrine.

POORLY GRADED SAND (SP), fine, yellowish brown 10YR 5/6, fluvial.

LEAN CLAY (CL), as above, gray.

POORLY GRADED SAND (SP), fine, strong brown 7.5YR 4/6, fluvial.

POORLY GRADED SAND (SP), fine to very fine, yellowish brown 10YR 5/4, fluvial.

End of Boring at 130 Ft.
## LOG OF TEST BORING

**PROJECT NAME**: CLOW  
**LOCATION**: Coshocton, Ohio  
**CONTRACTOR**: Layne N.W.  
**DRILLING METHOD**: Dual Tube

### SAMPLING NOTES

<table>
<thead>
<tr>
<th>INTERVAL NO.</th>
<th>RECOVERY TYPE</th>
<th>MOISTURE</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS

See boring log for D-9.

### GENERAL NOTES

- **DATE STARTED**: APR 1 93  
- **DATE COMPLETED**: APR 2 93  
- **RIG**: IR TH-60  
- **CREW CHIEF**: M. Santas  
- **LOGGED**: R. Graham  
- **CHECKED**:  

### WATER LEVEL OBSERVATIONS

- **WHILE DRILLING**:  
- **AT COMPLETION**:  
- **AFTER DRILLING**:  

### End of Boring at 38 Ft.
**LOG OF TEST BORING**

**F-203 (R 01-87)**

**BORING NO.** D-9  
**SHEET NO.** 1 OF 3  
**PROJECT NO.** 115.70  
**PROJECT NAME** CLOW  
**LOCATION** Coshocton, Ohio  
**CONTRACTOR** Layne N.W.  
**INSTALLATION** 04/01/93  
**SURFACE ELEV.** 757.9  
**BOREHOLE DIA.** 6 IN.

<table>
<thead>
<tr>
<th>INTERVAL NO.</th>
<th>RECOVERY/TYPE</th>
<th>MOISTURE</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>SS</td>
<td>M</td>
<td>5</td>
</tr>
<tr>
<td>B</td>
<td>SS</td>
<td>M</td>
<td>10</td>
</tr>
<tr>
<td>C</td>
<td>SS</td>
<td>M</td>
<td>15</td>
</tr>
<tr>
<td>D</td>
<td>SS</td>
<td>M/W</td>
<td>20</td>
</tr>
<tr>
<td>E</td>
<td>SS</td>
<td>W</td>
<td>25</td>
</tr>
</tbody>
</table>

**VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS**

- **FILL, SILTY SAND WITH GRAVEL (SM),** brownish yellow 10YR 6/6 and very dark grayish brown 10YR 3/2, medium dense.
- **FILL, as above, fine brick in sample, loose.**
- **POORLY GRADED SAND WITH SILT (SP-SM),** yellowish brown 10YR 5/4, loose, fluvial sand.
- **POORLY GRADED SAND WITH SILT (SP-SM),** as above.
- **SILTY SAND WITH GRAVEL (SM),** brownish yellow 10YR 6/6, no odor, very loose, fluvial.

**GENERAL NOTES**

- **DATE STARTED** APR 1993  
- **DATE COMPLETED** APR 1993  
- **RIG** IR TH-60  
- **CREW CHIEF** M. Santas  
- **LOGGED** R. Graham  
- **CHECKED**

**WATER LEVEL OBSERVATIONS**

- **WHILE DRILLING**  
- **AT COMPLETION**  
- **AFTER DRILLING**

**CAVE-IN:** DATE/TIME  DEPTH  
**WATER:** DATE/TIME  DEPTH
<table>
<thead>
<tr>
<th>INTERVAL NO.</th>
<th>RECOVERY TYPE</th>
<th>MOISTURE</th>
<th>DEPTH</th>
<th>VISUAL CLASSIFICATION AND GENERAL OBSERVATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>SS</td>
<td>9</td>
<td>35</td>
<td>POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM), brownish yellow 10YR 6/6, medium dense, fluvial.</td>
</tr>
<tr>
<td>G</td>
<td>SS</td>
<td>16</td>
<td>40</td>
<td>POORLY GRADED SAND WITH GRAVEL (SP), brownish yellow 10YR 6/6.</td>
</tr>
<tr>
<td>W</td>
<td></td>
<td></td>
<td>50</td>
<td>POORLY GRADED SAND WITH SILT (SP-SM), fine grained sand, brownish yellow 10YR 6/6, fluvial.</td>
</tr>
<tr>
<td>W</td>
<td></td>
<td></td>
<td>60</td>
<td>POORLY GRADED SAND WITH SILT (SP-SM), fine grained, brownish yellow 10YR 6/6, fluvial.</td>
</tr>
</tbody>
</table>

As above, loose.
LOG OF TEST BORING

BORING NO. D-9
SHEET NO. 3 OF 3

PROJECT NAME CLOW
LOCATION Coshocton, Ohio
CONTRACTOR Layne N.W.

DRILLING METHOD HSA 4 1/4" BOREHOLE DIA. 6 IN.

SURFACE ELEV. 757.9
PROJECT NO. 115.70
INSTALLATION 04/01/93

WELL GRADED SAND WITH GRAVEL (SW), olive brown 2.5Y 4/4, fluvial.

As above.

End of Boring at 78 Ft.

<table>
<thead>
<tr>
<th>INTERVAL NO.</th>
<th>TYPE</th>
<th>RECOVERY</th>
<th>MOISTURE</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
LOG OF TEST BORING

BORING NO. D-10
SHEET NO. 1 OF 1
PROJECT NO. 11570
INSTALLATION 03/31/93
SURFACE ELEV. 757.2
BOREHOLE DIA. 6 IN.

PROJECT NAME CLOW
LOCATION Coshocton, Ohio
CONTRACTOR Layne N.W.
DRILLING METHOD Dual Tube

SAMPLING NOTES

INTERVAL NO. TYPE N IN

RECOVERY

MOISTURE

DEPTH

VISUAL CLASSIFICATION
AND GENERAL OBSERVATIONS

See boring log for D-11.

End of Boring at 38 Ft.

GENERAL NOTES
DATE STARTED MAR 31 93
DATE COMPLETED MAR 31 93
RIG IR TH-60
CREW CHIEF M. Santas
LOGGED R. Graham CHECKED

WATER LEVEL OBSERVATIONS
WHILE DRILLING Ft.
AT COMPLETION Ft.
AFTER DRILLING
CAVE-IN: DATE/TIME DEPTH
WATER: DATE/TIME DEPTH
ATTACHMENT 2
WELL CONSTRUCTION DETAILS
MONITORING WELL CONSTRUCTION

1) CASING DETAILS
   A) TYPE OF PIPE:
      PVC / STAINLESS / TEFLOM / OTHER
   B) TYPE OF PIPE JOINTS:
      SLIP / THREADED / TAPED / OTHER
   C) TYPE OF WELL SCREEN:
      PVC / STAINLESS / TEFLOM / OTHER
   D) INSTALLED PROTECTOR PIPE W/LOCK?

2) WELL DEVELOPMENT
   A) METHOD:
      BAILING / AUGER / COMPR. AIR / OTHER
   B) TIME SPENT FOR DEVELOPMENT:
      12 hrs
   C) APPROXIMATE WATER VOLUME:
      REMOVED: 50 gal
      ADDED:
   D) WATER CLARITY:
      BEFORE DEVELOPMENT:
      CLEAR / TURBID / OPAQUE
      AFTER DEVELOPMENT:
      CLEAR / TURBID / OPAQUE
   E) ODOR?

3) WATER LEVEL SUMMARY
   A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT:
      17.3 ft.
   B) OTHER MEASUREMENTS (T.O.C.):
      DATE / TIME DEPTH FT.
      DATE / TIME DEPTH FT.
      DATE / TIME DEPTH FT.

ADDITIONAL COMMENTS:
MONITORING WELL CONSTRUCTION

1) CASING DETAILS
   A) TYPE OF PIPE:
      PVC/STAINLESS/TEFLON/OTHER
   B) TYPE OF PIPE JOINTS:
      PELLETS/GRANULAR/AR/PC/OTHER
   C) TYPE OF WELL SCREEN:
      PVC/STAINLESS/TEFLON/OTHER
   D) INSTALLED PROTECTOR PIPE W/LOCK?
      YES OR NO

2) WELL DEVELOPMENT
   A) METHOD:
      BAILING/PUMPING/SUSPENDED COMpressed AIR/OTHER
   B) TIME SPENT FOR DEVELOPMENT:
      3.4 hours
   C) APPROXIMATE WATER VOLUME:
      REMOVED: 50 gallons

3) WATER LEVEL SUMMARY
   A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?
      51.37 ft. OR DRY
   B) OTHER MEASUREMENTS (T.O.C.):
      DATE/TIMEDEPTH FT.

ADDITIONAL COMMENTS:
MONITORING WELL CONSTRUCTION

1) CASING DETAILS
   a) TYPE OF PIPE:
      PVC / STAINLESS / TEFION / OTHER
   b) PIPE SCHEDULE:
      40
   c) PIPE DIAMETER (I.D., O.D.):
      2.0 IN., 2.0 IN.
   d) TYPE OF PIPE JOINTS:
      SLIP / THREADS / TAPED / OTHER
      SOLVENT CEMENT: YES OR NO
   e) TYPE OF WELL SCREEN:
      PVC / STAINLESS / TEFION / OTHER
   f) SLOT SIZED:
      0.1 IN.
   g) SCREEN DIAM.: I.D. IN., O.D. IN.
   h) INSTALLED PROTECTOR PIPE W/LOCK:
      YES OR NO
      PROTECTOR PIPE DIA., IN. LOCK NO.

2) WELL DEVELOPMENT
   a) METHOD:
      BAILING / AUGERING / SURFACE / COMPRESSED AIR / OTHER
   b) TIME SPENT FOR DEVELOPMENT:
      3/4 HR
   c) APPROXIMATE WATER VOLUME:
      REMOVED 40 GALLONS
      ADDED
   d) WATER CLARITY:
      BEFORE DEVELOPMENT:
      CLEAR / TURBID / OPAQUE
      AFTER DEVELOPMENT:
      CLEAR / SLIGHTLY TURBID / TURBID / OPAQUE
   e) ODOR:
      YES OR NO

3) WATER LEVEL SUMMARY
   a) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT:
      60.92 FT. OR DRY
   b) OTHER MEASUREMENTS (T.O.C.):
      DATE / TIME DEPTH FT.
      DATE / TIME DEPTH FT.
      DATE / TIME DEPTH FT.

ADDITIONAL COMMENTS:
**MONITORING WELL CONSTRUCTION**

**PROJECT NAME:** Clow Water Systems Co.  
**PROJECT NO.:** 185.92  
**LOCATION:** Coshocton, OH  
**DATE INSTALLED:** 12/17/1996  
**WELL NO.:** E-4  
**PREPARED BY:** A. Ojeda

### 1) CASING DETAILS

**A) TYPE OF PIPE:** PVC / STAINLESS / TEFLON / OTHER  
**PIPE SCHEDULE:** 40  
**PIPE DIAMETER I.D.:** 2.0 IN., O.D. 2.0 IN.  
**B) TYPE OF PIPE JOINTS:** SLIP / THREADED / W/TAPE / OTHER  
**SOLVENT CEMENT:** YES OR NO  
**C) TYPE OF WELL SCREEN:** PVC / STAINLESS / TEFLON / OTHER  
**SLOT SIZE:** 0.1 IN.  
**D) INSTALLED PROTECTOR PIPE W/LOCK:** YES OR NO  
**PROTECTOR PIPE DIA:** 6 IN., LOCK NO.____

### 2) WELL DEVELOPMENT

**A) METHOD:** BARGING / PUMPING / COMPRRESSED AIR / OTHER  
**B) TIME SpENT FOR DEVELOPMENT:** 3 1/4 HRS  
**C) APPROXIMATE WATER VOLUME:** REMOVED 50 GALLONS

**D) WATER CLARITY:**
- BEFORE DEVELOPMENT: CLEAR / TURBID / OPAQUE
- AFTER DEVELOPMENT: CLEAR / SLIGHTLY TURBID / TURBID / OPAQUE

**E) ODOR:** YES OR NO

### 3) WATER LEVEL SUMMARY

**A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT:** 55.20 FT. OR DRY

**B) OTHER MEASUREMENTS (T.O.C.):**

- DATE / TIME: DEPTH FT.
- DATE / TIME: DEPTH FT.
- DATE / TIME: DEPTH FT.

