SABIC Innovative Plastics US LLC
Burkville, Alabama
EPA I.D. Number ALD 981 026 677

FACT SHEET

A draft Remedial Plan has been prepared for the SABIC Innovative Plastics facility. This hazardous waste facility is located in Burkville, Alabama. This fact sheet has been prepared to briefly advise the public of the principal permitting, legal and policy issues of the draft Remedial Plan.

I. REMEDIATION PLAN REVIEW PROCESS

The purpose of the Remedial Plan review process is to allow the State and the public to evaluate SABIC's ability to comply with the hazardous waste management requirements of the AHWMMA, as amended.

II. PROCEDURES FOR REACHING A FINAL DECISION

ADEM Admin. Code r. 335-14-8-.08(6)(b)1. requires that the public be given a 45-day comment period for each draft Remedial Plan. The comment period will begin on BEGIN DATE, which is the date of publication of the public notice in major local newspaper(s) of general circulation, and will end on END DATE. The public notice will also be broadcast over local radio station(s).

Any person interested in commenting on the Cleanup Agreement or Remedial Plan must do so within the 45-day comment period discussed above.

All persons wishing to comment on any of the cleanup agreement conditions or the Remedial Plan should submit their comments in writing to the Alabama Department of Environmental Management, Permits and Services Division, 1400 Coliseum Blvd. (zip 36110-2059), P.O. Box 301463 (zip 36130-1463) Montgomery, Alabama, ATTENTION: Mr. Russell A. Kelly.

ADEM will consider all written comments received during the comment period while making a Remedial Plan decision for this facility. When the Department makes its final decision, notice will be given to the applicant and each person who has submitted written comments or requested notice of the final decision.

III. FACILITY DESCRIPTION

SABIC operates a polycarbonate resin manufacturing plant located in Burkville, Lowndes County, Alabama on approximately 6,300 acres of land. The production area is approximately 300 acres located centrally within the property. On July 5, 2011 a spill of approximately 124 gallons of tetrachloroethylene (PCE) occurred from a heat exchanger located within the interior of the Chlorine Enclosure Building. Approximately 25 gallons exited the doorway at the northeast corner of the building and infiltrated into the gravel and surficial soils. Initial response actions included using absorbents to collect PCE pooling on the floor within the building and excavating soil outside the doorway. Confirmation samples collected along the bottom portion of the excavation indicated PCE concentrations above the ADEM preliminary screening value (PSV). Based on this finding, SABIC voluntarily agreed to undertake certain environmental investigations and remediation measures in accordance with appropriate regulatory procedures. On March 5, 2012, SABIC entered into Cleanup Agreement ALD 981 026 677 with ADEM. The Cleanup Agreement sets forth specified procedures, conditions and schedules for SABIC to assess the extent of the PCE release and to perform remedial measures for protection of human health and the environment.

On February 19, 2019, SABIC Innovative Plastics US LLC (SABIC) provided written notice to the department of the discovery of elevated pH in soil samples collected beneath two tanks, V1635A, and V1635B. An investigation completed on April 27, 2019, concluded that the two tanks, rubber tank liners and tank bottoms had failed and 32% caustic had been spilled. SABIC removed as much soil and perched liquid as was possible without undermining the foundation of the ring-wall. The tank bottoms were repaired.

IV. SUMMARY OF PROPOSED REMEDIATION PLAN

An updated Remedial Plan originally submitted on March 18, 2015 and revised on November 20, 2015, and December 17, 2019, is being implemented to address the PCE spill site at the Chlorine Enclosure Building and Caustic spill site in accordance with SABIC's Cleanup Agreement.

VI. TECHNICAL CONTACT

Ben King
Engineering Services Section
Industrial Hazardous Waste Branch, Land Division
Alabama Department of Environmental Management
1400 Coliseum Blvd (36110-2059)
P.O. Box 301463 (36130-1463)
Montgomery, Alabama
(334) 394-4330
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ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

IN THE MATTER OF:	)	
	)	
SABIC INNOVATIVE PLASTICS US LLC	)	
	)	CLEANUP AGREEMENT ALD 981 026 677
RE:	)	
SABIC INNOVATIVE PLASTICS US LLC	)	
BURKVILLE, LOWNDES COUNTY, ALABAMA	)	
	)	
	)	
EPA ID NO.: ALD 981 026 677	)	
	)	

PART I

I.A. JURISDICTION

1. This Cleanup Agreement ("Agreement") is issued pursuant to the authority vested in the Alabama Department of Environmental Management (ADEM or "the Department") by the Alabama Hazardous Wastes Management and Minimization Act, Code of Alabama, 1975, as amended, §§ 22-30-1 to 22-30-24 (the AHWMMA).

2. This Agreement is issued to SABIC Innovative Plastics US LLC ("SABIC"), the owner of the property located at 1 Plastics Drive, Burkville, Alabama. For identification purposes this property will be referred to as "the Facility."

3. SABIC will not contest ADEM's jurisdiction to compel compliance with this Agreement in subsequent enforcement proceedings, either administrative or judicial; to require SABIC's compliance in terms of this Agreement; or to impose sanctions for violations of this Agreement.

4. That, for the purpose of the Agreement only, SABIC agrees that the Department may properly bring an action to compel compliance with terms and conditions contained herein in the Circuit Court for Montgomery County. SABIC also agrees that in any action brought by the Department to compel compliance with the terms of this Agreement, SABIC shall be limited to the defense of Force Majeure, compliance with this Agreement, and physical impossibility. SABIC shall not contest the terms of this Agreement.

I.B. PARTIES BOUND

1. This Agreement shall apply to and be binding upon ADEM, SABIC and its officers, directors, employees, agents, successors in interest and assigns of the property and to the owners thereof, heirs, trustees, receivers, and upon all persons or entities existing or operating under or for them. Each signatory to this Agreement must certify that he or she is fully authorized by the party he or she represents to enter into the terms and conditions of this Agreement, to execute the Agreement on behalf of the party represented and to legally bind such party.

2. No change in the corporate status relating to SABIC will in any way alter SABIC or any parties having acquired the right, title or interest in all or a portion of the afore described property responsibility under this Agreement.

3. SABIC shall provide a copy of this Agreement to all contractors, laboratories, and consultants retained to conduct or monitor any portion of the work performed pursuant to this Agreement within 14 calendar days of the issuance of this Agreement or the retention of such person(s), whichever occurs later, and shall condition all such contracts on compliance with the terms of this Agreement.

4. SABIC shall give written notice of this Agreement to any successor in interest prior to transfer of ownership or operation of the Facility or a portion thereof and shall notify the Department in writing within 30 calendar days prior to such transfer. This Agreement shall be binding upon each successor in interest and assigns of the property and to the owners thereof.

5. SABIC agrees to undertake all actions required by the terms and conditions of this Agreement, including any portions of this Agreement incorporated by reference. This Agreement shall not be appealable and SABIC does hereby waive any administrative hearing on terms and conditions of the same. [This does not waive SABIC's appeal rights through Dispute Resolution.]

I.C. FACTUAL BACKGROUND

1. The Facility is located in Lowndes County of central Alabama, in the City of Burkville. The total acreage of the Facility is approximately 6,300 acres, and of this, operations are conducted on approximately 300 acres.

2. The Facility was owned and operated by General Electric Company starting in 1987 until its obligations were assumed by SABIC in August of 2007.

3. SABIC is headquartered in Houston Texas.

4. On July 5, 2011, approximately 124 gallons of tetrachloroethene (PCE) was unintentionally released from the jacket of a heat exchanger during cleaning. Approximately 24 gallons was released from the building onto the ground outside. ("PCE Spill Site"). Subsequent efforts to excavate the contaminated soil led to the discovery of an apparent historical PCE release to the soils. Excavation was discontinued at approximately 32 inches below the surface due to obstructions caused by the existing building foundations and other facility infrastructure. The excavated soil was managed as a D039 hazardous waste and was handled by Rineco Chemical Industries, Inc. of Benton, Arkansas. The soil that remains within the excavated area still contains PCE at levels above Alabama Risk-Based Corrective Action (ARBCA) Guidance Manual Preliminary Screening Values (PSVs).

5. On December 2, 2011, the excavation was backfilled with clean soil in order to address worker safety concerns.

6. On February 19, 2019, SABIC provided written notice to the department of the discovery of elevated pH in soil samples collected beneath two tanks, V1635A, and V1635B. An investigation completed on April 27, 2019, concluded that the two tanks, rubber tank liners and tank bottoms had failed and 32% caustic had been spilled. SABIC removed as much soil and perched liquid as was possible without undermining the foundation of the ring-wall. The tank bottoms were repaired.

I.D. AGREEMENT

Based on the forgoing, it is hereby AGREED:

1. That within 14 calendar days of the issuance of this Agreement or the retention of such person(s), whichever occurs later, SABIC shall provide a copy of this Agreement to all contractors, laboratories, and consultants retained to conduct or monitor any portion of the work performed pursuant to this agreement, and shall condition all such contracts on compliance with the terms of this Agreement.

2. That, upon execution of this Agreement, SABIC shall comply with the provisions of Parts I through IV of this Agreement until a determination is made in writing by the Department, pursuant to Condition II.F. of this Agreement, that all obligations have been or are fulfilled and the Agreement is terminated. This Agreement is issued as an alternative to a SWMU Corrective Action Permit pursuant to ADEM Admin. Code r. 335-14-8; therefore, references to the requirements and procedures of ADEM Admin. Code r. 335-14-8 shall be applicable to this Agreement.

3. That any modifications made to this Agreement will be governed by the provisions of ADEM Admin. Code r. 335-14-8-.04.

4. That SABIC shall provide funding to the Department as reimbursement for the oversight costs of regulating the Facility as follows:

    a. SABIC has agreed to provide funding to the Department through a quarterly purchase order for all costs of administering the provisions of this Agreement related to those activities for which SABIC is responsible, including but not limited to document reviews, contract support, compliance inspections, and other administrative costs incurred by the Department.

    b. The Department shall provide to SABIC documentation of quarterly charges made against the aforementioned purchase order.

5. That SABIC is not relieved of any liability if it fails to comply with any provision of this Agreement.

6. That, for the purposes of this Agreement only, SABIC agrees that the Department may properly bring an action to compel compliance with the terms and conditions contained herein in the Circuit Court for Montgomery County. SABIC also agrees that in any action brought by the Department to compel compliance with the terms of this Agreement, SABIC shall be limited to the defenses of Force Majeure, compliance with this Agreement, and physical impossibility.

7. That this Agreement shall be final, effective and binding on the parties upon execution by all Parties.

I.F. DISPUTE RESOLUTION

1. Notwithstanding any other provision in this Agreement, in the event SABIC disagrees, in whole or in part, with the Department's revision of a submittal or disapproval of any submittal required by this Part, the following may, at SABIC's discretion, apply:

    a. In the event that SABIC chooses to invoke the provisions of this section, SABIC shall notify the Department within 30 calendar days of receipt of the Department's revision of a submittal or disapproval of a submittal. Such notice shall set forth the specific matters in dispute, the position SABIC asserts should be adopted as consistent with the requirements of this Agreement, the basis for SABIC's position, and any other matters considered necessary for the Department's determination.

    b. The Department and SABIC shall have an additional 30 calendar days from the Department's receipt of the notification provided for in Agreement Condition I.F.1.a. to meet or confer to resolve any disagreement.

    c. In the event that agreement is reached, SABIC shall submit and implement the submittal in accordance with and within the time frame specified in such agreement.

d. If agreement is not reached within the 30-calendar-day period, the Department will notify SABIC in writing of his or her decision on the dispute, and SABIC shall comply with the terms and conditions of the Department's decision in the dispute. For purposes of this provision in this Agreement, the responsibility for making this decision shall not be delegated below the Land Division Chief.

e. With the exception of those conditions under dispute, SABIC shall proceed to take any action required by those portions of the submission and of this Agreement that the Department determines are not affected by the dispute.

f. Administrative actions of the Department enforcing the AHWMMA are not subject to this section.

I.G. NOTICE

Whenever any person gives or serves any notice under this Agreement, each such notice shall be in writing and shall be deemed effective: (i) when delivered, if personally delivered to the person being served or to an officer of a corporate party being served, or (ii) three (3) business days after deposit in the mail, if mailed by United States mail, postage paid, certified, return receipt requested:

To SABIC:

Site General Manager
SABIC Innovative Plastics US LLC
1 Plastics Drive
Burkville, AL 36752

To the Department:

Chief, Land Division

For U.S. Mail:
Alabama Department of Environmental Management
P.O. Box 301463
Montgomery, Alabama 36130-1463

For Delivery:
Alabama Department of Environmental Management
1400 Coliseum Boulevard
Montgomery, Alabama 36110-2059

PART II

STANDARD AND GENERAL FACILITY CONDITIONS

II.A. EFFECT OF AGREEMENT

The Facility is required to conduct remediation in accordance with the conditions of this Agreement. Issuance of the Agreement does not authorize any injury to persons or property, invasion of other private rights, or any infringement of state or local regulations. Compliance with the terms of this Agreement does not constitute a defense to any action brought under AHWMMA, or any other law governing protection of public health or the environment, for any imminent and substantial endangerment to human health, welfare, or the environment.