**ADDITIONAL COMMENTS:**

---
MONITORING WELL CONSTRUCTION

1) CASING DETAILS
   A) TYPE OF PIPE:
      PVC / STAINLESS / TEFLO / OTHER
   B) PIPE SCHEDULE:
      DEPT:
   C) PIPE DIAMETER I.D.:
      D) O.D.:
   E) SOLVENT CEMENT:
      YES OR NO
   F) TYPE OF PIPE JOINTS:
      SLIP / THREADED (W/TAPE) / OTHER
   G) TYPE OF WELL SCREEN:
      PVC / STAINLESS / TEFLO / OTHER
   H) SLOT SIZE:
      I) SCREEN DIAM. I.D.:
      O.D.:
   J) INSTALLED PROTECTOR PIPE W/LOCK:
      YES OR NO
   K) PROTECTOR PIPE DIAM.
      L) LOCK NO.

2) WELL DEVELOPMENT
   A) METHOD:
      BAILING / AUGER / COMPRRESSED AIR / OTHER
   B) TIME SPENT FOR DEVELOPMENT:
      314 HRS
   C) APPROXIMATE WATER VOLUME:
      REMOVED:
      ADDED:
   D) WATER CLARITY:
      BEFORE DEVELOPMENT:
      CLEAR / TURBID / OPAQUE
      AFTER DEVELOPMENT:
      CLEAR / TURBID / TURBID / OPAQUE
   E) ODOR:
      YES OR NO

3) WATER LEVEL SUMMARY
   A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT:
      26.82 FT. OR DRY
   B) OTHER MEASUREMENTS (T.O.C):
      DATE / TIME:
      DEPTH:
      DATE / TIME:
      DEPTH:
      DATE / TIME:
      DEPTH:

ADDITIONAL COMMENTS:
## Monitoring Well Construction

**Project Name:** Clow Water Systems Co.

**Project No.:** 115.92

**Location:** Coshocton, OH

**Date Installed:** 12/10/19 '6

**Well No.:** L-3

**Prepared By:** A. Ojeda

### 1) Casing Details

<table>
<thead>
<tr>
<th>A) Type of Pipe:</th>
<th>PVC / STAINLESS / TEFLOM / OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Schedule:</td>
<td>40 ft.</td>
</tr>
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<table>
<thead>
<tr>
<th>B) Type of Pipe Joints:</th>
<th>SLIP / THREADS (w/ TAPE) / OTHER</th>
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<tbody>
<tr>
<td>Solvent Cement:</td>
<td>YES OR NO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C) Type of Well Screen:</th>
<th>PVC / STAINLESS / TEFLOM / OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slot Size:</td>
<td>0.1 in.</td>
</tr>
<tr>
<td>Screen Dia.:</td>
<td>I.D.: 2.0 in., O.D.: 2.1 in.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D) Installed Protector Pipe w/ Lock?</th>
<th>YES OR NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protector Pipe Dia.:</td>
<td>6 in., Lock No.</td>
</tr>
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</table>

### 2) Well Development

<table>
<thead>
<tr>
<th>A) Method:</th>
<th>BANDING / STICKING / COMPRESSED AIR / OTHER</th>
</tr>
</thead>
</table>

| B) Time Spent for Development | 1 hr. |

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<tr>
<th>C) Approximate Water Volume:</th>
<th>Removed 60 gal.</th>
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<tbody>
<tr>
<td>Added</td>
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</table>

### 3) Water Level Summary

| A) Depth from Top of Casing After Development? | 33.50 ft. or Dry |

<table>
<thead>
<tr>
<th>B) Other Measurements (T.O.C.):</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>DATE / TIME</th>
<th>DEPTH</th>
<th>DATE / TIME</th>
<th>DEPTH</th>
<th>DATE / TIME</th>
<th>DEPTH</th>
</tr>
</thead>
</table>

### Additional Comments:

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---
PROJECT NAME: Glaw Water Systems Co.
PROJECT NO. 115.92
LOCATION: Coshocton, OH
DATE INSTALLED: 12/9/96
WELL NO. L-4
PREPARED BY: A. Ojeda

MONITORING WELL CONSTRUCTION

1) CASING DETAILS
A) TYPE OF PIPE:
PVC / STAINLESS / TEFLOM / OTHER
PIPE SCHEDULE 40
PIPE DIAMETER ID. 2.0 IN., OD. 2.0 IN.

B) TYPE OF PIPE JOINTS:
SLIP / THREADED (W/TAPE ?) / OTHER
SOLVENT CEMENT: YES OR NO

C) TYPE OF WELL SCREEN:
YC / STAINLESS / TEFLOM / OTHER
SLOT SIZE: .01 IN.
SCREEN DIAM: I.D. IN. 2.0, O.D. IN. 2.1

D) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO
PROTECTOR PIPE DIA. ___ IN. LOCK NO. ___

2) WELL DEVELOPMENT
A) METHOD
BAILING/RHINO/SURGING/COMPRESSED AIR/OTHER

B) TIME SPENT FOR DEVELOPMENT: ___ Hr.

C) APPROXIMATE WATER VOLUME: REMOVED ___ GAL.
ADDED ___ GALLONS

D) WATER CLARITY:
BEFORE DEVELOPMENT — CLEAR / TURBID / OPAQUE
AFTER DEVELOPMENT — CLEAR / TURBID / OPAQUE
ODOR? YES OR NO

3) WATER LEVEL SUMMARY
A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?
37.60 FT. OR DRY

B) OTHER MEASUREMENTS (T.O.C.):
DATE / TIME ___ DEPTH ___ FT.
DATE / TIME ___ DEPTH ___ FT.
DATE / TIME ___ DEPTH ___ FT.

ADDITIONAL COMMENTS:
1) CASING DETAILS
   A) TYPE OF PIPE:
      PVC/ STAINLESS / TEFLOM / OTHER
   B) TYPE OF PIPE JOINTS:
      SLIP / THREADED (W/ TAPE?) / OTHER
      SOLVENT CEMENT: YES OR NO
   C) TYPE OF WELL SCREEN:
      PVC/ STAINLESS / TEFLOM / OTHER
   D) INSTALLED PROTECTOR PIPE W/ LOCK? OR NO

2) WELL DEVELOPMENT
   A) METHOD
      BAILEING/FUMPING/ SURGING/ COMPRESSED AIR/OTHER
   B) TIME SPENT FOR DEVELOPMENT
   C) APPROXIMATE WATER VOLUME:
      REMOVED 60 gal
      ADDED 0 gal
   D) WATER CLARITY:
      BEFORE DEVELOPMENT - CLEAR / TURBID / OPAQUE
      AFTER DEVELOPMENT - CLEAR / SLIGHTLY TURBID / TURBID / OPAQUE
   E) ODOR?

3) WATER LEVEL SUMMARY
   A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT
      DRY
      34.32 ft.
   B) OTHER MEASUREMENTS (T.O.C.):
      DATE / TIME DEPTH FT.

ADDITIONAL COMMENTS:
PROJECT NAME: Clow Water Systems Co.
PROJECT NO.: 115.92
LOCATION: Coshocton, OH
DATE INSTALLED: 12/13/96
WELL NO.: L-6
PREPARED BY: A. Ojeda

MONITORING WELL CONSTRUCTION

1) CASING DETAILS
A) TYPE OF PIPE:
PVC/ STAINLESS/ TEFLON/ OTHER

B) TYPE OF PIPE JOINTS:
SLIP/ THREADS/ W/TAPE ?/ OTHER
SOLVENT CEMENT: YES OR NO

C) TYPE OF WELL SCREEN:
PVC/ STAINLESS/ TEFLON/ OTHER
SLOT SIZE: __ IN.
SCREEN DIA.: I.D. IN. __ O.D. IN. __

D) INSTALLED PROTECTOR PIPE W/LOCK ? YES OR NO
PROTECTOR PIPE DIA. __ IN. LOCK NO. __

2) WELL DEVELOPMENT
A) METHOD
BAILING/ PUMPING/ TURNG/ COMPRESSED AIR/OTHER

B) TIME SPENT FOR DEVELOPMENT __ hr.

C) APPROXIMATE WATER VOLUME: REMOVED __ gallons
ADDED __

D) WATER CLARITY:
BEFORE DEVELOPMENT - CLEAR/ TURBID/ OPAQUE
AFTER DEVELOPMENT - CLEAR/ SLIGHTLY TURBID/ TURBID/ OPAQUE
E) ODOR ? YES OR NO

3) WATER LEVEL SUMMARY
A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT ? __ FT. OR DRY

B) OTHER MEASUREMENTS (T.O.C.):
DATE / TIME DEPTH __ FT.
DATE / TIME DEPTH __ FT.
DATE / TIME DEPTH __ FT.

ADDITIONAL COMMENTS:
MONITORING WELL CONSTRUCTION

1) CASING DETAILS
A) TYPE OF PIPE:
- PVC / STAINLESS / TEFLOM / OTHER
- PIPE SCHEDULE: 40
- PIPE DIAMETER: I.D. 2.0 IN., O.D. 2.0 IN.

B) TYPE OF PIPE JOINTS:
- SLIP / THREADED (W/TAPE ?) / OTHER
- SOLVENT CEMENT: YES OR NO

C) TYPE OF WELL SCREEN:
- PVC / STAINLESS / TEFLOM / OTHER
- SLOT SIZE: 0.75 IN.
- SCREEN DIAM: I.D. IN. 2.0, O.D. IN. 2.0

D) INSTALLED PROTECTOR PIPE W/LOCKS OR NO

2) WELL DEVELOPMENT
A) METHOD:
- BAILING/PUMPING/SPRASING/COMPR. AIR/OTHER

B) TIME SPENT FOR DEVELOPMENT: 3/4 HR
C) APPROXIMATE WATER VOLUME: REMOVED 50 GALLONS

D) WATER CLARITY:
- BEFORE DEVELOPMENT - CLEAR / TURBO / OPAQUE
- AFTER DEVELOPMENT - CLEAR / SLIGHTLY TURBO / TURBO / OPAQUE

E) ODOR: YES OR NO

3) WATER LEVEL SUMMARY
A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?
- 31.09 FT. OR DRY

B) OTHER MEASUREMENTS (T.O.C.):
- DATE / TIME: DEPTH FT.
- DATE / TIME: DEPTH FT.
- DATE / TIME: DEPTH FT.

ADDITIONAL COMMENTS:
PROJECT NAME: Cw Water Systems Co.
PROJECT NO.: 115.92
LOCATION: Coshocton, OH
DATE INSTALLED: 12/11/96
WELL NO.: 5-2
PREPARED BY: A. Ojeda

MONITORING WELL CONSTRUCTION

1) CASING DETAILS
A) TYPE OF PIPE:
   PVC / STAINLESS / TEFLOW / OTHER
B) PIPE SCHEDULE: 40
   PIPE DIAMETER: 2.0 IN. O.D. 2.0 IN.
C) TYPE OF PIPE JOINTS:
   SLIP / SLEEVE (W/TAPE) / OTHER
   SOLVENT CEMENT: YES OR NO
D) TYPE OF WELL SCREEN:
   PVC / STAINLESS / TEFLOW / OTHER
   SLOT SIZE: .01 IN.
   SCREEN DIA.: 1.0 IN. O.D. 2.1
E) INSTALLED PROTECTOR PIPE W/LOCK?: YES OR NO
   PROTECTOR PIPE DIA.: 6 IN. LOCK NO.

2) WELL DEVELOPMENT
A) METHOD:
   BAILING / PUMPING / SURFACE / COMPR. AIR / OTHER
B) TIME SPENT FOR DEVELOPMENT: 31/4 hr
C) APPROXIMATE WATER VOLUME:
   REMOVED: 60 gph
   ADDED:
D) WATER CLARITY:
   BEFORE DEVELOPMENT:
   CLEAR / TURBO / OPAQUE
   AFTER DEVELOPMENT:
   CLEAR / SLIGHTLY TURBO / TURBO / OPAQUE
E) ODOR?: YES OR NO

3) WATER LEVEL SUMMARY
A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT:
   52.95 FT. OR DRY
B) OTHER MEASUREMENTS (T.O.C.):
   DATE / TIME DEPTH FT.
   DATE / TIME DEPTH FT.
   DATE / TIME DEPTH FT.

ADDITIONAL COMMENTS:
1) CASING DETAILS

A) TYPE OF PIPE:
- PVC STAINLESS, TEFLOW, OTHER
- PIPE SCHEDULE 40

B) TYPE OF PIPE JOINTS:
- COUPLINGS, THREADED (V/TAP), OTHER

C) WAS SOLVENT USED? YES or NO

D) TYPE OF WELL SCREEN:
- PVC STAINLESS, TEFLOW, OTHER

E) WELL SCREEN SLOT SIZE 0.010 in.

F) PIPE DIA: 10 in. 1.85 OD in. 2.0

G) INSTALLED PROTECTOR PIPE V/LOCK? YES or NO

2) WELL DEVELOPMENT

A) METHOD
- BAILING, PUMPING, SURGING, COMPRESSED AIR
- OTHER (NOTE ADDITIONAL COMMENTS BELOW)

B) TIME SPENT FOR DEVELOPMENT? 20 minutes

C) APPROXIMATE WATER VOLUME: REMOVED 100 gal

D) WATER CLARITY BEFORE DEVELOPMENT?
- CLEAR, TURBID, OPAQUE

E) WATER CLARITY AFTER DEVELOPMENT?
- CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE

F) ODOR? YES or NO

3) WATER LEVEL SUMMARY

A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?
- 35.25 ft. or DAY

B) OTHER MEASUREMENTS (T.O.C.):
  - DATE/TIME
  - DATE/TIME
  - DATE/TIME

ADDITIONAL REMARKS:
-
1) CASING DETAILS
   A) TYPE OF PIPE:
      - STAINLESS, Teflon, other
   B) TYPE OF PIPE SCHEDULE:
      - 40
   C) WAS SOLVENT USED? YES or NO
   D) TYPE OF WELl SCREEN:
      - STAINLESS, Teflon, other
   E) WELl SCREEN SLOT SIZE: 0.010"
   F) PIPE Dia: 1D in., 1.25, 2 in., 3.5
   G) INSTALLED PROTECTOR PIPE w/LOCK1 yes or no
      PROTECTOR PIPE Dia. 4 in.

2) WELl DEVELOPMENT
   A) METHOD
      - BALING, PUMPING, SURGING, COMPRESSED AIR
      OTHER (NOTE ADDITIONAL COMMENTS BELOW)
   B) TIME SPENT FOR DEVELOPMENT: 20 hours
   C) APPROXIMATE WATER VOLUME: REMOVED
      REMOVED
      ADDED
   D) WATER CLARITY BEFORE DEVELOPMENT:
      CLEAR, TURBID, OPAQUE
   E) WATER CLARITY AFTER DEVELOPMENT:
      CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE
   F) ODOR? YES or NO

3) WATER LEVEL SUMMARY
   A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT:
      36.2 ft. or dry
   B) OTHER MEASUREMENTS (T.O.C.):
      DATE/TIME
      DATE/TIME
      DATE/TIME

ADDITIONAL COMMENTS:
1) CASING DETAILS
   A) TYPE OF PIPE:
      PVC, STAINLESS, TEFLOW, OTHER
      PIPE SCHEDULE 4C
   B) TYPE OF PIPE JOINTS:
      COUPLINGS, THREADED (W/TAPE), OTHER
   C) WAS SOLVENT USED? YES OR NO
   D) TYPE OF VELL SCREEN:
      PVC, STAINLESS, TEFLOW, OTHER
   E) VELL SCREEN SLOT SIZE 0.010"
   F) PIPE DIA: ID IN. 1.85 OD IN. 2.0
   G) INSTALLED PROTECTOR PIPE W/LOCK? YES OR NO
      PROTECTOR PIPE DIA. 4 IN.

2) VELL DEVELOPMENT
   A) METHOD
      BAILING, PUMPING, SURGING, COMPRESSED AIR
      OTHER
      (NOTE ADDITIONAL COMMENTS BELOW)
   B) TIME SPENT FOR DEVELOPMENT? 20 minutes
   C) APPROXIMATE WATER VOLUME: REMOVED 600 gal
      ADDED
   D) WATER CLARITY BEFORE DEVELOPMENT?
      CLEAR, TURBID, OPAQUE
   E) WATER CLARITY AFTER DEVELOPMENT?
      CLEAR, LIGHTLY TURBID, TURBID, OPAQUE
   F) ODOR? YES OR NO

3) WATER LEVEL SUMMARY
   A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT?
      21.33 FT. OR DRY
   B) OTHER MEASUREMENTS (T.O.C.):
      DATE/TIME
      DATE/TIME
      DATE/TIME

ADDITIONAL COMMENTS:

B-3
1) Casing Details

A) Type of Pipe:
- PVC, STAINLESS, TEFLOW, OTHER
- Pipe Schedule 40

B) Type of Pipe Joints:
- Couplings (threaded/w/tape), other

C) WAS Solvent Used? YES or NO

D) Type of Well Screen:
- PVC, STAINLESS, TEFLOW, OTHER

E) Well Screen Slot Size
- 0.010

F) Pipe Dia: 1/2 in. 1.50 OD IN. 2.0

G) Installed Protector Pipe w/lock? YES or NO

2) Well Development

A) Method
- Bailing, Pumping, Drilling, Compressed Air
- Other

(More Additional Comments Below)

B) Time Spent for Development: 20 Minutes

C) Approximate Water Volume: Removed 100 +

D) Water Clarity Before Development:
- CLEAR, TURBID, OPAQUE

E) Water Clarity After Development:
- CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE

F) Odor? YES or NO

3) Water Level Summary

A) Depth from Top of Casing After Development:
- 21.72 FT. OR DAY

B) Other Measurements (T.O.C.):
- DATE/TIME
- DATE/TIME
- DATE/TIME

Additional Comments:________________________

________________________

B-4
1) CASING DETAILS
   A) TYPE OF PIPE:
      PVC, STAINLESS, TEFLOW, OTHER
      PIPE SCHEDULE 40
   B) TYPE OF PIPE JOINTS:
      COUPLING, THREAD (W/TAPE), OTHER
   C) WAS SOLVENT USED? YES OR NO
   D) TYPE OF WELL SCREEN:
      PVC, STAINLESS, TEFLOW, OTHER
   E) WELL SCREEN SLOT SIZE 0.010
   F) PIPE DIA: 10 IN. 1.75 OD IN. 20
      INSTALLED PROTECTOR PIPE V/LUCK? YES OR NO
      PROTECTOR PIPE DIA. 4 IN.

2) WELL DEVELOPMENT
   A) METHOD
      BAILING, PUMPING, SURGING, COMPRESSED AIR
      OTHER
      (NOTE ADDITIONAL COMMENTS BELOW)
   B) TIME SPENT FOR DEVELOPMENT: 15
   C) APPROPRIATE WATER VOLUME: REMOVED 5 GALLONS
      ADDED
   D) WATER CLARITY BEFORE DEVELOPMENT:
      CLEAR, TURBID, OPAQUE
   E) WATER CLARITY AFTER DEVELOPMENT:
      CLEAR, SLIGHTLY TURBID, TURBID, OPAQUE
   F) ODOR? YES OR NO
      SULFIDE

3) WATER LEVEL SUMMARY
   A) DEPTH FROM TOP OF CASING AFTER DEVELOPMENT:
      21.0 FT. OR DRY
   B) OTHER MEASUREMENTS (T.O.C.):
      DATE/TIME
      DATE/TIME
      DATE/TIME

ADDITIONAL COMMENTS:
Typical Pump Control Settings
## Typical Pump Settings

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<th>REFILL SETTING</th>
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<td>C</td>
<td>C</td>
</tr>
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<td>45</td>
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<td>D+</td>
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Appendix B
Amended Corrective Measures Groundwater Monitoring Plan

Prepared for:
McWane Ductile - Ohio
2266 South Sixth Street
Coshocton, Ohio 43812

April 15, 2016
Amended Corrective Measures Groundwater Monitoring Plan

Prepared for:
McWane Ductile - Ohio
2266 South Sixth Street
Coshocton, Ohio 43812

Client: Ms. Heather Rainwater
McWane Ductile - Ohio
2266 South Sixth Street
Coshocton, Ohio 43812

Project No.: McWane-01(15)

Distribution: Ms. Heather Rainwater, McWane Ductile - Ohio
SEC File

Date: April 16, 2016

Prepared by:

Chris Hartford, P.E., Project Engineer

Reviewed By:

R. Curtis Spence, P.E., President

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70 West Columbus Street
Pickerington, Ohio 43147
614.837.4750
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## APPENDIX A

Figure 1 – Site Map  
Figure 2 – Typical Groundwater Flow (September 2015)  

## APPENDIX B

Table 1 – Groundwater Monitoring Wells to be Sampled  
Table 2 – Constituents to be Monitored  
Table 3 – Concentration Levels  
Table 4 – Background Calculations for Wells A-6 and D-6  

## APPENDIX C

Sampling and Analysis Plan
1.0 INTRODUCTION

1.1 Background

McWane Ductile - Ohio (McWane) operates a ductile iron foundry in Coshocton, Ohio. The site contains three closed waste management units. The closed units are the solid waste or North Landfill (closed in 1996), the hazardous waste surface impoundment (closed in 1995) and an exempt-waste disposal cell which was closed under RCRA closure regulations in 2008. Groundwater monitoring is required for each of these units under solid waste rule OAC 3745-27-10. In addition, a concrete pond is used to accumulate non-contact cooling water and other waters. A RCRA closure was performed on the pond in 2009 and post-closure monitoring pursuant to hazardous waste regulations has been performed since 2009.

A Corrective Measures Plan Supplement (CMPS), dated September 29, 2004 and prepared by RMT, Inc., was submitted to the Ohio Environmental Protection Agency (Ohio EPA) for the solid waste landfill, the hazardous waste surface impoundment and the exempt-waste disposal cell. The CMPS was approved pursuant to the December 2004 Director's Final Findings and Orders (F&Os). Appendix C of the CMPS consists of a Corrective Measures Groundwater Monitoring Plan (CMGMP) and Appendix E of the CMPS consists of a Groundwater Sampling and Analysis Plan (SAP). Groundwater sampling and analysis for the three units has since been performed in accordance with the solid waste groundwater regulations (OAC 3745-27-10), the CMGMP and the SAP, and thereafter as amended by the Evaluation of March 2009 Semiannual Groundwater Monitoring Event (RMT, May 2009). Groundwater monitoring for the concrete pond is performed in accordance with RCRA hazardous waste post-closure regulations and the Post Closure and Closure Plan — Concrete Pond (RMT, 2008, revised March 2010).

Historically, the results of sampling groundwater monitoring wells downgradient of the solid waste landfill, the hazardous waste surface impoundment and the exempt-waste disposal cell consistently detected concentrations of constituents exceeding background
groundwater quality. In 2005, a groundwater extraction system was installed immediately
downgradient of the solid waste landfill. The extraction system consists of eight extraction
wells screened in the shallow, uppermost aquifer and provides source control to reduce
or eliminate releases of waste-derived constituents in groundwater. The location of the
groundwater monitoring and extraction wells are shown in Figure 1 (Appendix A). The
installation of the groundwater extraction system constituted a corrective measure. The
2004 CMGMP was written with the understanding that the extraction system would be
installed and future groundwater monitoring would be performed following the corrective
measures groundwater monitoring program as required by OAC 3745-27-10(F). However, groundwater monitoring required as a result of the concrete pond closure
follows the hazardous waste regulations.