II.B. SEVERABILITY

The provisions of this Agreement are severable and if any provision of this Agreement, or the application of any provision of this Agreement to any circumstance, is held invalid, the application of such provision to other circumstances and the remainder of this Agreement shall not be affected thereby.

II.C. DUTIES AND REQUIREMENTS

1. Duty to comply

   SABIC shall comply with all conditions of this Agreement, except to the extent and for the duration that such noncompliance is authorized by an emergency permit. Any Agreement noncompliance, other than noncompliance authorized by an emergency permit, constitutes a violation of the AHWMMA, and is grounds for enforcement action, Agreement termination, revocation and reissuance, or modification.

2. Duty to Complete Corrective Action

   a. SABIC shall complete corrective action as required by ADEM Admin. Code r. 335-14-5-.06(12).

3. Need to Halt or Reduce Activity Not A Defense

   It shall not be a defense for SABIC in an enforcement action that it would have been necessary to halt or reduce the activities required hereunder in order to maintain compliance with the conditions of this Agreement.

4. Duty to Mitigate

In the event of noncompliance with this Agreement, SABIC shall take all reasonable steps to minimize releases to the environment, and shall carry out such measures as are reasonable to prevent significant adverse impacts on human health or the environment.

5. Proper Operation and Maintenance

SABIC shall, at all times, properly operate and maintain all facilities and systems of treatment, monitoring, and control (and related appurtenances) which are installed or used by SABIC to achieve compliance with the conditions of this Agreement. Proper operation and maintenance (O&M) includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this Agreement.

6. Agreement Actions

This Agreement may be modified, revoked and reissued, or terminated for cause as specified in ADEM Admin. Code r. 335-14-8-.04(2), 335-14-8-.04(3) and 335-14-8-.04(4). The filing of a request for an Agreement modification, revocation and reissuance, or termination, or the notification of planned changes or anticipated noncompliance on the part of SABIC does not stay any Agreement condition.

7. Property Rights

Execution of this Agreement does not convey any property rights of any sort, nor any exclusive privilege.

8. Duty to Provide Information

SABIC shall furnish to the Department, within a reasonable time as determined by the Department, any relevant information under the control of SABIC which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Agreement, or to determine compliance with this Agreement. SABIC shall also furnish to the Department, upon request, copies of records required to be kept by this Agreement.

9. Inspection and Entry

SABIC shall allow duly designated officers and employees of the Department, or an authorized representative, upon the presentation of credentials and other documents as may be required by law to:

a. Enter at reasonable times upon SABIC's and/or the Facility's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this Agreement;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Agreement;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Agreement; and,

d. Sample or monitor, at reasonable times, for the purposes of assuring Agreement compliance or as otherwise authorized by the AHWMMA, any substances or parameters at any location. SABIC shall have the opportunity to split samples during sampling.

10. Monitoring and Records

a. Samples and measurements collected for the purpose of monitoring shall be representative of the monitored activity. The method used to obtain a representative sample of the waste to be analyzed must be the appropriate method from ADEM Admin. Code r. 335-14-2-Appendix I or an alternative method specifically approved by the Department for the applicable activity. Laboratory methods must be those specified in Test Methods for Evaluating Solid Waste: Physical/Chemical Methods SW-846 (latest edition), Methods for Chemical Analysis of Water and Wastes (EPA-600/4-79-020), Standard Methods for the Examination of Water and Wastewater (latest edition), the most current version of the Alabama Environmental Investigation and Remediation Guidance (AEIRG), or an alternative method specifically approved by the Department for the applicable activity. [ADEM Admin. Code r. 335-14-8-.03(1)(j)1.]

b. SABIC shall maintain, at the facility, records of all monitoring information, including all calibration and maintenance records, records of all data used to prepare documents required by this Agreement, and copies of all reports required by this Agreement, for a period of at least three (3) years from the date of the sample, measurement, report or record, or until remediation is completed, whichever date is later. This period may be extended by the Department at any time and is automatically extended during the course of any unresolved enforcement action regarding this facility. [ADEM Admin. Code r. 335-14-5-.05(5)(b) and 335-14-8-.03(1)(j)2.]

c. SABIC shall maintain, at the facility, records for all groundwater monitoring wells and piezometers and associated groundwater surface elevations throughout the Agreement period and throughout any associated post-closure care period(s) established by future remediation activities completed under this Agreement. These records shall include the surveyed location, surveyed elevation, surveyed elevation reference point, total depth, screened interval, construction details, well log, and all other pertinent information for each well and piezometer.

d. Records of monitoring information shall include

i. The dates, exact place, and times of sampling measurements;

ii. The individuals who performed the sampling or measurements;

iii. The dates in which the analyses were performed;

iv. The individuals who performed the analyses

v. The analytical techniques or methods used; and;

vi. The results of such analyses.

e. The following documents and information shall be maintained throughout the remediation period at the Facility:

i. Complete copy of this Agreement;

ii. Operating records required by ADEM Admin. Code r. 335-14-5-.05 and this Agreement; and

iii. Copies of all plans, reports, inspection schedules, and inspection logs, as required by ADEM Admin. Code r. 335-14-5 and this Agreement.

11. Signatory Requirements

All applications, reports or information submitted to the Department shall be signed and certified in accordance with ADEM Admin. Code r. 335-14-8-.02(2) and 335-14-8-.03(1)(k).

12. Reporting Requirements

a. Planned changes

SABIC shall give notice to the Department as soon as possible of any planned physical alterations or additions to the Facility for any areas subject to the investigation, remediation, monitoring and/or remedy operation and maintenance requirements identified under this Agreement.

b. Anticipated Noncompliance

The Facility shall give advanced notice to the Department of any planned changes in the Facility or activity that may result in noncompliance with Agreement requirements.

c. Transfer Agreements

This Agreement may be transferred to a new owner or operator only if it is modified or revoked and reissued pursuant to ADEM Admin. Code r. 335-14-8-.04(1) or ADEM Admin. Code r. 335-14-8-.04(3)(a)1.(vii). Before transferring ownership or operation of the facility during a post-closure period, SABIC shall notify the new owner or operator, in writing, of the requirements of ADEM Admin. Code r. 335-14-5 and 335-14-8 and this Agreement.

d. Monitoring Reports

Monitoring results shall be reported at the intervals specified elsewhere in this Agreement.

e. Compliance Schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this Agreement shall be submitted to the Department no later than 14 calendar days following each schedule date.

f. Twenty-four Hour Reporting

i. SABIC shall report to the Department any noncompliance with this Agreement that may endanger human health or the environment. Any such information shall be reported orally within 24 hours from the time SABIC becomes aware of the circumstances. This report shall include, but is not limited to, the following:

(I) Information concerning the release of any hazardous waste which may endanger public drinking water supplies; and,

(II) Information concerning the release or discharge of any hazardous waste, or hazardous waste constituents, or of a fire or explosion at the facility, which could threaten the environment or human health outside the facility.

ii. The description of the occurrence and its cause shall include:

(I) Name, address, and telephone number of the owner or operator;

(II) Name, address, telephone number, and Environmental Protection Agency (EPA) Identification Number of the facility;

(III) Date, time, and type of the incident;

(IV) Name and quantity of material(s) involved;

(V) The extent of injuries, if any;

(VI) An assessment of actual or potential hazards to the environment and human health outside of the facility, where this is applicable; and,

(VII) Estimated quantity and disposition of recovered material that resulted from the accident.

iii. A written submission shall also be provided within 5 calendar days of the time that SABIC becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the periods of noncompliance (including exact dates and times); whether the noncompliance has been corrected, and if not, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

g. Other Noncompliance

SABIC shall report to the Department all instances of noncompliance not otherwise required by Agreement Conditions II.C.12.d., II.C.12.e., or II.C.12.f. at the time any other reports required by this Agreement are submitted. The reports shall contain the information required by Agreement Condition II.C.12.f.

h. Other Information

Where SABIC becomes aware that it failed to submit any relevant facts in any document required by this Agreement, or submitted incorrect information in any report to the Department, it shall promptly submit such facts or information. In addition, upon request, SABIC shall furnish to the Department any information related to compliance with this Agreement.

i. Monthly Progress Reports

By the seventh day of each calendar month, SABIC shall submit to the Department a progress report on activities conducted, including photographs as appropriate, during the preceding calendar month.

13. Certification of Construction

SABIC may not treat, store, or dispose of hazardous waste or contaminated media at any new or modified portion of a facility until SABIC has submitted to the Department a letter (together with the certification by the construction quality assurance (CQA) officer required by ADEM Admin. Code r. 335-14-5-.02(10)(d), if applicable, and any other certifications required by this Agreement or ADEM Admin. Code r. 335-14) signed by SABIC and a professional engineer registered in the State of Alabama stating that the treatment, storage, or disposal facility has been constructed or modified in compliance with this Agreement where appropriate; and,

a. The Department has inspected the modified or newly constructed treatment, storage, or disposal facility and finds it is in compliance with the conditions of this Agreement; or

b. The Department has either waived the inspection or has not notified SABIC, within 15 calendar days of the notification from the Facility, of its intent to inspect. [ADEM Admin. Code r. 335-14-8-.03(1)(1)2.]

14. SABIC shall assure that all measures necessary to maintain and/or achieve compliance with all applicable requirements of ADEM Admin. Code r. 335-14 are taken during the term of this Agreement, during the remediation period, and throughout any post-closure care period, including the long-term monitoring period for operation of a remedy system, or during the institutional control maintenance period, whichever is longer.

15. In the event that circumstances beyond SABIC's control arise to prevent achievement of any deadline set forth by this Agreement, SABIC may immediately, upon the occurrence thereof, request an extension by sending a written request to the Department explaining the need for the extension. The Department may, after consideration of the circumstances, grant the extension. Requests for extensions may require an Agreement modification pursuant to ADEM Admin. Code r. 335-14-8-.04(2).

II.D. RESERVED

II.E. DEFINITIONS

For purposes of this Agreement, terms used herein shall have the same meaning as those in ADEM Admin. Code r. 335-14-1, 335-14-2, 335-14-5, and 335-14-8, unless this Agreement specifically provides otherwise. Where terms are not defined in the regulations or this Agreement, a standard dictionary reference or the generally accepted scientific or industrial meaning of the term shall define the meaning associated with such terms.

"Area of concern" (AOC), for the purposes of this Agreement, includes any area having a probable release of a hazardous waste or hazardous constituent that is not from a SWMU and is determined by the Department to pose a current or potential threat to human health or the environment. Such areas of concern may require investigations and remedial action as required under Section 3005(c)(3) of the RCRA and ADEM Admin. Code r. 335-14-8-.03(3)(b)2. in order to ensure adequate protection of human health and the environment.

"Contamination," for the purposes of this Agreement, refers to the presence of any hazardous constituent in a concentration that exceeds the naturally occurring concentration of that constituent in the immediate vicinity of the facility (*i.e.*, areas not affected by the facility).

"Extent of contamination," for the purposes of this Agreement, is defined as the horizontal and vertical area in which the concentrations of hazardous constituents in the environmental media being investigated are above detection limits or background concentrations indicative of the region, whichever is appropriate as determined by the Department.

"Hazardous constituents," for the purpose of this Agreement, are those substances listed in ADEM Admin. Code r. 335-14-2-Appendix VIII and/or ADEM Admin. Code r. 335-14-5- Appendix IX and include hazardous constituents released from solid waste, hazardous waste, and hazardous waste constituents that are reaction by-products.

"Land Use Controls," (LUC) for the purposes of this Agreement, are any restriction or control that serves to protect human health and the environment by limiting the use of or exposure to any portion of a property or site, including water resources. These controls include, but are not limited to:

1. Engineering controls for remedial actions directed toward containing or controlling the migration of contaminants through the environment. These include, but are not limited to, stormwater conveyance systems, slurry walls, liner systems, caps, leachate collection systems, pump and-treat systems, and groundwater recovery systems. Engineering controls are classified as:

(i) Class 1, which include multi-layer caps or liner systems, soil vapor extraction systems, groundwater pump-and-treat systems, leachate and groundwater recovery systems, stormwater conveyance systems, slurry walls and active ventilation of closed spaces.

(ii) Class 2, which include clay or soil caps or liner systems, substructural vapor barriers, and passive ventilation of closed spaces.

(iii) Class 3, which include asphalt caps and fencing systems.

(iv) For other engineering controls not listed, ADEM shall determine the classification of the engineering control upon the request of an owner or operator or other responsible person.

2. Institutional controls that are legal or contractual restrictions on property use which remain effective after remediation is completed and are used to meet an approved remediation plan or proposal. These include, but are not limited to, deed notations, deed restrictions, water use restrictions, restrictive covenants, conservation easements, and limited development rights. Institutional controls are classified as:

(i) Class 1, which includes any water use restriction.

(ii) Class 2, which include restrictive covenants for industrial or commercial use only or no schools or daycares, and imposition of conservation easements or limited developmental rights.

(iii) Class 3, which include restrictive covenants for no excavations, for use as green space only, and no hunting or fishing.

(iv) For other institutional controls not listed, ADEM shall determine the classification of the institutional control upon the request of an owner or operator or other responsible person.

3. Water use restrictions that can be placed on the use of a particular water supply source that has been identified as being contaminated with a hazardous waste, hazardous constituent, hazardous substance or petroleum product in order to protect human health and the environment.

"Method detection limit" (MDL), for the purposes of this Agreement, means the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix type containing the analyte.

"Mixed waste," for the purposes of this Agreement, means a solid waste that is a mixture of hazardous waste (as defined in ADEM Admin. Code r. 335-14-2-.01(3)) and radioactive waste (as defined in 10 CFR 61.2). The radioactive component of mixed waste is subject to regulation by the Atomic Energy Act (AEA)/Nuclear Regulatory Commission (NRC). The non-radioactive chemically hazardous component of mixed waste is subject to regulation by the AHWMMA and ADEM Admin. Code r. 335-14.

"Operating day," for the purposes of this Agreement, means any calendar day on which hazardous waste is treated, stored, or disposed of in a unit. For example, each calendar day that a hazardous waste storage unit contains hazardous waste is an operating day; as is each calendar day that a disposal unit contains or receives hazardous waste, or each calendar day that hazardous waste is treated in a treatment unit.

A "Release," for the purposes of this Agreement, includes any spilling, leaking, pouring, emitting, emptying, discharging, injecting, escaping, leaching, pumping, or disposing into the environment of any hazardous waste or hazardous constituent.

"Solid waste management unit" (SWMU), for the purposes of this Agreement, includes any unit that has been used for the treatment, storage or disposal of solid waste at any time, irrespective of whether the unit is or ever was intended for the management of solid waste. RCRA-regulated hazardous waste management units are also solid waste management units. SWMUs include areas that have been contaminated by routine and systematic releases of hazardous waste or hazardous constituents, excluding one-time accidental spills that are immediately remediated and cannot be linked to solid waste management activities (*e.g.*, product or process spills).

"Storm event," for the purposes of this Agreement, is defined as a 1-year, 24-hour storm event or rainfall which measures 1 inch or greater in 1 hour or less. Rainfall measurements may be taken at the site, or the closest official weather monitoring station may be used.

II.F. EXPIRATION AND CONTINUATION OF AGREEMENT

This Agreement and all conditions herein will remain in effect until all obligations contained herein have been fulfilled, as determined in writing by the Department.

II.G. RESERVED

II.H. COST ESTIMATES

1. SABIC shall submit to the Department for review a detailed written cost estimate of remediation activities (and, if necessary, post-closure) required by this Agreement, in current dollars. The cost estimate must contain all of the applicable provisions of ADEM Admin Code r. 335-14-5-.08(10). In addition, SABIC shall maintain the detailed written cost estimate in accordance with ADEM Admin. Code r. 335-14-5-.08(10), as well as Agreement Condition II.C.10.e.

2. All cost estimates must be updated annually as required by ADEM Admin. Code r. 335-14-5-.08(10)(b).

3. The cost estimate shall be maintained and submitted in the form designated or otherwise approved by the Department.

4. SABIC must update the cost estimate no later than 30 calendar days after the Department has approved a modification to the Remediation Plan, or any other plan required or referenced by this Agreement, if the change in the plan results in an increase of the cost estimate amount.

II.I. FINANCIAL ASSURANCE

1. Beginning not later than 120 days after the effective date of this Agreement, SABIC shall comply with ADEM Admin. Code r. 335-14-5-.08 by providing documentation of financial assurance in an amount that equals or exceeds the cost estimate required by Condition II.H. If the cost estimate required by Condition II.H increases, SABIC shall, within 120 days of submitting the revised cost estimate to the Department, provide documentation of financial assurance in an amount that equals or exceeds the revised cost estimate. Changes in financial assurance mechanisms must be approved by the Department.

2. SABIC shall submit itemized statements for all capital expenditures and a complete, revised cost estimate to the Department when requesting approval for a reduction in the financial assurance amount.

II.J. AGREEMENT MODIFICATIONS

SABIC shall request an Agreement modification whenever changes in operating plans or facility design affect any plan (*e.g.*, closure, groundwater monitoring, post-closure, or corrective action) required or referenced by this Agreement. SABIC must submit a written request for an Agreement modification pursuant to the requirements of ADEM Admin. Code r. 335-14-8-.04(2). at least 60 calendar days prior to the proposed change in facility design or operation.

II.K. REPORTS, NOTIFICATIONS, AND SUBMISSIONS

One (two for documents required to be placed on public notice) hard copy and one electronic (an optical character recognition or text-searchable) copy of all reports, notifications, or other submissions that are required by this Agreement should be sent via certified mail, overnight delivery, or hand delivered to:

Chief, Land Division
Alabama Department of Environmental Management
P.O. Box 301463 (Zip 36130-1463)
1400 Coliseum Boulevard (Zip 36110-2059)
Montgomery, Alabama

Alternatively, submittals under this Part may be made via electronic mail to a representative of the Department, when agreed to by the Department and SABIC beforehand.

II.L. FORCE MAJEURE

1. SABIC shall perform the requirements of this Agreement within the schedules and time limits set forth herein and in any approved plan unless the performance is prevented or delayed by events which constitute a force majeure. A force majeure is defined as any event arising from causes which are not reasonably foreseeable, which are beyond the control of SABIC, and which cannot be overcome by due diligence.

2. Within 72 hours of the time that SABIC knows or has reason to know of the occurrence of any event which SABIC has reason to believe may prevent SABIC from timely compliance with any requirement under this Agreement, SABIC shall provide verbal notification to the Department. Within 7 calendar days of the time that SABIC knows or has reason to know of the occurrence of such event, SABIC shall submit to the Department a written description of the event causing the delay, and actions which will be taken to mitigate the duration of the delay.

3. The burden of proving that any delay was caused by a force majeure shall, at all times, rest with SABIC. If the Department agrees that a force majeure has occurred, the Department will so notify SABIC. The Department will also approve or disapprove of SABIC's proposed actions for mitigating the delay. If the Department does not agree that a force majeure has occurred, or if the Department disapproves of SABIC's proposed actions for mitigating the delay, it shall provide a written explanation of its determination to SABIC. Pursuant to the Dispute Resolution section, within fifteen (15) calendar days of receipt of the explanation SABIC may file an objection.

4. Delay in the achievement of one requirement shall not necessarily justify or excuse delay in the achievement of subsequent requirements. In the event any performance under this Agreement is found to have been delayed by a force majeure, SABIC shall perform the requirements of this Agreement that were delayed by the force majeure with all due diligence.

PART III

GROUNDWATER MONITORING AND CORRECTIVE ACTION

III.A. REQUIRED PROGRAM(S)

1. Groundwater monitoring shall consist of the General Groundwater Monitoring Program of Agreement Condition III.B. and the Remedial Measures Monitoring contained in Agreement Condition III.E.

2. SABIC shall implement groundwater monitoring as required by this Agreement and Remediation Plan not later than 120 calendar days after the effective date of this Agreement. This implementation represents a continuation of current monitoring.

III.B. GENERAL GROUNDWATER MONITORING PROGRAM

1. Well Location, Installation and Construction

SABIC shall install and/or maintain a groundwater monitoring system to comply with the requirements of ADEM Admin. Code r. 335-14-5-.06(8), 335-14-5-.06(9), 335-14-5-.06(10), and 335-14-5-.06(11) as applicable and as specified below:

a. SABIC shall maintain all groundwater monitoring wells at the facility as identified in Table III.1. of this Agreement, at the locations specified on Figures 5 through 9 and Appendix A of the Remediation Plan, and any other groundwater monitoring wells specified by Agreement Condition III.B.1.c.

i. All groundwater monitoring wells shall be maintained in accordance with the plans and specifications presented in Section 5 of the Remediation Plan, and in accordance with ADEM Admin. Code r. 335-14-5-.06.

ii. A groundwater monitoring well shall not be removed from any monitoring program specified in this Agreement without an approved Agreement modification pursuant to Agreement Condition II.J.

iii. If a groundwater monitoring well is damaged, SABIC shall immediately notify the Department in writing, which shall include a description of the well repair activities to be conducted. The well repair procedures must be approved by the Department prior to implementation. Within 30 calendar days after the well is repaired, SABIC shall submit a written notification to the Department that the well repair activities were conducted in accordance with the approved procedures.

iv. If a groundwater monitoring well is deleted from the monitoring program(s) required by this Agreement in accordance with Agreement Conditions III.B.1.a.ii. and II.J., it shall be abandoned within 90 calendar days after deletion using procedures to be approved by the Department.

Within 30 calendar days after the well is abandoned, SABIC shall submit a written notification to the Department that the well abandonment activities were conducted in accordance with the approved procedures.

b. SABIC shall maintain groundwater monitoring wells MW-23 and MW-24 as the background monitoring well(s) for the entire facility as specified in Section 5 of the Remediation Plan.

c. SABIC shall install and maintain additional groundwater monitoring wells as necessary to assess changes in the rate and extent of any plume of contamination or as otherwise deemed necessary to maintain compliance with ADEM Admin. Code r. 335-14-5-.06(6), 335-14-5-.06(8), 335-14-5-.06(9), 335-14-5-.06(10), and 335-14-5-.06(11), as applicable. A plan in the form of an Agreement modification request specifying the design, location and installation of any additional monitoring wells shall be submitted to the Department at least 90 calendar days prior to installation which, at a minimum, shall include:

i. Well construction techniques, including casing depths and proposed total depth of well(s);

ii. Well development method(s);

iii. A complete description of well construction materials;

iv. A schedule of implementation for construction; and,

v. Provisions for determining the lithologic characteristics, hydraulic conductivity, grain size distribution, and porosity for the applicable aquifer unit(s) at the location of the new well(s).

2. General Groundwater Monitoring Requirements

a. SABIC shall determine the groundwater surface elevation from all monitoring wells listed in Table III.1. of this Agreement at least annually and each time a sampling event is conducted. The results of these determinations shall be submitted in accordance with Agreement Condition III.B.6. Elevation data shall be recorded and reported as feet above mean sea level (ft. MSL) and referenced to an appropriate national geodetic vertical datum (NGVD) benchmark.

b. SABIC shall determine the groundwater flow rate and direction in the underlying aquifer(s) at least annually and submit the results in accordance with Agreement Condition III.B.6.

c. SABIC shall determine background concentrations of hazardous constituents and other chemical parameters required to be monitored by this Agreement in accordance with Section 5 of the Remediation Plan and ADEM Admin. Code r. 335-14-5-.06(8)(g).

3. Groundwater Protection Standard

a. The groundwater protection standard, as required under ADEM Admin. Code r. 335-14-5-.06(3), shall consist of Table III.3 of this Agreement, which lists the hazardous constituents and their respective concentration limits.

b. The groundwater protection standard applies to all hazardous waste or hazardous constituent releases as deemed appropriate by the Department to protect human health and the environment.

4. Compliance Period

a. The compliance period, during which the groundwater protection standard specified in Agreement Condition III.B.3. applies, shall begin at the time of the first sampling event of the remedial measures monitoring program (Agreement Condition III.E.).

b. The compliance period shall continue (after beginning pursuant to Agreement Condition III.B.4.a.) until the groundwater protection standard as defined by Agreement Condition III.B.3.a. has not been exceeded for a period of three consecutive years.

c. If SABIC is engaged in a remedial measures program pursuant to Agreement Condition III.E., then the compliance period shall continue until the groundwater protection standard has not been exceeded for a period of three consecutive years after remedial measures have been terminated and this Agreement has been modified, in accordance with Agreement Condition II.J.

5. Sampling and Analysis Procedures

SABIC shall use the following techniques and procedures when obtaining and analyzing samples from the groundwater monitoring wells described in Agreement Condition III.B.1. to provide a reliable indication of the quality of the groundwater, as required under ADEM Admin. Code r. 335-14-5-.06(8)(d), (e), and (g):

a. Samples shall be collected, preserved, and shipped (when shipped off-site for analysis) in accordance with the procedures specified in Section 5 of the Remediation Plan.

b. Samples shall be analyzed according to the procedures specified in Section 5 of the Remediation Plan, the most recent edition of SW-846 or other appropriate methods approved by the Department. Analytical method detection limits shall be less than or equal to the concentration limits specified in Table III.2 or III.3, unless otherwise approved in writing by the Department.

c. Samples shall be tracked and controlled using the chain-of-custody procedures specified in Section 5 of the Remediation Plan.

d. Statistical analyses used to evaluate the groundwater monitoring data shall be as described in Section 5 of the Remediation Plan and ADEM Admin. Code r. 335-14-5-.06(8)(h).

e. All samples collected in accordance with this Agreement shall not be filtered prior to analysis

6. Recordkeeping and Reporting

a. SABIC shall keep and maintain all monitoring, testing, and analytical data obtained in accordance with Agreement Conditions III.B. and III.E., as required by Agreement Condition II.C.10.

b. SABIC shall submit to the Department a written report to include all analytical sampling data, established background values, statistical evaluations, groundwater elevations, associated potentiometric maps, and the annual groundwater flow rate and direction determinations. The analytical method and the method detection limit (MDL) for each constituent must be integrated into all reports of analysis. The report shall be submitted within 60 calendar days after the first sampling event and on an annual basis thereafter. Copies of this report shall be kept at the facility in accordance with Agreement Conditions II.C.10.c. and II.C.10.e.

c. SABIC shall submit progress reports to the Department describing implementation of groundwater monitoring and/or remedial measures activities at the site as required by Part III of this Agreement on an annual basis. The first progress report shall be submitted to the Department within 90 calendar days after the effective date of this Agreement. The progress reports shall continue until such time as the required monitoring and/or remedial measures systems and activities required by this Agreement are fully constructed and operational. In the event that additional monitoring and/or remedial measures requirements are imposed through an Agreement modification, in accordance with Agreement Condition II.J., the annual reporting requirement shall resume, commencing upon the effective date of the Agreement modification and continuing until the required monitoring and/or remedial measures systems and activities are again fully constructed and operational.