The solid waste regulations and the hazardous waste regulations are not consistent with
each other. The term "concentration levels" refers to groundwater remediation standards
as described in the solid waste groundwater regulation OAC 3745-27-10(F)(7) and as
identified in the approved CMGMP. The concentration levels set forth in the CMGMP are
based on various criteria (MCLs, SMCLs, treatment derived and background) and set
action levels, above which, additional monitoring or other activities may be required.
However, concentration levels set forth in the approved post-closure plan for the concrete
pond use prediction limits based on pooled, upgradient data compared to downgradient
data to determine if a statistically significant increase exists.

The prediction limits (concentration levels) established for post-closure monitoring of the
concrete pond tend to be more stringent than concentration levels established for the site-
wide groundwater monitoring program (CMGMP) under the solid waste regulations. As
a result, a number of constituents have repeatedly exceeded the prediction limits under
the RCRA program while not exceeding the concentration levels established under the
CMGMP. This has resulted in additional monitoring activities under the RCRA program.
McWane demonstrated via a letter dated July 18, 2012 that these statistical increases
were the result of natural variability rather than a release from the concrete pond. The
demonstration also questioned the need for RCRA monitoring of the concrete pond, given
the site-wide monitoring program already in place. Ohio EPA approved the demonstration in an email dated August 31, 2012.

Ohio EPA met with McWane and McWane’s consultant, Spence Environmental Consulting, Inc. (SEC) on December 11, 2013, and agreed to amend the Corrective Measures Groundwater Monitoring Plan (CMGMP) so that there is one comprehensive groundwater monitoring plan that addresses the entire site under a single set of standards or concentration levels. This Amended CMGMP (ACMGMP) considers the solid waste landfill, the hazardous waste surface impoundment, the exempt-waste disposal cell and the concrete pond as one unit (see Figure 1) under the solid waste regulations. There will be no post-closure groundwater monitoring specific to the concrete pond under RCRA.

1.2 Purpose and Scope

This ACMGMP is designed to determine the effectiveness of the corrective measures pursuant to OAC 3745-27-10(F)(2)(e). The plan includes provisions for determining semi-annually whether groundwater remediation standards or concentration levels established in accordance with OAC 3745-27-10(F)(7) are achieved for those contaminants Ohio EPA has agreed represent constituents of concern (COCs). If concentration levels are not achieved, the plan includes provisions for determining the nature and extent of any exceedances and evaluating trends over time with respect to data and wells.

This ACMGMP defines a set number of monitoring wells to be sampled on a semi-annual basis for a defined list of constituents. The constituents monitored will be consistent for all wells sampled. The concentration levels have been evaluated and updated to reflect current regulation and policy. The sampling and analysis plan (SAP) included in Appendix C has been prepared in accordance with OAC 3745-27-10(C)(2) and reflects actual site conditions, acceptable practices and relevant guidance manuals (Technical Guidance Manual for Groundwater Investigations, Ohio EPA, May 2012).
1.3 Preliminary Plan

A Preliminary Plan for an Amended Corrective Measures Groundwater Monitoring Plan dated April 14, 2014 was submitted to Ohio EPA and described the following proposed changes to the existing CMGMP:

- The monitoring wells to be sampled.
- The constituents to be analyzed.
- The concentration levels to be used for each constituent.

Given the significance of the proposed changes and their impact on the content of the ACMGMP as a whole, the proposed changes were described in the preliminary plan so that McWane and Ohio EPA could discuss and reach agreement on the changes prior to submission of this amended CMGMP. Comments were provided from Ohio EPA in a letter dated July 22, 2014 and have been incorporated into this plan.

2.0 MONITORING WELL NETWORK

The monitoring well network will consist of the eighteen wells identified in Table 1 (Appendix B). These wells will be sampled semi-annually along with the combined effluent water from the groundwater extraction system.

The remaining wells (B-5, B-0, E-1, E-3, L-5, L-6, D-7, S-2, S-6 and A-7) and the individual extraction wells (EW-1 thru EW-8) will be used to collect groundwater elevation data. Typical groundwater flow is shown in Figure 2 of Appendix A.

3.0 CONSTITUENTS

The proposed list of constituents, included in Table 2 (Appendix B), will be analyzed for the eighteen wells to be sampled and the combined effluent water.
4.0 CONCENTRATION LEVELS

Concentration levels for COCs have been updated based on regulatory information currently available. Table 3 in Appendix B identifies the concentration levels for the constituents that will be monitored.

Table 4 contains updated background calculations for the six constituents that will continue to be monitored using background as concentration levels. Background is calculated as a value halfway between the highest site background value and the maximum statewide ambient values for sand and gravel as reported in Table 4. If the highest background value for any of the six constituents is exceeded for that sampling event, the halfway value will be recalculated.

Concentration levels for the COCs will be evaluated annually to determine whether the basis for establishing any of the levels has changed. With respect to background used as a basis for establishing the concentration level, the most recent Ohio EPA groundwater quality report will be used to update the ambient groundwater quality data.

5.0 SAMPLING AND ANALYSIS PLAN

The sampling and analysis plan is included in Appendix C as a separate document so that it may be utilized in the field as a stand-alone document.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

A description of the quality assurance/quality control procedures to be followed is included in the sampling and analysis plan in Appendix C.
7.0 DATA EVALUATION

7.1 Exceedances

Groundwater results will be reviewed and evaluated as soon as they are received to determine whether any COCs have exceeded their respective concentration level. Summary table(s) of the data will be prepared. Monitoring wells with COCs exceeding concentration levels will be identified, especially wells located at the property boundary. If the results of sampling indicate that concentration levels are exceeded in wells other than property boundary wells, additional groundwater monitoring activities will typically not be performed as the extent of exceedances will be limited to the McWane property and will not pose an immediate risk to off-site receptors. Exceptions to this include sample results from non-property boundary wells that exhibit abnormally high concentrations of specific COCs repeatedly. Instances like this will be evaluated on a case by case basis and the procedures outlined below followed.

7.2 Property Boundary Wells

Exceedances of concentration levels for COCs at property boundary wells (D-8, D-9, D-10A, D-12, D-13 and E-2) will be evaluated as follows:

- For constituents that have concentration levels based on MCLs (antimony, arsenic, cadmium, chromium, selenium, cyanide and fluoride), additional activities will be performed. First, the specific constituent(s) will be evaluated to determine the degree to which they exceeded their respective concentration level and the history of exceedance. Trends of concentrations over time will be plotted and evaluated. Individual wells may be resampled to verify initial results. Based on the results of initial evaluation, subsequent activities may include fate and transport modeling, risk assessment, additional well installation or other.

- For constituents that have concentration levels based on SMCLs or background (aluminum, iron, manganese, potassium, sodium, chloride, ammonia nitrogen,
phosphorus and sulfate), additional activities will not be performed as these constituents are not considered hazardous to human health and the environment. The standards that exist for these constituents are based on aesthetic criteria such as odor, taste and turbidity that these compounds can impart to groundwater.

- For constituents that have concentration levels based on treatment technique (copper and lead) or VAP (vanadium), the need for additional activities will be evaluated on a case by case basis.

8.0 GROUNDWATER EFFECTIVENESS EVALUATION

8.1 Purpose and Scope

Following is a description of the methodology for determining the effectiveness of the groundwater corrective measures pursuant to OAC 3745-27-10(F)(2)(e). This will be accomplished by evaluating the following:

- Is hydraulic control of the COCs maintained by the groundwater extraction system and is the system functioning properly?
- What is the trend of concentrations over time for COCs in wells immediately upgradient and downgradient of the groundwater extraction system (L-4, L-2, L-3, S-1 and S-2)?
- What is the trend of concentrations over time for COCs in property boundary wells D-8, D-9, D-10A, D-12, D-13 and E-2?

8.2 Hydraulic Control

Hydraulic control of the leachate-derived constituents will be evaluated as follows:

- Does the groundwater elevation data indicate the most significant contaminated flow lines are being captured by the groundwater extraction system?
o How do constituent concentrations in wells immediately downgradient of the extraction system (L-2 and L-3) and wells further downgradient (S-1 and S-2) compare to concentrations in well L-4 (immediately upgradient of extraction system)?

8.3 Concentration Trends – Wells Used to Evaluate Extraction System

The trend of concentration over time for arsenic will be plotted for wells L-4, L-2, L-3, S-1 and S-2. Well L-4 is immediately upgradient of the groundwater extraction system and wells L-2, L-3, S-1 and S-2 are downgradient of the extraction system. Arsenic will be evaluated for each semi-annual groundwater sampling event because it is the primary COC for the site. Other COCs may be evaluated as appropriate. The concentration trends will be evaluated as to whether they are stable, increasing or decreasing.

8.4 Concentration Trends – Property Boundary Wells

The trend of concentration over time for arsenic will be plotted for property boundary wells D-8, D-9, D-10A, D-12, D-13 and E-2. Arsenic will be evaluated for each semi-annual groundwater sampling event because it is the primary COC for the site. Other COCs may be evaluated as appropriate. The concentration trends will be evaluated as to whether they are stable, increasing or decreasing.

9.0 SUBMISSION OF RESULTS

All groundwater elevation, sample analysis and statistical analysis results generated in accordance with OAC 3745-27-10 (B), (C), (D), (E) and (F) will be submitted to Ohio EPA not later than 75 days after sampling the wells. All groundwater data and an
The accompanying text will be submitted to Ohio EPA in a form specified by the director or his authorized representative.

The accompanying text will consist of, at a minimum, the following:

1. Lab data sheets.
2. Field and laboratory quality assurance/quality control (QA/QC) data.
3. Chain of custody and sample receipt forms including preservation methods.
4. Data summary table(s).
5. The potentiometric maps required by paragraph (C)(3) of this rule.
6. A description of the analysis methods used including method detection limits, and practical quantitation limits for the constituents analyzed.

Comment: The items requested in paragraph (C)(10) of this rule, with the exception of paragraph (C)(10)(c) of this rule, may be submitted on an electronic format compatible with Ohio EPA software.
APPENDIX A

Figure 1 – Site Map

Figure 2 – Typical Groundwater Flow, September 2015

SEC, Inc.
LEGEND

Where: $K =$ hydraulic conductivity
$K_e =$ effective porosity
$g =$ gradient
$V =$ velocity
$
\begin{array}{|c|c|}
\hline
r & \text{Value} \\
\hline
1 & 0.25 \\
2 & 0.50 \\
3 & 0.75 \\
\hline
\end{array}
$

FIGURE 2
APPENDIX B

Table 1 – Groundwater Monitoring Wells to be Sampled

Table 2 – Constituents to be Monitored

Table 3 – Concentration Levels

Table 4 – Background Calculations for Wells A-6 and D-6
<table>
<thead>
<tr>
<th>Well</th>
<th>Purpose of Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-6</td>
<td>Background</td>
</tr>
<tr>
<td>D-6</td>
<td>Background</td>
</tr>
<tr>
<td>L-2</td>
<td>Landfill Boundary Well</td>
</tr>
<tr>
<td>L-3</td>
<td>Landfill Boundary Well</td>
</tr>
<tr>
<td>L-4</td>
<td>Landfill Boundary Well</td>
</tr>
<tr>
<td>S-1</td>
<td>Surface Impoundment Well</td>
</tr>
<tr>
<td>S-3</td>
<td>Surface Impoundment Well</td>
</tr>
<tr>
<td>S-4</td>
<td>Surface Impoundment Well</td>
</tr>
<tr>
<td>S-5</td>
<td>Surface Impoundment/Concrete Pond Well</td>
</tr>
<tr>
<td>E-2</td>
<td>Downgradient/Property Boundary Well</td>
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<tr>
<td>E-4</td>
<td>Downgradient Well</td>
</tr>
<tr>
<td>D-2</td>
<td>Downgradient Well</td>
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<tr>
<td>D-3</td>
<td>Downgradient Deep Well</td>
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<td>D-8</td>
<td>Downgradient Property Boundary Well</td>
</tr>
<tr>
<td>D-9</td>
<td>Downgradient Deep Property Boundary Well</td>
</tr>
<tr>
<td>D-10A</td>
<td>Downgradient Property Boundary Well</td>
</tr>
<tr>
<td>D-12</td>
<td>Downgradient Property Boundary Well</td>
</tr>
<tr>
<td>D-13</td>
<td>Downgradient Property Boundary Well</td>
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### Table 2
Constituents to be Monitored
McWane Ductile
Coshocton, Ohio
April 2016