III.C. DETECTION MONITORING PROGRAM (RESERVED)

III.D. COMPLIANCE MONITORING PROGRAM (RESERVED)

III.E. REMEDIAL MEASURES MONITORING PROGRAM

The requirements of this Condition are applicable to the PCE Spill and Caustic Tanks Leak Sites. Except as specified otherwise in this Agreement, the Remedial Measures Monitoring Program shall be implemented in accordance with the Remediation Plan and ADEM Admin. Code r. 335-14-5-.06(11).

1. Monitoring Systems

SABIC shall:

a. Maintain groundwater monitoring wells MW-23 and MW-24 as background wells for the entire facility as specified in Table III.1 of this Agreement and as shown on Figures 5 through 9 of the Remediation Plan.

b. Maintain groundwater monitoring wells MW-13, MW-18, MW-20, MW-21, MW-22, MW-25, and MW-26 as boundary wells for the entire facility as specified in Table III.1. of this Agreement and as shown on Figures 5 through 9 of the Remediation Plan.

c. Maintain groundwater monitoring wells MW-1, MW-2, MW-3R, MW-4, MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12, MW-14, MW-15, MW-16, MW-17, MW-19, MW-27, OW-1, OW-2, OW-3, OW-4R, and OW-5 as effectiveness wells as specified in Table III.1. of this Agreement and as shown on Figures 5 through 9 of the Remediation Plan.

d. Maintain wells PW-1, PW-2, PW-3R, PW-4, and RMDW-1, RMDW-2, RMDW-3 as recovery wells as specified in Table III.1. of this Agreement and as shown in Figures 5 through 9 and Appendix A of the Remediation Plan.

2. Corrective Action Program

a. SABIC shall conduct a Remedial Measures Program, as described in Sections 4 and 5 of the Remediation Plan, to remove or treat in place all hazardous constituents that exceed their respective groundwater protection standards as described in Table III.3. of this Agreement at the point of compliance, between the point of compliance and the down-gradient facility property boundary, and beyond the facility boundary in accordance with ADEM Admin. Code r. 335-14-5-.06(11)(e)2.

b. Pursuant to ADEM Admin. Code r. 335-14-5-.06(11)(c) and 335-14-5-.06(11)(e)3., SABIC shall implement the Remedial Measures Program as described in Sections 4 and 5 of the Remediation Plan within 120 calendar days after the effective date of this Agreement. This implementation represents a continuation of the Interim Remedial Measures Program currently being implemented.

c. SABIC shall handle or treat groundwater in accordance with Sections 4 and 5 of Remediation Plan.

3. Monitoring Requirements

In addition to the general groundwater monitoring requirements specified in Agreement Condition III.B.2., SABIC shall:

a. Sample all background, boundary, recovery, and effectiveness monitoring wells shown in Table III.1. of this Agreement and analyze for the constituents listed in Table III.2. of this Agreement on at least an annual basis beginning within 120 calendar days of the effective date of this Agreement and continuing through the end of the compliance period.

b. Sample all background, effectiveness, recovery, and boundary monitoring wells shown in Table III.1. of this Agreement and analyze for the constituents listed in Table III.3. of this Agreement on at least an annual basis according to Table 1 of the Remediation Plan beginning within 120 calendar days of the effective date of this agreement and continuing through the end of the compliance period.

c. Sample all background, effectiveness, recovery, and boundary monitoring wells shown in Table III.1. of this Agreement and analyze for temperature (degrees F or C), specific conductance (Mhos/cm), and pH (standard units) each time the well is sampled. The data obtained shall be submitted as raw data in the reports required by Agreement Condition III.B.6.

d. When evaluating the monitoring results to determine the effectiveness of the remedial measures, in accordance with Agreement Condition III.E.4.:

   i. Determine if the remedial measures system effectively addresses the entire plume of contamination;

   ii. Determine if the concentrations of the hazardous constituents are decreasing (pH increasing or decreasing toward neutrality, as applicable) in the effectiveness wells specified in Agreement Condition III.A.1.;

   iii. Determine if hazardous waste or hazardous constituents are being released into the environment; and,

   iv. Determine if hazardous constituents have been detected in the boundary wells specified in Agreement Condition III.A.1.

4. Reporting and Response Requirements

In addition to the recordkeeping and reporting requirements specified in Agreement Condition III.B.6.:

a. SABIC shall report the effectiveness of the remedial measures program annually, as required under ADEM Admin. Code r. 335-14-5-.06(11)(g). These reports shall be submitted to the Department within 60 calendar days of each annual anniversary of this Agreement after remedial measures are initiated and continue until corrective action is completed. SABIC must provide data from groundwater monitoring along with an analysis of that data and any conclusions regarding the effectiveness of the program in accordance with Agreement Condition III.E.3.d. If the analysis of the data warrants any change to the remedial measures program, SABIC must include these revisions in the annual report, which will be followed up within 90 calendar days with an application for Agreement modification in accordance with Agreement Condition II.J.

b. If remedial measures are terminated under Agreement Condition III.B.4.c., SABIC must sample all background, effectiveness, and boundary sampling locations for the compounds listed in ADEM Admin. Code r. 335-14-5-Appendix IX.

TABLE III.1
MONITORING WELL DESIGNATIONS

WELL NUMBER	WELL TYPE	WELL LATITUDE	WELL LONGITUDE	UNIT(S) MONITORED	WELL DEPTH (ft.)	GROUND ELEVATION (ft. MSL)	TOP-OF-RISER ELEVATION (ft. MSL)	SCREENED INTERVAL (ft. MSL)		SAMPLING SCHEDULE
MW-1	EFF	86°31'26.34"W	32°18'30.36"N	PCE & Caustic	29.00	234.85	234.51	220.51	205.51	Semi-Annual
MW-2	EFF	86°31'27.50"W	32°18'33.43"N	PCE & Caustic	28.71	233.53	233.38	219.67	204.67	Semi-Annual
MW-3R	EFF	86°31'26.84"W	32°18'28.31"N	PCE & Caustic	28.30	234.89	234.09	220.79	205.79	Annual
MW-4	EFF	86°31'23.61"W	32°18'33.63"N	PCE & Caustic	29.40	233.23	235.84	221.44	206.44	Semi-Annual
MW-5	EFF	86°31'23.55"W	32°18'28.84"N	PCE & Caustic	33.40	235.20	234.86	216.46	201.46	Annual
MW-6	EFF	86°31'32.76"W	32°18'29.59"N	PCE & Caustic	27.95	232.85	235.65	217.70	207.70	Semi-Annual
MW-7	EFF	86°31'23.73"W	32°18'35.58"N	PCE & Caustic	33.10	232.61	235.84	212.74	202.74	Semi-Annual
MW-8	EFF	86°31'34.33"W	32°18'36.44"N	PCE & Caustic	31.45	230.63	233.60	212.15	202.15	Annual
MW-9	EFF	86°31'43.49"W	32°18'46.08"N	PCE & Caustic	29.35	230.99	234.07	214.72	204.72	Annual
MW-10	EFF	86°31'51.64"W	32°18'50.38"N	PCE & Caustic	30.25	230.54	233.69	213.44	203.44	Semi-Annual
MW-11	EFF	86°31'41.13"W	32°18'27.83"N	PCE & Caustic	37.40	235.54	238.70	216.30	201.30	Annual
MW-12	EFF	86°31'35.49"W	32°18'18.55"N	PCE & Caustic	31.11	231.83	234.93	213.82	203.82	Annual
MW-13	BDY	86°31'16.60"W	32°18'15.32"N	PCE & Caustic	31.55	231.69	234.95	213.40	203.40	Annual
MW-14	EFF	86°31'06.36"W	32°18'23.80"N	PCE & Caustic	35.00	237.06	239.94	214.94	204.94	Annual
MW-15	EFF	86°31'02.50"W	32°18'44.86"N	PCE & Caustic	29.00	237.62	240.66	221.66	211.66	Annual
MW-16	EFF	86°31'40.49"W	32°18'59.22"N	PCE & Caustic	27.05	228.51	231.53	214.48	204.48	Annual
MW-17	EFF	86°31'20.54"W	32°18'57.65"N	PCE & Caustic	26.30	231.59	234.95	218.65	208.65	Annual
MW-18	BDY	86°32'06.10"W	32°19'00.16"N	PCE & Caustic	30.55	231.25	234.17	213.62	203.62	Annual
MW-19	EFF	86°32'07.46"W	32°18'52.23"N	PCE & Caustic	30.88	228.96	232.06	211.18	201.18	Semi-Annual
MW-20	BDY	86°31'56.29"W	32°18'32.39"N	PCE & Caustic	30.10	233.67	236.83	216.73	206.73	Annual
MW-21	BDY	86°31'56.56"W	32°18'18.17"N	PCE & Caustic	29.10	231.13	234.10	215.00	205.00	Annual
MW-22	BDY	86°31'34.53"W	32°18'03.87"N	PCE & Caustic	17.63	211.77	214.33	201.70	196.70	Annual
MW-23	BKG	86°31'17.29W	32°17'37.13"N	PCE & Caustic	31.95	196.19	199.40	177.45	167.45	Annual
MW-24	BKG	86°30'17.21"W	32°18'13.65"N	PCE & Caustic	29.95	226.13	229.17	209.22	199.22	Annual
MW-25	BDY	86°31'29.49"W	32°19'18.54"N	PCE & Caustic	28.18	220.68	222.89	204.71	194.71	Annual

MW-26	BDY	86°32’16.12”W	32°18’58.33”N	PCE & Caustic	22.40	220.72	223.56	211.16	201.16	Annual
MW-27	EFF	86°31’25.89”W	32°18’36.02”N	PCE & Caustic	31.88	233.03	235.92	214.04	204.04	Semi-Annual
OW-1	EFF	86°31’26.79”W	32°18’32.00”N	PCE & Caustic	28.90	234.19	233.71	224.81	204.81	Semi-Annual
OW-2	EFF	86°31’26.79”W	32°18’31.44”N	PCE & Caustic	31.35	234.31	233.77	222.42	202.42	Annual
OW-3	EFF	86°31’26.83”W	32°18’31.20”N	PCE & Caustic	30.40	234.57	234.11	223.71	203.71	Semi-Annual
OW-4R	EFF	86°31’26.81”W	32°18’30.37”N	PCE & Caustic	28.40	234.81	234.41	226.01	206.01	Semi-Annual
OW-5	EFF	86°31’25.56”W	32°18’30.42”N	PCE & Caustic	29.40	235.26	234.82	225.42	205.42	Annual
PW-1	REC	86°31’26.79”W	32°18’31.63”N	PCE & Caustic	26.10	234.21	233.47	227.37	207.37	Quarterly
PW-2	REC	86°31’24.90”W	32°18’33.89”N	PCE & Caustic	31.29	233.48	232.61	221.32	201.32	Quarterly
PW-3R	REC	86°31’25.19”W	32°18’30.97”N	PCE & Caustic	31.13	235.09	234.48	223.35	203.35	Quarterly
PW-4	REC	86°31’23.85”W	32°18’35.30”N	PCE & Caustic	30.86	232.24	231.27	220.41	200.41	Quarterly
RMDW-1	REC	TBD	TBD	PCE & Caustic	TBD	TBD	TBD	TBD	TBD	Quarterly
RMDW-2	REC	TBD	TBD	PCE & Caustic	TBD	TBD	TBD	TBD	TBD	Quarterly
RMDW-3	REC	TBD	TBD	PCE & Caustic	TBD	TBD	TBD	TBD	TBD	Quarterly

* Well Type:
EFF - Effectiveness Monitoring Well
BKG - Background Well
BDY - Boundary Monitoring Well
REC - Recovery Well

TABLE III.2

GROUNDWATER QUALITY MONITORING CONSTITUENTS*

HAZARDOUS CONSTITUENT
Acetone
Alkalinity
2-Butanone (MEK)
Carbon disulfide
Carbon Tetrachloride
Chloroform
Chloromethane
cis-1,2-Dichloroethene
Dichloromethane
pH
Tetrachloroethene
Toluene
Trichloroethene
Vinyl Chloride

* The constituents listed herein are the subset of the Groundwater Protection Standard listed in Table III.3 for which monitoring is required.

TABLE III.3

GROUNDWATER PROTECTION STANDARD

HAZARDOUS CONSTITUENT	UNIT*	CONCENTRATION LIMIT (mg/L)
Acetone	PCE spill site	1.40E+00
Alkalinity	Caustic Tanks leak site	>20
2-Butanone (MEK)	PCE spill site	5.60E-01
Carbon Disulfide	PCE spill site	8.10E-02
Carbon Tetrachloride	PCE spill site	5.00E-03
Chloroform	PCE spill site	8.00E-02
Chloromethane	PCE spill site	1.90E-02
Cis-1,2-Dichloroethene	PCE spill site	7.00E-02
Dichloromethane	PCE spill site	5.00E-03
ph	Caustic Tanks leak site	< 8.5**
Tetrachloroethene	PCE spill site	5.00E-03
Toluene	PCE spill site	1.00E+00
Trichloroethene	PCE spill site	5.00E-03
Vinyl chloride	PCE spill site	2.00E-03

* Identifies the unit(s) at which the given constituent must be monitored.
** pH value is unitless

PART IV

SOLID WASTE MANAGEMENT UNIT IDENTIFICATION AND EVALUATION

IV.A. APPLICABILITY

The conditions of this Part apply to:

1. The solid waste management units (SWMUs) and areas of concern (AOCs) identified in Table IV.1, which require investigation and/or remediation;

2. The SWMUs identified in Table IV.2, which require no further investigation under this Agreement as this time;

3. Any additional SWMUs or AOCs discovered during the course of groundwater monitoring, field investigations, environmental audits, or other means; and,

4. Contamination beyond the facility boundary, if applicable. The Facility shall implement corrective actions beyond the facility boundary where necessary to protect human health and the environment, unless the Facility demonstrates to the satisfaction of the Department that, despite the Facility's best efforts, as determined by the Department, the Facility was unable to obtain the necessary permission to undertake such actions. The Facility is not relieved of all responsibility to clean up a release that has migrated beyond the facility boundary where off-site access is denied. On-site measures to address such releases will be determined on a case-by-case basis. Assurances of financial responsibility for completion of such off-site remediation will be required.

IV.B. NOTIFICATION AND ASSESSMENT REQUIREMENTS FOR NEWLY IDENTIFIED SWMUs AND AOCs

1. SABIC shall notify the Department in writing, within 15 calendar days of discovery, of any additional AOCs as described under Agreement Condition IV.A.3. The notification shall include, at a minimum, the location of the AOC and all available information pertaining to the nature of the release (*e.g.*, media affected, hazardous constituents released, magnitude of release, etc.). If the Department determines that further investigation of AOC is required, the Agreement will be modified in accordance with ADEM Admin. Code r. 335-14-8-.04(2).

2. SABIC shall notify the Department in writing, within 15 calendar days of discovery, of any additional SWMUs as described under Agreement Condition IV.A.3.

3. SABIC shall prepare and submit to the Department, within 90 calendar days of notification, a SWMU Assessment Report (SAR) for each SWMU identified under Agreement Condition IV.B.2. At a minimum, the SAR shall provide the following information:

    a. Location of unit(s) on a topographic map of appropriate scale as required under ADEM Admin. Code r. 335-14-8-.02(5)(b)19.

    b. Designation of type and function of unit(s).

    c. General dimensions, capacitates and structural description of unit(s) (supply and available plans/drawings).

    d. Dates and times unit(s) was operated.

    e. Specification of all wastes that have been managed at/in the unit(s) to the extent available. Include any available data on hazardous constituents in the wastes.

    f. All available information pertaining to any release of hazardous waste or hazardous constituents from such unit(s) (to include groundwater data, soil analyses, air, and/or surface water data).

4. Based on the results of the SAR, the Department shall determine the need for further investigations at the SWMUs covered in the SAR. If the Department determines that such investigations are needed, SABIC shall initiate an investigation as outlined in Agreement Condition IV.D.1. immediately upon receiving notification of the Department's determination.

IV.C. NOTIFICATION REQUIREMENTS FOR NEWLY DISCOVERED RELEASES AT PREVIOUSLY IDENTIFIED PARCELS, SITES, SWMUs OR AOCs

1. SABIC shall notify the Department in writing of any newly discovered release(s) of hazardous waste or hazardous constituents discovered during the course of groundwater monitoring, field investigations, environmental audits, or other means, within 15 calendar days of discovery.

2. If the Department determines that further investigation of the Parcels, Sites, SWMUs or AOCs described in Agreement Condition IV.C.1. is needed, SABIC shall initiate an investigation as outlined in Agreement Condition IV.D.1. immediately upon receiving notification of the Department's determination.

IV.D. COMPREHENSIVE INVESTIGATION

1. The Facility must perform a Comprehensive Investigation (CI) for any SWMU and AOC identified by the Department in accordance with Agreement Conditions IV.A.1, IV.B.4, and IV.C.2.

2. The CI must completely identify the concentration of hazardous constituents released from each SWMU and AOC and fully delineate the areas where such hazardous constituents have come to be located.

3. The CI must fully characterize the nature and extent of contamination released from each SWMU or AOC under investigation.

4. The CI must be performed in a manner consistent with the most recent edition of the AEIRG.

5. Except as provided by Agreement Condition IV.D.6., the CI must be completed within 180 days from the effective date of this Agreement; or, for Parcels, Sites, SWMUs or AOCs identified pursuant to Agreement Conditions IV.B. and IV.C., within 180 calendar days from the receipt of notification from the Department that a CI is required. If, prior to the effective date of this Agreement, the Department has approved a work plan that includes a schedule for completing the CI, the CI shall be completed in accordance with the approved schedule.

6. CI Schedule of Compliance

   a. For CIs expected to require greater than 180 days to complete, SABIC shall submit a schedule of compliance subject to Departmental approval/modification.

   b. Submittal of a CI Schedule of Compliance does not delay or otherwise postpone SABIC's obligation to initiate the CI.

   c. The Schedule of Compliance must include:

      i. A detailed narrative discussion which explains why the CI cannot be completed with 180 days; and,

      ii. A detailed chronological listing of milestones, with estimated durations, which provides sufficient information to track progress of the investigation.

   d. The CI Schedule of Compliance shall be reviewed by the Department in accordance with Agreement Condition IV.G.

   e. SABIC shall complete the CI in accordance with approved CI Schedule of Compliance.

7. CI Progress Reports

   a. For a CI being conducted in accordance with an approved CI Schedule of Compliance, SABIC must submit progress reports on a quarterly basis.

   b. The CI Progress Reports must include:

      i. A description of the CI activities completed during the reporting period;

ii. Summaries of any problems or potential problems encountered during the reporting period;

iii. Actions taken to rectify problems;

iv. Changes in relevant personnel;

v. Projected work for the next reporting period;

vi. Any proposed revisions to the CI Schedule of Compliance. Modifications of the CI Schedule of Compliance are subject to approval by the Department; and,

vii. A summary of data collected during the reporting period, including:

a. The location of each sampling point identified on a site map.

b. The concentration of each hazardous constituent detected at each sampling point.

c. Submittal of CI progress reports, work plans, or other documents during the CI does not alter the approved CI Schedule of Compliance.

8. CI Reports

a. SABIC shall prepare and submit to the Department a CI Report within 90 calendar days from the completion of investigation activities, or in accordance with the approved CI Schedule of Compliance, if applicable.

b. The CI Report must provide a detailed description of all required elements of the investigation as described in the most recent edition of the AEIRG.

c. The CI Report shall be reviewed by the Department in accordance with Agreement Condition IV.G.

IV.E. SELECTION OF REMEDIAL MEASURES AND AGREEMENT MODIFICATION

1. SABIC shall develop and submit to the Department a Remediation Plan (RP) for any areas of the Facility where hazardous constituents have come to be located at concentrations exceeding those appropriate for the protection of human health and the environment. The RP must include all applicable elements of the proposed remedy pursuant to the most recent edition of the AEIRG.

2. The RP shall be submitted within 180 calendar days following the submittal of a CI Report indicating that hazardous constituents have come to be located at any area of the facility, or beyond the facility, at concentrations exceeding those appropriate for the protection of human health and the environment, or that a remedy is otherwise necessary to protect human health and the environment, or within 180 calendar days following notification from the Department that a RP is required, whichever occurs earlier.

3. The RP shall be submitted along with a request for Agreement modification pursuant to ADEM Admin. Code r. 335-14-8-.04(2), and shall include any applicable fees pursuant to ADEM Admin. Code r. 335-1-6. This modification will serve to incorporate the proposed final remedy, including all procedures necessary to implement and monitor the remedy, into this Agreement.

IV.F. RESERVED

IV.G. SUBMITTALS

1. All work plans, reports, schedules, and other documents ("submittals") required by this Part shall be subject to approval by the Department to assure that such submittals and schedules are consistent with the requirements of this Agreement and with applicable regulations and guidance. SABIC shall revise all submittals and schedules as directed by the Department.

2. The Department will review all submittals in accordance with the conditions of this Agreement. The Department will notify SABIC in writing of any submittal that is disapproved and the basis therefore. If the Department disapproves a submittal, the Department shall (1) notify SABIC in writing of the submittal's deficiencies and specify a due date for submission of a revised submittal, (2) revise the submittal and notify SABIC of the revisions, or (3) conditionally approve the submittal and notify SABIC of the conditions. If the Department imposes revisions as described in item (2), the Department shall describe the required revisions in writing to SABIC. This description shall be considered a supplement to the subject submittal. Agreement Condition I.F. shall apply only to submittals that have been disapproved and revised by the Department, or that have been disapproved by the Department, then revised and resubmitted by SABIC, and again disapproved by the Department.

3. All submittals shall be submitted within the time frame specified by the Department and in accordance with the approved schedule of compliance. Extensions of the due date for submittals may be granted by the Department based on SABIC's demonstration of sufficient justification for the extension exists, including Force Majeure as described herein.

4. All submittals required by this Part shall be signed and certified in accordance with ADEM Admin. Code r. 335-14-8-.02(2).

5. Two (2) copies of all submittals shall be provided by SABIC in accordance with Agreement Condition II.K.

TABLE IV.1

The following Solid Waste Management Unit(s) (SWMU) and/or Area(s) of Concern descriptions correspond with those noted in the Comprehensive Investigation (CI) Report. Where discrepancies exist, the agreement will take precedence.

List of SWMUs and AOCs requiring a Comprehensive Investigation (CI) and/or remediation:

SWMU/AOC NAME	UNIT COMMENT	POTENTIALLY AFFECTED MEDIA
Chlorine enclosure building (PCE Spill Site)	Tetrachloroethene spill site	Soil and Groundwater
Caustic Tanks leak site	Adjacent Caustic tank bottoms failed	Soil and Groundwater

* Remediation Plan developed and submitted by SABIC on March 18, 2015, as modified by subsequent amendments dated August 7, 2015, November 25, 2015, and December 17, 2019.

TABLE IV.2

The following Solid Waste Management Unit (SWMU) and/or Area of Concern (AOC) numbers and descriptions correspond with those noted in the Comprehensive Investigation (CI). Where discrepancies exist, the agreement will take precedence.

List of SWMUs and AOCs requiring no further action at this time:

SWMU/ AOC NUMBER	SWMU/AOC NAME	UNIT COMMENT	POTENTIALLY AFFECTED MEDIA

Note: No SWMUs or AOCs are identified as no further action at time of agreement execution

TABLE IV.3

RESERVED

PART V

REMEDIAL MEASURES IMPLEMENTATION

V.A. APPLICABILITY

The conditions of this Part apply to SWMUs and AOCs identified in Table V.1.

V.B. GENERAL CONDITIONS

1. SABIC is required to perform corrective measures for the SWMUs and AOCs identified in Condition V.A. The approved remedy for these defined units, waterway areas, or land parcels, includes any and all actions set forth in this Agreement and in the approved Interim Remedial Measures Plans and Remediation Plans approved by the Department, as noted below:

Applicable SWMU/AOC	RP	Approval Date
Chlorine Enclosure Building PCE spill site	Remediation Plan Approved	May 5, 2016*
Caustic Tanks leak site	Addressed in the December 17, 2019 amendment to the Remediation Plan	TBD**

* Remediation Plan developed and submitted by SABIC on March 18, 2015, as modified by subsequent amendments dated August 7, 2015, November 25, 2015, and December 17, 2019.

** The remediation plan addressing the Caustic Tanks SWMU will be considered approved as part of the current renewal of the Cleanup Agreement

2. Remedial Cleanup Levels

Upon approval, pursuant to Condition IV.E., of the Remediation Plan designating applicable cleanup level(s), the cleanup level(s) for the areas specific to the Remediation Plan will be deemed to be a condition of this Agreement.

3. Groundwater Monitoring and Remediation

Where required pursuant to Conditions V.B.1. and V.C. of this Agreement, SABIC shall comply with the general groundwater monitoring requirements of Part III of this Agreement.

4. Land Use Controls

Where required pursuant to Conditions V.B.1. and V.C. of this Agreement, SABIC shall establish appropriate land use controls to achieve protection of human health and the environment. SABIC shall comply with Conditions V.B.5. and V.B.6. of this Agreement when implementing remedial measures requiring land use controls. In the event an off-site property owner does not allow an environmental covenant to be imposed, SABIC shall notify the Department within 14 calendar days of receipt of such written notification of the refusal by the off-site property owner. If the property owner does not provide a written refusal of the request to allow an environmental covenant to be imposed, SABIC shall notify the Department within 14 days of delivery of the request to the off-site property owner. In such cases, the Department may allow SABIC to propose an alternate area-specific land use control in accordance with ADEM Admin. Code r. 335-5-1-.02(i), subject to the Department's review and approval.