<table>
<thead>
<tr>
<th>Metals (ug/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
</tr>
<tr>
<td>Antimony</td>
</tr>
<tr>
<td>Arsenic</td>
</tr>
<tr>
<td>Cadmium</td>
</tr>
<tr>
<td>Chromium</td>
</tr>
<tr>
<td>Copper</td>
</tr>
<tr>
<td>Iron</td>
</tr>
<tr>
<td>Lead</td>
</tr>
<tr>
<td>Manganese</td>
</tr>
<tr>
<td>Potassium</td>
</tr>
<tr>
<td>Selenium</td>
</tr>
<tr>
<td>Sodium</td>
</tr>
<tr>
<td>Vanadium</td>
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<table>
<thead>
<tr>
<th>Inorganic Parameters (mg/L)</th>
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</thead>
<tbody>
<tr>
<td>Chloride</td>
</tr>
<tr>
<td>Cyanide</td>
</tr>
<tr>
<td>Fluoride</td>
</tr>
<tr>
<td>Ammonia nitrogen</td>
</tr>
<tr>
<td>Phosphorus</td>
</tr>
<tr>
<td>Sulfate</td>
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### Table 3
Concentration Levels  
McWane Ductile  
Coshocton, Ohio  
April 2016

<table>
<thead>
<tr>
<th>CONSTITUENT</th>
<th>CONCENTRATION LEVEL</th>
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<tbody>
<tr>
<td><strong>Metals (ug/L)</strong></td>
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</tr>
<tr>
<td>Aluminum</td>
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<td>Antimony</td>
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<tr>
<td>Arsenic</td>
<td>10</td>
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<td>Cadmium</td>
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<td>Copper</td>
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<td>BG</td>
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<td>Lead</td>
<td>15</td>
<td>TT</td>
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<td>Manganese</td>
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<td>Potassium</td>
<td>4,660</td>
<td>BG</td>
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<td>Selenium</td>
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<td>MCL</td>
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<td>Sodium</td>
<td>120,000</td>
<td>US EPA</td>
</tr>
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<td>Vanadium</td>
<td>110</td>
<td>VAP</td>
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<td><strong>Inorganic Parameters (mg/L)</strong></td>
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<td></td>
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<tr>
<td>Chloride</td>
<td>250</td>
<td>SMCL</td>
</tr>
<tr>
<td>Cyanide</td>
<td>0.2</td>
<td>MCL</td>
</tr>
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<td>Fluoride</td>
<td>4</td>
<td>MCL</td>
</tr>
<tr>
<td>Ammonia nitrogen</td>
<td>0.24</td>
<td>BG</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.40</td>
<td>BG</td>
</tr>
<tr>
<td>Sulfate</td>
<td>250</td>
<td>SMCL</td>
</tr>
</tbody>
</table>

Notes:
- **MCL** = Federal Maximum Contaminant Level for drinking water.
- **BG** = Halfway between ambient and highest background value.
- **SMCL** = Secondary Maximum Contaminant Level
- **TT** = Treatment Technique
- **VAP** = Voluntary Action Program (OAC 3745-300-08, Table VII, App A, effective August 1, 2014).
- **US EPA** = Recommended for individuals with low-sodium tolerance.
  (EPA Drinking Water Advisory: Consumer Acceptability Advice and Health Effects Analysis on Sodium, February 2003).
Table 4
Background Calculations for Wells A-6 and D-6
McWane Ductile
Coshocton, Ohio
April 2016

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>* Ambient</th>
<th>Highest Background</th>
<th>** Background</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A-6</td>
<td>D-6</td>
<td></td>
</tr>
<tr>
<td>Aluminum</td>
<td>ug/L</td>
<td>202</td>
<td>132</td>
<td>1,310</td>
</tr>
<tr>
<td>Iron</td>
<td>ug/L</td>
<td>1,183</td>
<td>459</td>
<td>636</td>
</tr>
<tr>
<td>Manganese</td>
<td>ug/L</td>
<td>191</td>
<td>4,060</td>
<td>31.3</td>
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<tr>
<td>Nitrogen, Ammonia</td>
<td>mg/L</td>
<td>0.22</td>
<td>0.25</td>
<td>0.20</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>mg/L</td>
<td>0.32</td>
<td>0.47</td>
<td>0.23</td>
</tr>
<tr>
<td>Potassium</td>
<td>ug/L</td>
<td>2,370</td>
<td>6,950</td>
<td>4,470</td>
</tr>
</tbody>
</table>

* Mean value for sand and gravel aquifer - Ohio 2014 Integrated Report, Appendix A
** Background (halfway between ambient and highest background value)
APPENDIX C

Sampling and Analysis Plan
Groundwater Sampling and Analysis Plan

Prepared for:
McWane Ductile - Ohio
2266 South Sixth Street
Coshocton, Ohio 43812

April 15, 2016
Groundwater Sampling and Analysis Plan

Prepared for:

McWane Ductile - Ohio
2266 South Sixth Street
Coshocton, Ohio 43812

Client: Ms. Heather Rainwater
McWane Ductile - Ohio
2266 South Sixth Street
Coshocton, Ohio 43812

Project No.: McWane-01(15)

Distribution: Ms. Heather Rainwater, McWane Ductile - Ohio
SEC File

Date: April 15, 2016

Prepared by:

Chris Hartford, P.E., Project Engineer

Reviewed By:

R. Curtis Spence, P.E., President

Spence Environmental Consulting, Inc.
70 West Columbus Street
Pickerington, Ohio 43147
614.837.4750
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   1.1 Background .....................................................................................................1  
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APPENDIX A  
Figure 1 — Site Map

APPENDIX B  
Table 1 — Groundwater Monitoring Wells to be Sampled  
Table 2 — Constituents to be Monitored  
Table 3 — Containers, Preservatives, Holding Times and Test Methods

APPENDIX C  
Example Daily Activity and Sample Forms

SEC, Inc.
1.0 INTRODUCTION

1.1 Background

McWane Ductile - Ohio (McWane) operates a ductile iron foundry in Coshocton, Ohio. The site contains three closed waste management units. The closed units are the solid waste or North Landfill (closed in 1996), the hazardous waste surface impoundment (closed in 1995) and an exempt-waste disposal cell which was closed under RCRA closure regulations in 2008. Groundwater monitoring is required for each of these units under solid waste rule OAC 3745-27-10. In addition, a concrete pond is used to accumulate non-contact cooling water and other waters. A RCRA closure was performed on the pond in 2009 and post-closure monitoring pursuant to hazardous waste regulations has been performed since 2009.

A Corrective Measures Plan Supplement (CMPS), dated September 29, 2004 and prepared by RMT, Inc., was submitted to the Ohio Environmental Protection Agency (Ohio EPA) for the solid waste landfill, the hazardous waste surface impoundment and the exempt-waste disposal cell. The CMPS was approved pursuant to the December 2004 Director's Final Findings and Orders (F&Os). Appendix C of the CMPS consists of a Corrective Measures Groundwater Monitoring Plan (CMGMP) and Appendix E of the CMPS consists of a Groundwater Sampling and Analysis Plan (SAP). Groundwater sampling and analysis for the three units has since been performed in accordance with the solid waste groundwater regulations (OAC 3745-27-10), the CMGMP and the SAP, and thereafter as amended by the Evaluation of March 2009 Semiannual Groundwater Monitoring Event (RMT, May 2009). Groundwater monitoring for the concrete pond is performed in accordance with RCRA hazardous waste post-closure regulations and the Post Closure and Closure Plan – Concrete Pond (RMT, 2008, revised March 2010).

Historically, the results of sampling groundwater monitoring wells downgradient of the solid waste landfill, the hazardous waste surface impoundment and the exempt-waste disposal cell consistently detected concentrations of constituents exceeding background...
groundwater quality. In 2005, a groundwater extraction system was installed immediately
downgradient of the solid waste landfill. The extraction system consists of eight extraction
wells screened in the shallow, uppermost aquifer and provides source control to reduce
or eliminate releases of waste-derived constituents in groundwater. The location of the
groundwater monitoring and extraction wells are shown in Figure 1 (Appendix A). The
installation of the groundwater extraction system constituted a corrective measure. The
2004 CMGMP was written with the understanding that the extraction system would be
installed and future groundwater monitoring would be performed following the corrective
measures groundwater monitoring program as required by OAC 3745-27-10(F). However, groundwater monitoring required as a result of the concrete pond closure follows the hazardous waste regulations.

Ohio EPA met with McWane and McWane's consultant, Spence Environmental
Consulting, Inc. (SEC) on December 11, 2013, and agreed to amend the Corrective
Measures Groundwater Monitoring Plan (CMGMP) so that there is one comprehensive
groundwater monitoring plan that addresses the entire site under a single set of standards
or concentration levels. The Amended CMGMP (ACMGMP) includes this Sampling and
Analysis Plan (SAP) and considers the solid waste landfill, the hazardous waste surface
impoundment, the exempt-waste disposal cell and the concrete pond as one unit (see
Figure 1) under the solid waste regulations. There will be no post-closure groundwater
monitoring specific to the concrete pond under RCRA.

This SAP describes the following:

- Monitoring wells to be sampled
- Water elevation measurements
- Constituents to be analyzed
- Well purging
- Sample collection
- Field analysis
- Equipment decontamination
- Disposal of purge water
- Field records
- Laboratory analytical procedures
- Quality assurance/quality control.

Sampling will be performed on a semi-annual basis. This SAP has been prepared in accordance with OAC 3745-27-10(C)(2) and reflects actual site conditions, acceptable practices and relevant guidance manuals (Technical Guidance Manual for Groundwater Investigations, Ohio EPA, May 2012).

2.0 MONITORING WELL NETWORK

The monitoring well network will consist of the eighteen wells identified in Table 1 (Appendix B). These wells will be sampled semi-annually along with the combined effluent water from the groundwater extraction system.

The remaining wells (B-5, B-0, E-1, E-3, L-5, L-6, D-7, S-2, S-6 and A-7) and the individual extraction wells (EW-1 thru EW-8) will be used to collect groundwater elevation data.

3.0 WATER ELEVATION MEASUREMENTS

Groundwater elevations will be measured in all twenty eight site monitoring wells plus the eight extraction wells during each semi-annual sampling event. Measurements will be taken within a single 24 hour period prior to well purging using a Solinst or equivalent water level indicator. Measurements will be made using a reference point established with an indelible mark on the top of well casing or wellhead assembly for wells equipped with dedicated bladder pumps. Groundwater depths measured from the top of casing reference point will be measured to the nearest 0.01 ft. The elevation of these reference points was obtained during previous surveys. Data from the groundwater monitoring wells will be used to determine the direction of groundwater flow and to evaluate vertical gradients.
Bladder pumps have been installed in each of the monitoring wells in the groundwater monitoring program. As such, depth to bottom measurements will only be taken when pump or well maintenance allows. Historical well depth measurements have been used to calculate well volumes, as needed. This information has been provided in previous plans and reports (Attachment B of September 29, 2004 SAP).

4.0 CONSTITUENTS

The proposed list of constituents, included in Table 2 (Appendix B), will be analyzed for the eighteen wells to be sampled and the combined effluent water.

5.0 GROUNDWATER SAMPLE COLLECTION

Groundwater sampling activities will be performed as follows:

1. Collect groundwater elevation measurements of all monitoring and extraction wells within 24 hours prior to purging.
2. Note the condition of wells and pumps and implement corrective action as necessary.
3. Perform well purging of the eighteen monitoring wells to be sampled. Upgradient wells will be purged first, followed by downgradient wells. Monitor well volumes removed and perform field analysis to determine when purging is complete.
4. Collect samples for laboratory analysis.