5. Survey Plat

For remedial measures where residual concentrations of contaminants will remain in place at levels greater than those appropriate for unrestricted land use, or for remedial measures that rely on land use controls, SABIC must:

a. Within 90 calendar days following the effective date of an Agreement modification addressing remedy selection, submit to the local zoning authority, or the authority with jurisdiction over local land use, and to the Department, a survey plat indicating the location and dimensions of the SWMUs, AOCs, and capped or partially remediated areas with respect to permanently surveyed benchmarks, the locations of sampling points, and the concentrations of hazardous constituents detected. This plat must be prepared and certified by a professional land surveyor registered in the State of Alabama. The plat must be filed with the local zoning authority or the authority with jurisdiction over local land use and must contain a note, prominently displayed, which states SABIC's obligation to limit the property to the specified restricted uses.

b. Maintain the survey plat as described in Condition V.B.5.a. of this Agreement until SABIC has demonstrated, to the satisfaction of the Department, that the levels of hazardous constituents in all contaminated media are within limits appropriate for unrestricted land uses.

6. Environmental Covenant

No later than the submission of the survey plat required in Condition V.B.5., SABIC must:

a. Record in the probate judge's office of the county in which the property is located or a portion thereof an environmental covenant in accordance with ADEM Admin. Code r. 335-5 that will in perpetuity notify any potential purchaser of the property that:

i. The land is contaminated with hazardous constituents in concentrations that exceed unrestricted use standards;

ii. The use of the property is restricted by this Agreement for certain residential, municipal, or industrial purposes and may lead to an increased risk of exposure to hazardous constituents depending upon the activities initiated at the site. Such activities may yield an increased level of human health risk to the owner.

iii. The potential purchaser or entity that desires to work in the contaminated area should notify SABIC before mobilizing to the area covered by the land use control.

b. Submit to the Department a certification, signed by SABIC in accordance with Agreement Condition II.C.11., that the environmental covenant specified in this part has been performed. This certification must include a copy of the document in which the notation has been placed.

c. Maintain the environmental covenant described in Agreement Condition V.B.6. until SABIC has demonstrated, to the satisfaction of the Department, that the levels of hazardous constituents in all contaminated media are within limits appropriate for unrestricted land uses.

7. Security

Security measures, where required by Conditions V.B.1. and V.C. of this Agreement, will be conducted in accordance with ADEM Admin. Code r. 335-14-5-.02(5) and as prescribed in the approved Remediation Plan.

8. Inspection

Where remedial measures addressed in Conditions V.B.1. include provisions to cap in place or partially remediate properties or land areas, whether owned or not owned by SABIC, SABIC shall specify inspection protocols on a scheduled basis to ensure continued integrity of the remedy and to ensure that land use remains appropriately restricted per the environmental covenant established pursuant to Agreement Condition V.B.6. Inspection provisions shall be as prescribed in the approved Remediation Plan.

V.C. AREA-SPECIFIC CONDITIONS (RESERVED)

V.D. REMEDIAL MEASURES REPORTS

1. Remedial Measures Progress Reports

   If the time required to complete implementation of a specific set of remedial measures, as described in the Department-approved Remediation Plan, is greater than 180 calendar days, SABIC shall provide ADEM with progress reports according to the schedule in the ADEM-approved Remediation Plan. If no schedule has been approved as part of the associated plan, progress reports shall be submitted at least quarterly. The progress reports shall, at a minimum, contain the following information:

   a. A description of the portion of Remediation Plan completed;

   b. Summaries of, and deviations from, the approved Remediation Plan during the reporting period;

   c. Summaries of current and potential problems, including recommended solutions and alternatives, as well as remedial actions undertaken;

   d. Any monitoring data (soil, air, dust, water) collected for any reason during the construction period for the purposes of monitoring the potential for human and ecological exposure; and,

   e. Projected work for the next period and impacts to the approved schedule.

2. Final Remedial Measures Reports

   Upon completion of construction of remedial measures systems, implementation of land use controls, interim removal actions, or other short- term activities required by this Agreement and/or the approved Remediation Plan, SABIC shall submit to the Department a Final Remedial Measures Report containing, at a minimum, the following:

   a. A description of activities completed;

   b. For cap and cover remedies, as-built construction drawings presenting the final in-place three-dimensional location of contaminated material. A plan view of the remediated areas shall be presented in addition to a cross-section of the in-place capped areas;

   c. Hazardous waste manifests indicating the handling of any excavated material that has been shipped off-site to a Department-approved, certified landfill;

   d. For remedies involving land use controls, a copy of the survey plat and environmental covenant required by Condition V.B. of this Agreement;

   e. Monitoring data (soil, air, dust, water) collected for any reason during the construction period for the purposes of monitoring the potential for human and ecological exposure; and

f. Certification, prepared in accordance with ADEM Admin. Code r. 335-14-8-02 (2)(d) by SABIC and an independent professional engineer registered in the State of Alabama, that the remedial measures implementation phase (i.e., construction) required by this Agreement is complete and that the approved system and/or facilities are ready for operation in accordance with the intended design (i.e., Remediation Plan).

3. Remedial Measures (RM) Effectiveness Reports

a. For remedial measures that have been fully implemented and where the remedial measures system must operate for a period of time to achieve cleanup goals or levels, SABIC shall submit RM Effectiveness Reports annually, unless otherwise approved by the Department, beginning 180 calendar days following the Department's approval of the Final RM Report for the initial Remedial Measures system subject to this Agreement condition. The overall RM Effectiveness Reports shall include, at a minimum, the following information for each SWMU and/or AOC included in the report:

i. A detailed narrative presenting an evaluation of the effectiveness of the selected remedy;

ii. Summaries of compliance with, and progress toward achieving, cleanup goals;

iii. Any significant revisions, adjustments, or proposed modifications to the selected remedy;

iv. Tabulated environmental sampling and monitoring data including, but not limited to, groundwater quality, elevation data, and a graphical representation of all constituents detected during each sampling event from recovery wells, monitoring wells, drinking water wells, and other locations;

v. Chain of custody, field reports, and laboratory data sheets to include the date of collection, the date the sample was extracted, and the date of sample analysis for samples collected during the reporting period;

vi. Any monitoring data (soil, air, dust, water) collected for any reason during the post-construction period for the purposes of monitoring the potential for human and ecological exposure;

vii. Isoconcentration maps depicting the distribution of parameters for each sampling event;

viii. Time versus concentration plots for each monitoring parameter for each recovery well and a representative number of effectiveness wells;

ix. Tabulated volumetric data on groundwater pumped and pumping rates (monthly and cumulative) for each recovery well;

x. Records of any groundwater recovery system operation time, including shutdown periods, not including any minor (less than 24 hours) shutdowns for repairs, maintenance, etc.;

xi. Potentiometric surface maps;

xii. Description of land use during the reporting period at the designated area requiring corrective measures; and,

xiii. Findings of SABIC's investigation into the continued effectiveness of land use controls per Condition V.B.

b. If, at any time, SABIC determines that any remedy selection specified in Condition V.B or V.C. of this permit no longer satisfies the applicable requirements of ADEM Admin. Code r. 335-14-5-.06(12) or this permit for releases of hazardous waste or hazardous constituents originating from SWMUs or AOCs, SABIC must, within 90 calendar days, submit an application for an Agreement modification, pursuant to Agreement Condition II.J., to make any appropriate changes to the Remediation Plan.

c. The application for changes in the Remediation Plan, including changes in inspection and monitoring provisions of the Remediation Plan, shall be submitted as an application for an Agreement modification pursuant to the requirements of ADEM Admin. Code r. 335-14-8-.04.

4. Final Report of Remedial Measures

Within 90 calendar days following attainment of cleanup levels or goals as outlined in this Agreement and the approved Remediation Plan, SABIC shall submit to the Department a Final Report of Remedial Measures (FRRM). The FRRM shall contain a certification by SABIC and an Alabama-registered independent professional engineer that all remedial measures required by this Agreement and the approved Remediation Plan have been completed. The FRRM shall outline any procedures and schedules for dismantling of remedial measures systems, groundwater monitoring or recovery systems, removal of land use controls, and any other remedial systems or controls required by this Agreement or the approved Remediation Plan.

TABLE V.1

The following Solid Waste Management Unit(s) (SWMUs) and/or Area(s) of Concern (AOCs) numbers and descriptions correspond with those noted in the Comprehensive Investigation (CI) Report. Where discrepancies exist, the permit will take precedence.

List of SWMUs and AOCs requiring Remedial Measures.

SWMU/AOC NAME	UNIT COMMENT	POTENTIALLY AFFECTED MEDIA
Chlorine Enclosure Building (PCE Spill Site)	Tetrachloroethene spill site	Soil and Groundwater
Caustic Tanks leak site	Adjacent Caustic tank bottoms failed	Soil and Groundwater

PART VI

SUMMARY OF DEADLINES

The summary information provided herein is intended only as a guide to the requirements of this Agreement. It is not intended to be all inclusive, nor is it intended to be used as a substitute for the full text of this Agreement.

AGREEMENT CONDITION	ITEM	DUE DATE
I.B.3. and I.D.1.	Provide a copy of this Agreement to all contractors, laboratories, and consultants	14 days after the issuance of this Agreement or retention of such persons
I.B.4.	Provide to the Department a written notice of transfer of ownership or operation of the Facility or any portion of the Facility	30 days prior to such transfer
I.F.1.a.	Notify the Department of any dispute pertaining to a revision of a submittal	30 calendar days
I.F.1.b.	Reach an agreement pertaining to a submittal revision dispute	30 days after receipt of notification referenced in I.F.1.a
II.C.12.a.	Give notice to the Department of any planned physical alterations or additions to the permitted facility and any solid waste management units	As soon as possible
II.C.12.f.	Report any noncompliance with this Agreement that may endanger human health or the environment	Verbally within 24 hours from the time SABIC becomes aware of the circumstances. Written submission shall also be provided within 5 calendar days of the time that SABIC becomes aware of the circumstances
II.H.2. and 4.	Update cost estimates	No later than 30 calendar days after the Department has approved a modification to the Remediation Action Plan, or any other plan required or referenced by this Agreement, if the change in the plan results in an increase in the amount of the cost estimate and annually as required by ADEM Admin. Code r. 335-14-5- .08(10)(b).
II.I.1.	SABIC shall demonstrate financial assurance for completing the approved remedy	Within 120 calendar days after this Agreement has been modified
II.J.	Submit a written request for an Agreement modification pursuant to the requirements of ADEM Admin. Code r. 335-14-8-.04(2)	At least 60 calendar days prior to a proposed change in facility design or operation

II.L.2.	Notify the Department of any event that SABIC believes may prevent timely compliance	Verbally within 72 hours of the time that SABIC knows of such event and written within 7 calendar days of such event
II.L.3.	File an objection with the Department regarding the Department's determination that force majeure has occurred	Within 15 calendar days of the receipt of the Department's explanation
III.A.2.	Implement groundwater monitoring as required by this Agreement and Remediation Plan	120 calendar days after the effective date of this Agreement
III.B.1.a.iii.	Notification of damaged groundwater monitoring wells	Immediately in writing. The well must be repaired within 30 calendar days of damage, and repair report must be submitted within 30 calendar days of repair
III.B.1.c.	Install additional groundwater monitoring wells	As necessary to assess changes in the rate and extent of any plume of contamination, or as otherwise deemed necessary. Note: an Agreement modification request must be submitted within 90 calendar days prior to installation of additional groundwater monitoring well(s)
III.B.2.a.	Determine groundwater surface elevation	At least annually and each time a well is sampled
III.B.2.b.	Determine groundwater flow rate and direction	At least annually
III.B.6.b.	Submit groundwater monitoring report	Within 60 calendar days of the first sampling event and annually thereafter
III.B.6.c.	Submit progress reports	Within 90 calendar days after the effective date of this Agreement and annually thereafter. See agreement condition for start/stop/resume provisions
III.E.2.b.	Implement remedial measures plan	No later than 120 calendar days after the effective date of this Agreement
III.E.3.a.	Sample all background, boundary, and effectiveness wells and analyze for the constituents listed in Table III.2. of this permit	At least annually beginning within 120 calendar days of the effective date of this Agreement
III.E.3.b.	Sample all background, boundary, and effectiveness wells and analyze for the constituents listed in Table III.3. of this permit	At least annually beginning within 120 calendar days of the effective date of this Agreement
III.E.3.c.	Sample and analyze for temperature (degrees F or C), specific conductance (Mhos/cm), and pH (standard units), at all background, boundary, and effectiveness well locations	Each time the well is sampled

III.E.4.a.	Submit remedial measures effectiveness reports	Annually within 60 calendar days of each annual anniversary of this Agreement after remedial measures are initiated and until remedial measures are completed
IV.B.1.	Submit to the Department written notification of the discovery of additional AOCs described under Agreement condition IV.A.3	15 days after discovery
IV.B.2.	Submit to the Department written notification of the discovery of any additional SWMUs as described under Agreement Condition IV.A.3	15 days after discovery
IV.B.3.	Submit a SAR to the Department concerning the discovery of any new SWMUs or AOCs	90 calendar days
IV.C.1.	SABIC shall notify the Department in writing of any newly discovered releases of hazardous waste	15 calendar days
IV.D.5.	The CI must be completed	The CI must be completed within 180 days from the effective date of this Agreement
IV.D.8.a.	SABIC shall provide to the Department a CI Report	Within 90 calendar days following the completion of the CI
IV.E.2.	Submit to the Department a RP	Within 180 calendar days following the submittal of the CI Report
V.B.4.	Notification of property owner refusal to allow environmental covenant to be imposed	Within 14 calendar days
V.B.5.a.	Submit to the local zoning authority, or the authority with jurisdiction over local land use, and to the Department, a survey plat indicating the location and	Within 90 calendar days following the effective date of an Agreement modification addressing remedy selection
V.B.6.a.	Record environmental covenant	No later than the submission of the survey plat required in Condition V.B.5.

V.B.6.b.	Submit to the Department a certification that the environmental covenant has been performed	No later than the submission of the plat required in Condition V.B.5.
V.D.1.	Submit Remedial Measures Progress Reports if the time required to complete remedial measures is greater than 180 days	According to the Remediation Plan or at least quarterly
V.D.2.	Submit Final Remedial Measures Report	Upon completion of activities
V.D.3.	Submit Remedial Measures Effectiveness Reports	Annually beginning 180 calendar days following the Department's approval of the Final Remedial Measures Report
V.D.4.	Submit a Final Report of Remedial Measures (FRRM)	Within 90 calendar days following attainments of cleanup levels or goals

PART VII

SIGNATORIES

The undersigned warrant that they are authorized to bind legally their respective principals to this Agreement. This Agreement may be executed in multiple counterparts, each of which shall be deemed an original, but all which shall constitute one and same Agreement.

_____ Date_____

Lance R. LeFleur
Director
Alabama Department of Environmental Management

_____ Date_____

Coleman Larlee
Site General Manager SABIC Innovative Plastics

ARCADIS
Infrastructure · Water · Environment · Buildings

Imagine the result

Remedial Plan

Revised December 17, 2019
Revised November 20, 2015
March 18, 2015

SABIC

Burkville, Alabama

ALD 981 026 677

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Imagine the result

Remedial Plan

SABIC

Burkville, Alabama

ALD 981 026 677

Revised December 17, 2019

Revised November 20, 2015

March 18, 2015

ARCADIS

Remedial Plan

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Alabama Licensed Professional Geologist No. 1118

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Alabama Licensed Professional Engineer No. 37041-E

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Revised December 17, 2019
Revised November 20, 2015
March 18, 2015

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Table

Figures

Appendices

1.0 Introduction

SABIC Innovative Plastics LLC (SABIC) operates a polycarbonate resin manufacturing plant located in Burkville, Lowndes County, Alabama (**Figure 1**). The production area is approximately 300 acres and is located centrally within approximately 6,300 acres of land that is leased from the Industrial Development Board of the City of Montgomery (**Figure 2**).

1.1 PCE Release

A spill of tetrachloroethylene (PCE) occurred on July 5, 2011 from an area of the plant referred to as the Brine Unit. The spill area was excavated to remove PCE in soil; however, confirmation samples collected along the bottom portion of the excavation indicated PCE concentrations above the Alabama Department of Environmental Management (ADEM) Preliminary Screening Values (PSV). Based on this finding, SABIC voluntarily agreed to undertake certain environmental investigations and remedial measures in accordance with appropriate regulatory procedures.

1.2 Caustic Release

A release of liquid 32 percent sodium hydroxide (caustic) from two above-ground storage tanks, which are situated in the same secondary containment structure, was reported to the ADEM on February 19, 2019 (Tank V1635A) and April 23, 2019 (Tank V1635B). The two above-ground storage tanks are located approximately 300 feet (ft) south of the PCE spill area. The ADEM requested a solid waste management unit (SWMU) Assessment Report for the release in its letter dated March 14, 2019. The "Caustic Tanks SWMU Assessment Report" was submitted to the ADEM on May 20, 2019 and identified elevated pH in soil and groundwater. ADEM approved the SWMU Assessment Report in its letter dated July 10, 2019. Based on the investigation results, SABIC will implement remedial measures for caustic as provided in this Remediation Plan.

1.3 Cleanup Agreement

On March 5, 2012, SABIC entered into Cleanup Agreement ALD 981 026 677 (Cleanup Agreement) with the ADEM (ADEM, 2012). The Cleanup Agreement was modified with an approval date of May 5, 2016 to incorporate remedial measures for constituents in groundwater (ADEM, 2016). The Cleanup Agreement sets forth specified procedures, conditions and schedules for SABIC to assess the extent of

releases to the environment and to perform remedial measures for protection of human health and the environment.

1.4 Investigation and Remediation

Since September 2011, SABIC has developed environmental work plans, implemented site investigations, evaluated remedial measures, and is implementing remedial measures to address PCE, volatile organic compounds (VOCs), caustic (e.g., elevated pH) in accordance with the requirements of the Cleanup Agreement. Since operation of the interim remedial measure system (IRM system) in June 2015, concentrations of PCE in groundwater have been reduced greater than 90 percent in the source area wells. Further, the area of elevated pH in groundwater has been controlled and treated with the existing IRM system; however, SABIC is expanding the IRM system to provide additional control and treatment of groundwater south of the existing caustic tank containment (Arcadis, 2019a).

This report summarizes the collected data, results of associated data analyses (including screening-level evaluations human health and ecological risk), and interim remedial measures. The purpose of this report is to set forth the remedial plan to achieve site-specific cleanup goals.

2.0 Site Background

2.1 PCE Release Incident

On July 5, 2011 approximately 124 gallons of PCE were released from a heat exchanger located within the interior of the Chlorine Piping Enclosure Building (Enclosure Building, see **Figure 2**). PCE spilled onto a concrete floor, and approximately 25 gallons exited the doorway at the northeast corner of the building and infiltrated into the gravel and surface soil. Initial response actions included using absorbents to collect PCE pooling on the building floor and excavating soil outside of the doorway. Soil was excavated, contained in steel drums, and properly disposed. Rainwater that collected in the excavation was initially managed through treatment in the on-site wastewater treatment plant. Rainwater that collected over time in the excavation was containerized for off-site disposal. Drums of water and soil were disposed at an off-site treatment, storage and disposal facility (TSDF).

Initial response excavation was performed in several lifts, with samples collected at depths of approximately 4 inches, 18 inches, and 32 inches below ground surface

(bgs). Analytical results indicated that PCE concentrations in the upper 18 inches ranged from 2 to 4 milligrams per kilogram (mg/kg), with the highest PCE concentration (6,400 mg/kg) detected at 32 inches bgs.

Inquiry into past PCE handling practices in the area indicated that small incidental spills had possibly occurred in the vicinity of the Enclosure Building over time. The Enclosure Building is constructed on a sand footing and floor/wall seams are butt-jointed, so past PCE releases (if any) may have traveled down the joint space and dispersed laterally in the sand footing. Observations of the excavation indicated that a very small amount of PCE was exiting the sand footing beneath the building at approximately 24 inches bgs and perched rainwater had accumulated in the excavation. The excavation was temporarily covered and left open for periodic inspection of potential PCE entering the excavation from the soil. Accumulated rainwater in the excavation was pumped into drums for off-site transport and treatment. Upon consultation with the ADEM, the excavation was backfilled on December 2, 2011, as only a very small amount of free-phase PCE had been observed during only one event, and the open excavation presented a safety hazard.

2.2 Caustic Release Incident

Two adjacent tanks are situated in the Brine Unit of the plant and within a secondary containment structure. The two tanks contain fresh aqueous solution 32 percent caustic. On January 24, 2019, Tank V1635A was found to be leaking at the outside base of the tank between the pad skirting and the tank bottom. The tank was isolated, and the contents of the tank were pumped to another tank. The tank was entered and inspected, and the inspection showed that the rubber liner and the tank bottom required replacement.

During the replacement of the Tank V1635A bottom, it was discovered that soil inside the foundation wall exhibited elevated pH and had several areas of perched (e.g., free liquid) caustic. SABIC removed soil and perched liquid from beneath the tank as much as possible without undermining the ring-wall foundation. SABIC placed a liquid barrier material on the soil, filled the remaining void space (except for the top 6 inches) with a flowable concrete, and placed 6 inches of sand on top of the concrete to fill the remaining void space. A new tank bottom was then installed.

A similar leak was identified through inspection of the interior of Tank V1635B on April 22, 2019. Inspection of the tank showed corrosion of the steel floor with leaking of caustic identified. The response and repair for Tank V1635B were the same as the

response and repair of Tank V1635A as previously described. The two tanks are shown on **Figure 2**.

2.3 PCE Investigation

Arcadis implemented a high-resolution site characterization (HRSC) investigation in April 2012 to investigate the extent of PCE in surface and subsurface soil and to assess groundwater quality. The April 2012 investigation identified soil samples with PCE detects and three of four groundwater samples collected from four temporary wells with detects of PCE concentrations above the ADEM PSVs for tap water. Following the April 2012 investigation, the next phase of investigation was completed in August 2012 to delineate the horizontal and vertical extent of PCE in the soil and groundwater. The Interim Comprehensive Investigation (CI) Work Plan was developed, reviewed, and approved by the ADEM on June 12, 2012 and implemented in August 2012. Findings and results from both the April and August 2012 investigations are documented in the Interim CI Report. The Interim CI Report was submitted to ADEM in November 2012.

Environmental investigations completed in April and August 2012 (Interim CI Report, 2012) delineated the horizontal and vertical extent of PCE in soil and groundwater with temporary groundwater sample points. Findings from these investigations resulted in a third investigation to refine the conceptual site model, identify fate and transport parameters, identify constituents of potential concern (COPCs), install permanent groundwater wells, collect additional data for a human health, ecological, and environmental risk assessment, and evaluate potential interim remedial measures.

The Addendum 03 Work Plan for this third investigation was submitted to ADEM on February 15, 2013 and approved on February 28, 2013. The Addendum 03 Investigation was completed in accordance with the Work Plan from April 2013 through August 2013. The Addendum 03 Investigation was completed to finalize the investigation phase and gather the necessary information from pumping and pilot tests to transition the Site to remedial alternatives evaluations.

In accordance with the Cleanup Agreement, quarterly groundwater monitoring events and associated quarterly reporting were completed July 2013 through May 2016 when the Cleanup Agreement was modified. Semi-annual groundwater events commenced following the May 2016 Cleanup Agreement.

2.4 Caustic Investigation

An assessment of the caustic release was completed in April 2019 and included delineation of caustic parameters (pH and alkalinity) in soil and groundwater. The Caustic Tanks SWMU Assessment Report was submitted to the ADEM on May 20, 2019 (Arcadis, 2019a) and subsequently approved by the ADEM on July 10, 2019. The objectives of the soil sampling efforts were to evaluate soil quality conditions, determine the presence or absence of elevated pH (pH greater than 8.5 SU – Standard Units) , and delineate caustic parameters (measured as alkalinity) in soil and groundwater. The assessment defined the extent of elevated pH in soil and groundwater.

2.4.1 Caustic in Soil

Elevated pH in soil was confined to an area immediately below the two tanks. The soil interval below the tanks was addressed during the response activities and foundation repairs through soil excavation. Slightly elevated pH in soil was also detected in surface soil (0 to 1 ft bgs) to the southeast of the secondary containment for the two tanks. The elevated pH (8.6) detected in the surface soil sample southeast of the tank containment does not pose an unacceptable risk to human health or the environment and no further investigation of the soil is required.

2.4.2 Caustic in Groundwater

The extent of elevated pH and the associated alkalinity in groundwater is defined using the existing groundwater monitoring system of 36 permanent groundwater monitoring and remediation wells (Arcadis, 2019b). The groundwater sample results for pH were compared to the Secondary Alabama Drinking Water Standard maximum contaminant level (sMCL) for a pH maximum value of 8.5 SU. The groundwater analytical data indicated that the area with elevated pH is centralized under the Brine Unit near the tank release area. The groundwater data indicate that groundwater with elevated pH associated with the releases have not migrated offsite.

2.5 Risk Assessment

The site Risk Assessment was completed in September 2014 and approved by the ADEM in its letter dated December 23, 2014. The data collected from the investigation phase were evaluated and risk assessment datasets were prepared based on the anticipated exposure scenarios. Maximum detected concentrations were compared to

appropriate screening levels to identify COPCs. A site conceptual exposure model (SCEM) was prepared that identified the receptors and their complete exposure pathways. Finally, excess lifetime cancer risk and non-cancer hazards estimates were calculated for the complete exposure pathways for each receptor as identified in the SCEM.

The risk assessment evaluated potential exposures of hypothetical future adult and child residents to soil and to groundwater used as a potable water supply. The risk assessment also evaluated exposure of site workers (i.e., commercial or industrial) and construction workers to soil, groundwater, and soil vapor at the Site.

The risk assessment determined that the risk drivers at the site are PCE and vinyl chloride (Arcadis, 2014a). Results of the risk assessment indicated that groundwater in the first saturated zone above the Mooreville Chalk should not be used as a potable water supply within the SABIC property. An ecological risk evaluation was prepared to evaluate potential exposure of aquatic life to concentrations of PCE and chloroform detected in a stream on the SABIC property. The measured surface water concentrations were compared to the ecological screening benchmarks and the concentrations were well below screening levels. Therefore, risk to ecological receptors is not expected to occur.