5.1 Purging Procedures

All monitoring wells to be sampled contain dedicated bladder pumps. Since actual pumping rates and purge volumes required to stabilize the water chemistry at each well will vary as a function of groundwater elevation and hydraulic properties at the time of sampling, the purge rate and volume removed will be determined in the field during each sampling event. Every effort will be made to purge wells until a minimum of three well
volumes have been removed and indicator parameters have stabilized (see Field Analysis). Well volumes have previously been calculated for all wells to be sampled and purging will be performed such that well volumes consistently removed in the past are achieved. Depending on the time of year and other conditions, it is possible that some of the monitoring wells will be pumped dry prior to removing three well volumes and/or achieving stabilization criteria for indicator parameters. Wells that purge dry will be sampled when sufficient water has re-entered the well. It is also possible that some wells will be dry when sampling occurs. Samples will not be collected from these wells.

5.1.1 Field Analysis

The following indicator parameters will be measured in the field to evaluate well stabilization during well purging: temperature, pH, specific conductance and turbidity.

The following steps will be taken to ensure that field analysis is valid:
- Field samplers are trained in the use of the equipment.
- Instruments are calibrated in accordance with manufacturer's instructions.
- Standard forms are used to document field activities (Appendix C).
- Field readings and calibrations are documented.
- QC checks of field notes are performed.

Temperature, specific conductance and pH will be measured using an Ultrameter by Myron, or equivalent. Turbidity will be measured using a Hanna 98703, or equivalent. Groundwater samples for field analysis will be collected at varying intervals consistent with and depending on the total volume typically removed during past purging events.

Purging will be considered complete, and stabilization reached, when the turbidity measurements have three consecutive readings within ± 10%, or if two consecutive readings are below 10 NTU and two of the following conditions have been met:

Temperature: three consecutive readings within ± 0.5°C
pH: three consecutive readings within ± 0.2 Standard Units (SU)
Specific Conductance: three consecutive readings within ± 5%

If the turbidity measurements do not stabilize after three well volumes are removed, then the sample may be collected once pH, conductivity and temperature have all stabilized as defined above and the turbidity value is within 10% of the previous value. The stabilization criteria will not apply to a well that is purged dry and the well will be sampled when sufficient water recharges into the well.

All instruments will be used and calibrated in accordance with the manufacturer's specifications. Calibration results will be documented using standard field forms (Appendix C).

5.2 Sampling Procedures

Samples will be collected as soon as well purging is complete. If the well is pumped dry, the sample will be collected when sufficient water has re-entered the well. Samples will be collected within 24 hours of purging. Following is a description of the procedures for sampling:

1. Pre-cleaned sample containers containing preservative, if necessary, are provided by the laboratory. The sampler will verify each container is present and properly labeled.

2. Each sample container will be filled by allowing the water stream from the purge pump to strike the inner wall of the container to minimize the formation of air bubbles. Care will be taken not to overfill sample bottles containing preservative so as not to remove or dilute the preservative.

3. Table 3 in Appendix B identifies containers, preservatives and holding times for the parameters to be analyzed.

4. Blind duplicates will be collected at a rate of one in ten samples. Field equipment blanks will not be collected since all sampling equipment is dedicated to each well.
5. Information to be included on sample container labels will include site name, sample ID, sampler's initials, location, preservative used, parameter(s) to be analyzed, date and time of collection.

5.3 Equipment Decontamination

The water level indicator will be decontaminated between each well as follows:

- Rinse probe with soapy (phosphate free) water
- Rinse with deionized water
- Air dry

The probes for the pH, specific conductance and temperature will be rinsed between field measurements with deionized water. The container used to take turbidity readings will be rinsed between measurements with deionized water.

5.4 Disposal of Purge Water

Once sampling is completed, purge water from background wells A-6 and D-6 will be collected in containers and spread on the ground surface in the vicinity of the well from which it came.

Purge water from all other wells will be collected in containers and disposed in the plant wastewater treatment system.

5.5 Documentation

Daily field activities will be documented using the field forms included in Appendix C. Activities to be documented include the following:

- General Notes: weather, summary of work performed, corrective measures, equipment used
- Calibration logs
- Groundwater elevation data
- Purging and water sampling logs
6.0 LABORATORY ANALYTICAL PROCEDURES

Samples will be analyzed using the most appropriate and recent EPA Test Methods. Table 3 in Appendix B includes the current test method used for each parameter to be analyzed. The current laboratory is Pace Analytical Services, Inc. in Dublin, Ohio.

The laboratory will provide a Standard Level 2 Data Reporting package for each sampling event. The following information will be included with each package:

- Chain-of Custody for all samples
- Laboratory preparation blank results
- Laboratory control spike (LCS) results
- Sample spike recoveries
- Laboratory duplicate results
- Recovery test results

Ohio EPA will be notified of any changes to the laboratory selected to perform groundwater analytical services.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

This section describes the quality assurance/quality control (QA/QC) procedures to be followed in the field and in the laboratory, as well as QA/QC validation of the data package provided by the laboratory for each sampling event.

7.1 Field QA/QC

Field QA/QC will consist of the following:

- Field duplicates will be collected at a frequency of one per ten samples. It is anticipated that two field duplicates will be collected for each sampling event. Field equipment blanks will not be collected since sampling equipment is dedicated to each well.
• Temperature blanks will be provided by the laboratory to verify the temperature at the time the samples are received by the laboratory. Trip blanks will not be provided since volatile organic compounds (VOCs) are no longer being analyzed.
• Chain-of Custody forms will be completed and accompany sample shipping containers to document the transfer of the shipping containers and samples from the field to the laboratory.

7.2 Laboratory QA/QC

The handling and processing of all samples and QA/QC procedures by the laboratory are described in detail in the Quality Assurance Manual and SOPs maintained by the laboratory. These documents can be provided upon request. The purpose is to provide reliable results of known and acceptable quality. To this end, the laboratory will provide a Standard Level 2 Data Reporting package which will include the information described in Section 6.0 of this SAP.

7.3 QA/QC Validation

Data validation will be performed by a party independent of the laboratory. The data reviewer will perform a review of the data for compliance with established QC criteria based on the spike, duplicate and blank results provided by the laboratory. An evaluation of the data accuracy, precision, sensitivity and completeness will be performed in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic data Review Final (July 2002). A data validation report will be submitted with each semi-annual report and will address the following:

• Overall quality and usability of the data
• Evaluation of QC data
• Potential sample contamination
• Assessment of field and laboratory records
• Actions regarding specific QC criteria exceedances
APPENDIX A

Figure 1 – Site Map

SEC, Inc.
APPENDIX B

Table 1 – Groundwater Monitoring Wells to be Sampled

Table 2 – Constituents to be Monitored

Table 3 – Containers, Preservatives, Holding Times and Test Methods

SEC, Inc.
<table>
<thead>
<tr>
<th>Well</th>
<th>Purpose of Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-6</td>
<td>Background</td>
</tr>
<tr>
<td>D-6</td>
<td>Background</td>
</tr>
<tr>
<td>L-2</td>
<td>Landfill Boundary Well</td>
</tr>
<tr>
<td>L-3</td>
<td>Landfill Boundary Well</td>
</tr>
<tr>
<td>L-4</td>
<td>Landfill Boundary Well</td>
</tr>
<tr>
<td>S-1</td>
<td>Surface Impoundment Well</td>
</tr>
<tr>
<td>S-3</td>
<td>Surface Impoundment Well</td>
</tr>
<tr>
<td>S-4</td>
<td>Surface Impoundment Well</td>
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<tr>
<td>S-5</td>
<td>Surface Impoundment/Concrete Pond Well</td>
</tr>
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<td>E-2</td>
<td>Downgradient/Property Boundary Well</td>
</tr>
<tr>
<td>E-4</td>
<td>Downgradient Well</td>
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<td>D-2</td>
<td>Downgradient Well</td>
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<td>D-3</td>
<td>Downgradient Deep Well</td>
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<td>D-8</td>
<td>Downgradient Property Boundary Well</td>
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<td>D-9</td>
<td>Downgradient Deep Property Boundary Well</td>
</tr>
<tr>
<td>D-10A</td>
<td>Downgradient Property Boundary Well</td>
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<td>Downgradient Property Boundary Well</td>
</tr>
<tr>
<td>D-13</td>
<td>Downgradient Property Boundary Well</td>
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<td>Constituents to be Monitored</td>
<td>McWane Ductile</td>
</tr>
<tr>
<td>-----------------------------</td>
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</tr>
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**Metals (ug/L)**

- Aluminum
- Antimony
- Arsenic
- Cadmium
- Chromium
- Copper
- Iron
- Lead
- Manganese
- Potassium
- Selenium
- Sodium
- Vanadium

**Inorganic Parameters (mg/L)**

- Chloride
- Cyanide
- Fluoride
- Ammonia nitrogen
- Phosphorus
- Sulfate
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Container</th>
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<th>EPA Test Method</th>
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<td>Total Metals</td>
<td>P, G</td>
<td>HNO₃ to pH&lt;2</td>
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<tr>
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<td>H₂SO₄ to pH&lt;2, Cool 0-6°C</td>
<td>28 days</td>
<td>EPA 350.1/365.1</td>
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<td>Cool 0-6°C</td>
<td>28 days</td>
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<tr>
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APPENDIX C

Example Daily Activity and Sample Forms

SEC, Inc.
# GENERAL NOTES / DAILY WORK SUMMARY

<table>
<thead>
<tr>
<th>PROJECT NAME:</th>
<th>McWane Ductile Semi-Annual GW Monitoring</th>
<th>DATE:</th>
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<td>TIME LEFT SITE:</td>
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<td>WORK PERFORMED:</td>
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**WEATHER:**

**PROBLEMS ENCOUNTERED AND CORRECTIVE ACTION TAKEN:**

**COMMUNICATIONS:**

Name/Representing:

Subject/Comments:

QC'd by:
GENERAL NOTES – EQUIPMENT SUMMARY

PROJECT NAME: McWane Ductile Semi-Annual GW Monitoring  DATE:    
PROJECT NUMBER: McWane-01(16)  SAMPLER NAME:    

WATER LEVEL MEASUREMENTS WERE COLLECTED WITH:

Name and Model Number of Instrument  Serial Number (if applicable)

DEPTH TO BOTTOM OF WELL MEASUREMENTS WERE COLLECTED WITH:

Name and Model Number of Instrument  Serial Number (if applicable)

PURGE METHOD:

Name and Model Number of Pump  Serial Number (if applicable)

PURGE WATER DISPOSAL:

SAMPLING METHOD:

Name and Model Number of Pump  Serial Number (if applicable)

pH AND CONDUCTIVITY METER (Calibration on Separate Page):

Name and Model Number  Serial Number (if applicable)

TURBIDITY METER (Calibration on Separate Page):

Name and Model Number  Serial Number (if applicable)

Signed    Date    QC’d By:    Date
Certificate and Summary of Instrument Calibration

PROJECT NAME: McWane Ductile Semi-Annual GW Monitoring  
DATE: 

PROJECT NUMBER: McWane-01(16)  
SAMPLER NAME: 

Conductivity, pH and Temperature Meter

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<th>Instrument</th>
<th>Oakton CON-10</th>
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<td>Instrument Serial No.</td>
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<td>Curt Spence</td>
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pH Calibration

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Conductivity Calibration

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Calibration Solutions

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Conductivity (1413 μS)  
Lot #

pH and Conductivity Calibration Log

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Turbidity Meter

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Calibration performed at same time as pH/conductivity meter. Calibration is automatic and actual readings are not displayed.

Signature of Person Performing Calibration
## WATER LEVEL DATA

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**DATE:**

**PROJECT NUMBER:** McWane-01(16)  
**SAMPLER NAME:**

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**Signed**  
**Date**  
**QC’d By:**  
**Date**
# FIELD DATA FORM

**PROJECT NAME:** McWane Ductile Semi-Annual GW Monitoring  
**SAMPLE DATE:**  

**PROJECT NUMBER:** McWane-01(16)  
**SAMPLE COLLECTOR:**  

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<th>CONDUCTIVITY (µS/cm)</th>
<th>ODOR (UNFILTERED)</th>
<th>COLOR (UNFILTERED)</th>
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</tbody>
</table>

**PURGE VOLUME:** _______ GALS.  
**SAMPLE COLLECTION TIME:** _______
Appendix C
Amended Post-Closure Plan

Solid Waste Landfill
Hazardous Waste Surface Impoundment Closed as a Landfill (Cell 1)
Exempt Waste Disposal Cell (Cell 2)
Concrete Cooling Pond

Prepared for:

McWane Ductile - Ohio
A Division of McWane, Inc.
2266 South Sixth Street
Coshocton, Ohio 43812

March 23, 2017
Amended Post-Closure Plan

Solid Waste Landfill
Hazardous Waste Surface Impoundment Closed as a Landfill (Cell 1)
Exempt Waste Disposal Cell (Cell 2)
Concrete Cooling Pond

Prepared for:

McWane Ductile - Ohio
A Division of McWane, Inc.
2266 South Sixth Street
Coshocton, Ohio 43812

Client: Ms. Heather Rainwater
McWane Ductile - Ohio
2266 South Sixth Street
Coshocton, Ohio 43812

Project No.: McWane-01C(17)

Distribution: Ms. Heather Rainwater, McWane Ductile - Ohio
SEC File

Date: March 23, 2017

Prepared by:

[Signature]
Chris Hartford, P.E., Project Engineer

Reviewed By:

[Signature]
R. Curtis Spence, P.E., President

Spence Environmental Consulting, Inc.
70 West Columbus Street
Pickerington, Ohio 43147
614.837.4750
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  Appendix B Monthly Leachate Pump Log
SECTION 1.0: INTRODUCTION

1.1 Introduction

McWane Ductile – Ohio, a Division of McWane, Inc. (McWane) operates a ductile iron foundry in Coshocton, Ohio. The site contains three closed waste management units. The closed units are the solid waste or North Landfill (closed in 1996), the hazardous waste surface impoundment with associated disposal area (Cell 1), which was closed as a hazardous waste landfill in 1995, and an exempt-waste disposal cell (Cell 2) which was closed under RCRA closure regulations in 2008. The closed North Landfill has historically been regulated under solid waste regulations and Cells 1 and 2 under RCRA or hazardous waste regulations.

A groundwater extraction and discharge system was installed in 2005 immediately downgradient of the North Landfill. The installation of this system constituted a corrective measure under the solid waste regulations.

A concrete cooling pond is used to accumulate non-contact cooling water and other non-hazardous waters. A RCRA closure was performed on the pond in 2009; post-closure care has been performed since 2009 pursuant to hazardous waste regulations. The concrete cooling pond is still in use but no longer manages hazardous waste.

Having these units regulated under hazardous and solid waste regulations created difficulties as the two regulations are not consistent with each other with respect to groundwater monitoring. As such, Ohio EPA and McWane agreed groundwater monitoring for the North Landfill, Cells 1 and 2 and the concrete cooling pond (collectively the “Units”) should be performed under solid waste rule OAC 3745-27-10. This agreement resulted in an Amended Corrective Measures Groundwater Monitoring Plan (ACMGMP) being prepared to provide one comprehensive plan that addresses the entire site under one set of groundwater monitoring standards (OAC 3745-27-10(F)). The ACMGMP (April 2016) was approved by Ohio EPA in a letter dated September 13, 2016. The selected measure of groundwater extraction and discharge is performed in accordance with the Corrective Measures Plan (CMP) Supplement dated September 29, 2004, with groundwater monitoring performed as modified by the ACMGMP.

Figure 1 is a Site Map which shows the location of the Units, the monitoring wells and the groundwater extraction system.

1.2 Purpose and Scope

Post-closure care at the McWane facility consists of three primary activities:

1. Groundwater monitoring;
2. Post-closure monitoring and maintenance related to final cover systems of the North Landfill and Cells 1 and 2; and
3. Post-closure monitoring and maintenance related to the concrete cooling pond.

Groundwater monitoring is described in the ACMGMP. With respect to post-closure care activities related to the final cover systems and the concrete cooling pond, various plans existed describing these activities. The purpose of this document is to provide one comprehensive plan that complies with pertinent solid and hazardous waste regulations and addresses the cover systems for the North Landfill, Cells 1 and 2, as well as monitoring and maintenance activities for the concrete cooling pond. This plan outlines the items to be inspected and monitored, as well as the maintenance activities that McWane will perform for the Units. The North Landfill and Cells 1 and 2 have final cover systems and will be managed as one combined unit, hereafter identified as the "Landfill". The concrete cooling pond is still active and its inspection and maintenance activities are described separately.
SECTION 2: SITE DESCRIPTION

2.1 Site Description

Figure 1 is a Site Map of the McWane facility, which is located just outside the south central portion of Coshocton, Ohio. This map also identifies the groundwater extraction system and the wells to be sampled under the approved ACMGMP. Figure 2 is an expanded view of the Units, which are considered one large unit for purposes of groundwater monitoring.
SECTION 3: POST-CLOSURE PLAN

3.1 General

This Amended Post-Closure Plan identifies the monitoring and maintenance activities to be performed during the remaining post-closure care period. Three of the units covered under this plan are regulated under the hazardous regulations (Cells 1 and 2 and concrete cooling pond) and one unit is regulated under the solid waste regulations (North Landfill). The North Landfill and Cells 1 and 2 all have final cover systems and are immediately adjacent to each other. As such, this plan has been prepared in general accordance with OAC Rules 3745-27-14, 3745-55-17 and 3745-55-18 and includes the following:

- The name, address and telephone number of the person to contact during the post-closure care period.
- A description of the planned inspections, frequencies and documentation.
- A description of the planned monitoring activities and frequencies.
- A description of the planned maintenance activities and frequencies.

The North Landfill and Cells 1 and 2 will hereafter be identified as the "Landfill". Post-closure activities for the concrete cooling pond will also be performed pursuant to this Plan, but are described separately as this unit is still in service and has no cover system.

3.2 Post-Closure Contact

During the post-closure care period, the primary plant contact will be:

Heather Rainwater
Environmental Manager
McWane Ductile – Ohio
A Division of McWane, Inc.
2266 South Sixth Street
Coshocton, Ohio 43812
740-291-1087

3.3 Concrete Cooling Pond

3.3.1 Monitoring

Annually, typically during summer shutdown of the manufacturing process, the concrete cooling pond will be emptied. The water will be placed in the million gallon tank. Accumulated sludge will be processed through the wastewater treatment
plant. The concrete cooling pond will be inspected for: cracks or other signs of deterioration.

3.3.2 Maintenance

- Damaged concrete: Replace/Repair while the pond is emptied. After maintenance activities are completed the pond is returned to active use.

3.4 Landfill Post-Closure Monitoring

Post-closure monitoring activities for the Landfill will consist of inspections to be performed quarterly as described below. The Landfill inspection form is included in Appendix A and will be used in conjunction with Figure 2, which represents an expanded view of the Landfill and the concrete cooling pond. The location of items discovered during the inspection (e.g. rodent holes) will be noted on Figure 2 as appropriate.

3.4.1 Final Cover System

- Erosion: The Landfill will be visually inspected to evaluate the need to correct or repair excessive erosion damage to the cover. Excessive erosion is generally erosion that has formed a gully 6 inches or greater in depth.

- Vegetation – Visual inspection of the condition and quality of vegetative cover will indicate if maintenance is needed. Inappropriate vegetation includes trees or other plant life with deep roots.

- Settlement and Subsidence: The Landfill will be visually inspected to evaluate the need to correct differential settlement areas, deformation of side slopes or evidence of subsidence that could lead to surface water ponding. Excessive subsidence or differential settlement is settlement of such a magnitude that the normal drainage is interrupted, slope stability could be threatened, or cracking of the ground is observed.

- Rodent: Visual inspection to observe signs of burrowing or other rodent damage.

3.4.2 Surface Water Management System

- Erosion/condition of diversion berm on Cells 1 and 2.
- Erosion/condition of surface drainage channels surrounding each of the North Landfill and Cells 1 and 2.
- Condition of toe drains.
• Sedimentation basin and spillway. The inspections will look for erosional damage and sediment build-up. The outlet structure of the sedimentation basin will be inspected for blockages or deterioration.

3.4.3 Leachate Collection System Inspection Items

• Manhole covers inspected to verify their presence and proper placement.
• Aboveground portions of manholes for signs of damage or deterioration.
• Leachate pumping system, including control panel, will be inspected for damage and/or deterioration. While not part of the quarterly inspection, a monthly leachate pump log is included in Appendix B.
• Path of below-grade discharge lines outside the waste cells for evidence of damage or settlement.

3.4.4 Groundwater Monitoring System

Each groundwater monitoring well within or just outside the Landfill boundary (see Figure 2) will be inspected for the following:

• Labeling,
• Aprons,
• Protective casings, and
• Bumper guards are intact.

The riser pipes and supports of the monitoring wells will be checked for structural integrity and the presence and condition of the locks will be noted. Note that all groundwater monitoring wells (not just wells within Landfill boundary) are inspected and corrective action taken as needed during each semi-annual sampling event as described in the ACMGMP.

3.4.5 Survey Monuments

• Physical condition of the benchmarks will be observed for deterioration and legibility.
• Any discrepancy in survey results from the benchmarks will be noted, in the event that the position or elevation of the benchmark has been disturbed.

3.4.6 Security Devices

• Fencing and locks for signs of vandalism, deterioration, or damage that could result in unauthorized entry.
• Warning signs for legibility that may have been reduced by weathering or vandalism.

3.5 Landfill Post-Closure Maintenance

All inspections, routine and non-routine maintenance, and corrective action activities will be recorded quarterly on checklist sheets and maintained in the Environmental Department. The checklist sheets will contain the date of the activity, the name of the parties involved in the activity, and details of the specific activity taken. The results of the quarterly post-closure inspections and any necessary repairs will be documented to Ohio EPA in a quarterly report to be submitted within fifteen days of the inspection.

Post-closure maintenance activities will be performed as described below:

3.5.1 Final Cover System

• Mowing of the vegetative cover: Minimum annually or more frequent based on preference.
• Reseeding and fertilization of stressed areas of vegetative cover: As soon as possible after discovery.
• Extermination of burrowing animals: Minimum annually or more frequently as necessary.
• Excessive erosion: Stabilize as soon as possible after discovery.
• Localized subsidence or differential settlement: Note location of subsidence and contact Engineer for necessary actions.
• Slope slips: Note location of potential or actual slip and contact Engineer for necessary actions.

3.5.2 Surface Water Management System

• Sediment basin build-up: Removed periodically to prevent build-up of sediment in excess of 0.5 feet on the bottom.
• Sediment in channels, diversion berms, catch basins, and storm sewers: Remove periodically to prevent sediment that compromises the hydraulic drainage of the unit.
• Erosional washouts of > 6 inches in any part of the surface water control system: Repair as soon as possible after discovery.
• Damage to toe-drains: Replace/Repair as soon as possible after discovery.
• Seeps (or saturated ground): Note location of seep(s) and contact Engineer for necessary actions.
3.5.3 **Leachate Collection System**

- Leachate pump stations: Manually start/stop each pump quarterly. Ensure level controls are operating properly. Replace/Repair as soon as possible after discovery.
- Service pumps and control panel every 5 years.
- Leachate pump station below-ground force mains: Repair pipe section as soon as possible after discovery.
- Leachate collection system cleaning: Every 5 years. Initial cleaning pressure 300 psi. Cleaning frequency and pressure may vary depending on field conditions and build-up of materials. Repair cleanout piping above cap membrane as soon as possible after discovery.

3.5.4 **Groundwater Monitoring System**

- Damaged groundwater monitoring well: Replace/Repair as soon as possible after discovery.

3.5.5 **Survey Monuments**

- Damaged benchmark: Replace/Repair annually. Use other benchmarks for control until damaged unit is repaired.

3.5.6 **Security Devices**

- Damaged fencing, gates, locks, and signage: Replace/Repair as soon as possible after discovery.

3.6 **Annual Leachate Sampling and Reporting**

By April 1 of each calendar year, McWane must submit a report in accordance with OAC 3745-27-14 for its leachate system. The report will include the following information:

- A statement that the leachate collection system exists;
- Location of leachate water usage/treatment;
- Results from OAC 3745-27-10 Appendix I sampling for leachate pumps (one composite sample for the three pumps)
- Monthly leachate collected. The operating hour meter reading from each lift station will be recorded electronically the last business day of each month. The pump’s rated capacity of 15 gpm will be used to calculate gallons collected; and
- Financial assurance documentation
- Note: The Local Health Department does not have authority under the Solid Waste Program and therefore does not need to be copied on this report.
SECTION 4: CERTIFICATION

The post-closure period at the McWane facility will continue for 30 years after certification of closure is submitted for the North Landfill, Cell 1, Cell 2 and the concrete cooling pond. The post-closure period began December 3, 2008 for the North Landfill, Cell 1 and Cell 2 and August 1, 2009 for the concrete cooling pond. At the completion of the post-closure care period, McWane will submit to the Director of Ohio EPA by registered mail written certification that the post-closure care period for the respective unit was performed in accordance with OAC 3745-55-20, 3745-66-20, 3745-27-14, this post-closure plan and the ACMGMP. The certification will be signed by McWane Ductile - Ohio and an independent, qualified, registered professional engineer. Documentation supporting the certification will be furnished upon request.
Figure 1

Site Map

SEC, Inc.
Figure 2

Closed Disposal Units

SEC, Inc.
FIGURE 2

NOTE: BMS LOCATED ON EAST SIDE OF EHS OFFICE BUILDING
Appendix A

Landfill Inspection Checklist
Closed North Landfill and Hazardous Waste Cells 1 & 2

Evaluate and circle as either Satisfactory (S) or Unsatisfactory (U).

Corrective actions must be implemented for any Unsatisfactory conditions

<table>
<thead>
<tr>
<th>Inspector Name / Title:</th>
<th>Date:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Final Cover System</th>
<th>S</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Erosion - signs of erosion damage to landfill cover</td>
<td>Corrective Actions / Notes:</td>
<td></td>
</tr>
<tr>
<td>* Vegetation - condition and quality of vegetative cover (no bare spots or deep rooted species)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Settlement - signs of settling or ponding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Subsidence - signs of sideslopes slips</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Rodent - signs of burrowing or other rodent damage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Surface Water Management</th>
<th>S</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Erosion /condition of diversion berm between Cells 1 &amp; 2</td>
<td>Corrective Actions / Notes:</td>
<td></td>
</tr>
<tr>
<td>* Erosion /condition of diversion berm on Cell 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Erosion /condition of drainage channels surrounding landfills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Condition of toe drains</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Sedimentation Basin and spillway</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Leachate Collection System</th>
<th>S</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Manhole covers in place and in good condition</td>
<td>Corrective Actions / Notes:</td>
<td></td>
</tr>
<tr>
<td>* Condition of leachate station panel including label</td>
<td>LS - 1</td>
<td></td>
</tr>
<tr>
<td>* Evidence of pipe break (wet area along underground pipeline)</td>
<td>LS - 2</td>
<td></td>
</tr>
<tr>
<td>* Run pumps in manual mode to ensure proper operation</td>
<td>LS - 3</td>
<td></td>
</tr>
<tr>
<td>* Record operation hour meter readings</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Groundwater Monitoring System</th>
<th>S</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Check wells for labeling, protective casing condition, security</td>
<td>Corrective Actions / Notes:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Survey Monuments</th>
<th>S</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Check physical condition of permanent survey benchmarks</td>
<td>Corrective Actions / Notes:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Security Devices</th>
<th>S</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Fencing, gates, and locks</td>
<td>Corrective Actions / Notes:</td>
<td></td>
</tr>
<tr>
<td>* Signage at gates</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Appendix B

*Monthly Leachate Pump Log*

SEC, Inc.
Readings are to be taken the first business day of each month. Total Gallons are calculated by taking the previous month's reading and subtracting it from the current month's reading and multiplying by 15 gpm (pump capacity) and multiplying by 60 minutes.
November 30, 2009

Ms. Heather Klesch
Clow Water Systems Company
2266 South Sixth Street
Coshocton, Ohio 43812-6001

Re: Partial Closure Letter for the
Clow Water Systems Company Concrete Pond
Clow Water Systems
OHD004294849

Dear Ms. Klesch:

On June 4, 2009, Ohio EPA approved the closure/post closure plan for the concrete pond located at Clow Water Systems Company facility at 2266 South Sixth Street in Coshocton, Ohio.

On August 25, 2009, the director received partial closure certification documents for the storage and disposal unit known as the concrete pond from Clow Water Systems Company. Clow certified that the concrete pond has been closed according to the specifications in the approved closure/post closure plan. The type of closure was a restricted waste in place closure.

To verify Clow Water Systems Company’s closure activities, Donna Goodman from Ohio EPA’s Southeast District Office, conducted an inspection of the concrete pond on November 25, 2009. She also reviewed documents pertaining to the closure of the concrete pond and determined that the activities proposed in the closure plan were conducted adequately.

Based on this inspection and review, Ohio EPA has determined that Clow Water Systems Company has closed the concrete pond according to the approved closure plan and the substantive requirements of Ohio Administrative Code (OAC) rules 3745-55-11 through 3745-55-15. Clow Water Systems must continue post-closure care, in accordance with the approved post-closure plan and OAC rules 3745-55-16 through 3745-55-21.
Clow Water Systems Company remains a large quantity generator of hazardous waste. Our records show that Clow Water Systems Company uses a Financial Test mechanism to demonstrate compliance with the state's hazardous waste financial assurance requirements for closure, post-closure care and liability coverage. Although Clow Water Systems Company has closed the concrete pond according to the approved closure plan and Ohio Administrative Code (OAC) rules 3745-55-11 through 3745-55-15, the Clow Water Systems Company is still subject to financial assurance requirements for closure and post-closure costs and liability coverage for other remaining units at the facility.

The facility's compliance with closure obligations under Ohio's hazardous waste laws does not discharge Clow Water Systems Company's obligation to investigate and possibly clean up contamination from releases of hazardous waste or hazardous constituents at the facility, regardless of when the waste was placed in the unit. This requirement is known as RCRA Corrective Action.

Clow Water Systems Company has completed partial closure for the storage and disposal unit known as the concrete pond. However, cell 1 and 2 of the landfill are subject to post-closure requirements and the concrete pond is still subject to post-closure requirements under OAC rules 3745-55-16 through 3745-55-21.

If you have any questions concerning the closure process or the status of the facility, please contact Donna Goodman by phone at (740) 389-5293 or by mailing address at:

Ohio EPA  
Southeast District Office  
Division of Hazardous Waste Management  
2195 Front Street  
Logan, Ohio 43138

Sincerely,

David K. Chenault  
DHWM Manager  
Division of Hazardous Waste Management

DK/DG/mlm

cc: Jeremy Carroll, Manager, RISS, DHWM, CO  
Ed Lim, Manager, ERAS, DHWM, CO  
Harry Sarvis, Manager, CAS, DHWM, DO  
Donna Goodman, DHWM, SEDO  
Mike Allen, Engineering Unit, DHWM, CO  
Jeff Patzke, Manager, DDAGW, CO  
Ben Reed, DDAWG, SEDO
January 22, 1996

RE: COSHOCTON COUNTY
CLOW WATER SYSTEMS CO.
CLOSURE CERTIFICATION

Clow Water Systems Corporation
2266 South Sixth Street
P.O Box 6001
Coshocton, Ohio 43812-6001

Attn: Stephen A. Smith, Vice President

Dear Mr. Smith:

On November 22, 1995, the Southeast District Office (SEDO) of the Ohio Environmental Protection Agency (OEPA) received the Documentation Report for the construction of North Landfill Phase III Cover at Clow Water Systems Company (Clow) in Coshocton County. This report contained clay borrow site documentation and soils data, site earthwork construction details, additional closure construction information, field test results, survey results of subgrade and final grades for the recompacted barrier layer, photographs showing various construction activities, slope stability analysis for west slope of North Landfill, and drawings listed below:

<table>
<thead>
<tr>
<th>DWG.NO.</th>
<th>DRG. TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet 4 of 10</td>
<td>Final Grades</td>
</tr>
<tr>
<td>Sheet 8 of 10</td>
<td>Details</td>
</tr>
<tr>
<td>Sheet 9 of 10</td>
<td>Details</td>
</tr>
</tbody>
</table>

I. CLOSURE ACTIVITIES

The documentation was reviewed by the Division of Solid and Infectious Waste Management (DSIWM) for compliance with Order #5 of the Director's Final Findings and Orders (DFFOs), dated December 28, 1993. As a result of our review of this report and site inspections, the following salient points were noted:

- A request for change in specifications for this project from those contained in OAC 3745-27-08 (C)(1)(c)(iv), effective March 01, 1990, was made in a letter to OEPA dated June 02, 1994. This was supported by test results for the borrow material for clay cover that had been submitted on October 18, 1993. The report showed that the material could achieve the maximum hydraulic conductivity specification of 1x10^{-7} cm/sec with 20% smaller than 0.002
mm. as long as 60% or more of material passed the No. 200 sieve. This met the alternative specification requirements listed at the end of OAC 3745-27-08 (C)(1).

- In 1994, a portion of the recompacted barrier layer for the cap was constructed using a smooth drum vibratory roller with rototiller scarification prior to placing the subsequent lift. OEPA expressed concern that the equipment used could produce lift interfaces that would increase the overall permeability of the barrier layer. Later that year, field tests using two-stage borehole permeameters were used to measure the permeability of the recompacted layer. The test results, submitted on January 24, 1995, revealed problems with bonding between lifts showing a high horizontal versus vertical permeability ratio. DSIWM recommended three corrective action options in a letter to Clow dated April 18, 1995. Clow implemented the second option, i.e. covering the already constructed clay cover with a layer of geosynthetic clay liner (GCL). This area is shown in sheet 4, titled "Final Grades", submitted as a part of this report.

- For the remaining waste areas in the North Landfill Phase III, two feet of recompacted soil barrier layer was constructed in loose lifts of eight inches. The soil had a minimum gradation of 100% passing the 2-inch sieve, 80% passing the 3/4 inch sieve, 60% passing the No. 200 sieve and 20% smaller than 0.002 mm.

- Each lift was compacted to a dry density at least 90% of Modified Proctor maximum dry density at a moisture content at or wet of optimum using a fully penetrating wedge foot roller. Field dry densities and moisture contents for the clay were documented using a Troxler nuclear density gauge. These tests were performed every 1500 cubic yards. Areas that were tested and did not achieve the aforementioned dry densities and/or moisture content were reworked until acceptable dry densities and moisture contents were achieved. (P. 14)

- General fill, with an average thickness of 2.2 ft., was placed on top of the GCL or the soil barrier layer.

- Topsoil was placed over the general fill layer. Average thickness of topsoil was 0.7 feet.

- Seeding, fertilizing and mulching of the final cover was performed in accordance with the project specifications.

- A Surface Water Control System consisting of a drainage ditches, and a sedimentation pond, were constructed as shown in sheet 4.

- The final cap system on west end of Phase III has a slope greater than 25 percent as it approaches the sedimentation basin. Slope stability analysis was performed for this area. The results show that the final cover has a factor of safety of 2.6 without seismic loads and 1.7 with seismic loads. Therefore, the requirements of OAC 3745-27-11 (G)(1)(c) are met.
CONCLUSIONS

Based upon our review of the information submitted in the Documentation Report for the closure activities, it appears that the cap system, and surface water control system, have been constructed in substantial compliance with the requirements listed in Order No. 5 of the DFFOs and are therefore certifiable.

Thank you for proceeding with closure activities for the North Landfill Phase III. This approval does not release the facility from complying with other requirements of the DFFOs. Please be aware that as per Order No. 8 of the DFFOs, Clow must comply with post-closure care requirements specified in OAC rule 3745-27-14.

If you have any questions, please feel free to contact me at this office at (614) 385 8501.

Sincerely,

Sudha Brown
Environmental Specialist II
Division of Solid and Infectious Waste Management

SSB/jg

cc: Jimmy Logan, DSIWM, CO