2.5.1 Remedial Goals – Volatile Organic Compounds

Site-specific and risk-based remedial goals were not calculated for the Site because drinking water standards (i.e., MCLs and sMCLs) are available for the primary constituents of interest. Thus, the Alabama Drinking Water Standards are the remedial goals and Groundwater Protection Standards (GWPS) for constituents listed in the Cleanup Agreement.

2.5.2 Remedial Goals - Caustic

The conceptual site model and exposure pathways were evaluated to determine risk posed by caustic. Same as the risk assessment results established in 2014 (Arcadis, 2014a), evaluation determined that groundwater in the first saturated zone above the Mooreville Chalk should not be used as a potable water supply on the SABIC property. Similarly, specific remedial goals were not calculated for the caustic parameter pH because a drinking water standard (i.e., Alabama Secondary Drinking Water Standard Maximum Contaminant Level - MCL) is available. Therefore, the GWPS established for the caustic constituents will be expressed as elevated pH (e.g., greater than 8.5

SU) and alkalinity in the proposed modifications to the Cleanup Agreement. Alkalinity does not have a drinking water standard MCL or sMCL; therefore, the Environmental Protection Agency's (EPA) Freshwater Criteria of 20 milligrams per liter (mg/L) will be used for the GWPS (EPA, 2019).

3.0 Site Characterization

3.1 Topography and Surface Drainage

The northern part of Lowndes County, including the site, is in the Black Prairie district of the East Gulf Coastal Plain physiographic section. The Black Prairie, named for the black soil that is common in the area, is a gently to moderately rolling prairie that is characterized by extensive grassland with areas of few trees except on alluvial terraces. The elevation of the land surface within SABIC property ranges from about 250 feet above mean sea level (ft msl) to the south at US Highway 80 to approximately 125 ft msl to the north along the bank of the Alabama River. The facility is located on a local topographic high with average land surface elevation ranging between 220 ft msl and 230 ft msl.

Surface water generally flows from topographic highs in the south to the north within flowing creeks and streams, including Tallawassee Creek, Rock Creek, and Pintlala Creek that are tributaries to the Alabama River (see **Figure 1**).

3.2 Soils

The United States Department of Agriculture Natural Resource Conservation Service (NRCS) lists most of the site as Bama Fine Sandy Loam 0 to 4 percent slopes. The soil in this unit is described as well-drained, alluvial terrace, and loamy fluviomarine deposits derived from sedimentary rock. Regionally, the soil profile consists of 0 to 5 inches of fine sandy loam, 5 to 42 inches of sandy clay loam, and 42 to 80 inches of sandy loam (NRCS, 2012). Within the plant production area, much of the original surface soil has been removed and the facility is underlain by approximately eight feet of low permeability imported and compacted clay.

3.3 Site Geology and Hydrogeology

The site has been characterized through extensive subsurface and surface water studies that included the following:

- Collection of 237 soil samples from 29 soil borings.
- Collection of 94 groundwater samples from 45 vertical aquifer profile (VAP) borings.
- Quarterly and semi-annual groundwater sample collection from 36 monitoring and remedial pumping wells since 2013.

Groundwater underlying the site is contained in Quaternary alluvial deposits that range in thickness from about 30 to 40 feet with a saturated thickness typically less than 15 feet. The alluvial deposits are formed by ancestral flood plains of the Alabama River and associated large streams and creeks. These deposits are in a fining-upward sequence consisting of basal gravel with overlying sand, silt and clay. The alluvial deposits overlie the Mooreville Chalk confining unit and generally range in thickness of about 30 to 40 feet in the site area. Alluvial deposits are a potential source of water in the flood plains of the Alabama River, but generally are not developed for public water supplies in the site area (Planert*, et al.*, 1987).

The Mooreville Chalk underlies the Quaternary alluvial deposits and the chalk crops-out on the northern portion of the site in the direction of the Alabama River, in creek beds and stream bottoms to the north, and approximately two miles south of the site. The Mooreville Chalk consists of about 400 to 500 feet of chalk and calcareous clay within the site area. According to the United States Geological Survey (USGS) (Planert*, et al.*, 1987), the Mooreville Chalk is relatively impermeable and is not a source of water in the site area. The site is not located in a recharge area for any of the major regional aquifers (Eutaw, Gordo, and Coker aquifers) (Planert*, et al.*, 1987). Surface geology as mapped by the Geological Survey of Alabama is provided as **Figure 3**.

The shallow hydrostratigraphic layers beneath the site (shown in cross-section on **Figure 4**) consist of:

Upper Silts and Clays

Generally, the upper 20 feet at the site consists of silts and clays with minor sand content. Visual logging of soil borings, and data from the HPT, both indicate that this zone is low-permeability and generally unsaturated. Within the structural footprint of the plant, the upper 8 feet consists of low permeability and compact clay fill. The bottom of the upper zone consists of interbedded sand, silt, and clay as the contact with the lower sand is approached. These upper silts and clays are interpreted as alluvial terrace deposits.

Lower Sand

Approximately 10 to 15 feet of medium sand with occasional gravel underlie the upper silts and clays. Unlike the upper silts and clays, the lower sand is typically fully saturated. As expected, visual logging of the soil borings, and data from the HPT, indicate that this zone has considerably higher permeability compared to the upper silts and clays. Hydraulic conductivity of the lower sand established through aquifer tests conducted as part of the site investigations is approximately 10^{-3} centimeters/second (2.8 ft/day); this result is consistent with the relative hydraulic conductivity indicated by the HPT for the lower sand.

Mooreville Chalk

The Mooreville Chalk is a lower confining unit encountered between 30 and 35 feet bgs and underlies the lower sand zone within the production area. To the north and south the Mooreville Chalk crops out in the bottom of streams and creeks, and the water table aquifer is effectively absent in these areas. The areas where the Mooreville Chalk crops out significantly influences lateral direction of groundwater flow. The Mooreville Chalk is a relatively impermeable unit consisting of 300 to 400 feet of compact chalk and calcareous clay. The low permeability of the Mooreville Chalk prevents vertical groundwater flow from the local water table aquifer to the underlying Eutaw aquifer.

3.4 Groundwater Flow

The groundwater table beneath the central portion of the facility follows the general topography and forms a local high with a groundwater divide in the vicinity of the Brine Unit Based on collected water level elevations, flow radiates outward in all directions from the facility. Beneath the impacted portion of the Brine Unit, the dominant groundwater flow direction is north by northwest, although groundwater in portions of the area flows west and south (See **Figure 5** for groundwater level elevations and flow direction in the water table aquifer, March 2019). Most of the groundwater flows into streams to the north and west as base flow. There is no indication from quarterly groundwater monitoring, or computer-assisted modeling, that any groundwater impacted by the PCE, elevated pH, or alkalinity will exit the property as groundwater flow. Specifically, groundwater flowing to the north exits through seeps and base flow where the Mooreville Chalk crops out and the water table aquifer pinches out. To the west, the unnamed tributary flowing to Lake Berry bisects much of the water table aquifer, capturing most of the groundwater flowing toward the west.

3.5 Constituents of Concern

Those constituents detected in samples collected during site investigations at concentrations above the screening values for soils and groundwater were designated as constituents of potential concern (COPCs). Upon carrying COPCs through the risk and ecological risk assessments, Constituents of concern (COCs) for groundwater were determined at the site. The COCs for the site are pH and PCE, and vinyl chloride in groundwater. However, it should be noted that additional COCs are listed in the Cleanup Agreement based previous detects or the potential for breakdown constituents as a result of degradation of PCE in groundwater. COCs listed in Table III.2 of the Cleanup Agreement include:

- pH (to be added to Cleanup Agreement)
- Alkalinity (to be added to Cleanup Agreement)
- Acetone
- 2-Butanone (MEK)
- Carbon disulfide
- Carbon Tetrachloride
- Chloroform
- Chloromethane
- cis-1,2-Dichloroethene
- Dichloromethane
- Tetrachloroethene
- Toluene
- Trichloroethene
- Vinyl Chloride

The most recent concentrations of PCE, pH and alkalinity are shown on **Figures 6, 7, and 8, respectively**. The results from the most recent sampling event indicate the areas of elevated pH in groundwater are comingled with PCE concentrations in the Brine Unit.

3.5.1 Human Health

Identified risk drivers at the site are COCs in groundwater. Results of the risk assessment indicated that groundwater in the first saturated zone above the Mooreville Chalk should not be used as a potable water supply within the SABIC property. Other calculated human health risks were below the ADEM benchmarks. Remedial goals were not calculated for the site because water quality standards are available for COCs in groundwater. There is no other elevated risk for other media of interest.

3.5.2 Ecological

An evaluation of the ecological health at the site was performed as part of the overall risk assessment (Arcadis, 2014a). The ecological health evaluation consisted of a field and desktop evaluation of approximately 3,000 acres surrounding the operational area of the site, including the collection of surface water samples. The only constituents detected in surface water were PCE and chloroform. Surface water screening levels were selected in compliance with the ADEM water quality program. ADEM does not list water quality criteria for the constituent of interest for protection of ecological health. Therefore, these values were identified using the United States Environmental Protection Agency (EPA) Region IV surface water screening values (EPA 2001b).

Maximum detected concentrations for both PCE and chloroform in surface water were below the applicable EPA Region IV screening levels for ecological health. PCE was detected at a maximum of 11.3 micrograms per liter (µg/L) in surface water, which is well below the EPA Region IV ecological screening value of 84 µg/L. Chloroform was detected at a maximum 1.2 µg/L in surface water, which is also well below the EPA Region IV ecological screening value of 289 µg/L. Since maximum concentrations were below applicable screening levels, it is concluded that water quality in springs and surface water is not expected to cause adverse effects on ecological health. Concentrations in surface water and spring samples have remained below EPA ecological screening levels. Additionally, ranges of pH in all surface water and spring samples have been less than the drinking water standard of pH 8.5 SU.

4.0 Remedial Measures

4.1 Interim Remedial Measure

Various remedial measures were evaluated for achieving the objectives of containing and treating COCs in groundwater. Detailed evaluation of remedial alternatives is provided in the November 2015 Remedial Plan (Arcadis, 2015b). Based on evaluation of alternatives, a remedy was selected that included a hydraulic containment system that uses groundwater pumping, treatment, and vapor recovery from the vadose zone (soil vapor extraction - SVE).

The construction of the interim remedial measure began in March 2015 and was completed in June 2015. Details of the Interim Remediation System construction are presented in the August 2015 Interim Remedial Measure Dual-Phase Extraction System Startup Report (Arcadis, 2015a). By hydraulically containing the source area

and treating the highest concentrations of PCE, the extent of the dissolved-phase PCE plume has decreased significantly with time (Arcadis, 2019b).

It should be noted that the SVE system was successful for the removal of PCE mass in the vadose zone. The SVE portion of the system was shut down with ADEM approval in March 2016, following a period of reduced mass recovery. From that time to present, groundwater extraction has been utilized as the active remedial technology for the Site.

Based on groundwater investigation associated with Caustic Tanks SWMU Assessment Report (Arcadis, 2019a), the IRM system has been successful for hydraulically controlling and treating elevated pH and alkalinity in groundwater. However, expansion of the groundwater recovery system is required to hydraulically control a portion of the caustic plume south of the Brine Unit.

4.2 Modified Remedial Measure

The IRM system will be modified to capture the caustic plume in groundwater south of the Brine Unit. The modified system will consist of existing IRM extraction wells PW-01, PW-02 and PW-04 and a replacement extraction well PW-03R. In addition to the existing IRM extractions wells, three new extraction wells (RMDW-01, RMDW-02 and RMDW-03) are proposed to control and treat the caustic plume. All extraction wells will be used for groundwater recovery only. The locations of the extraction wells are provided in the Remedial Measure design plans in **Appendix A**.

The continued goal of the remedial system is to significantly reduce or eliminate migration of COCs in groundwater. By installing and operating groundwater extraction wells at the COC source area, the groundwater surface will be depressed (e.g., a hydraulic cone of depression) and the zone of hydraulic containment will be expanded. The hydraulic containment will significantly limit the mass of dissolved PCE, alkalinity, and elevated pH migrating from the source area. With continued system operation over time, the hydraulic containment process will decrease the concentration of COCs in the source area and downgradient of the source area.

Along with hydraulic containment and treatment of dissolved PCE, the addition of extraction wells (RMDW-01, RMDW-02 and RMDW-03) will contain and treat alkalinity and elevated pH in groundwater. Groundwater with a lower alkalinity and more neutral pH will be drawn into the saturated zone in the vicinity of the extraction wells, which will result in a decrease in the alkalinity and pH of the groundwater.

The IRM system has already proven to be effective; however, the effectiveness of the modified system will continue to be evaluated using data and information collected in the operations and monitoring program discussed in Section 5.0, “Long-Term Monitoring”.

4.2.1 Remediation Well Locations

IRM extraction wells PW-01, PW-02, PW-03, and PW-04 were installed in June 2015 and have been operating continuously. New extraction well locations PW-03R, RMDW-01, RMDW-02, and RMDW-03 were selected based on accessibility of drilling equipment, location of elevated alkalinity and pH, and in the case of PW-3R to avoid a future building expansion. A description of the existing and proposed extraction well locations are provided below:

- PW-01. Extraction well PW-01 was used for aquifer testing and pilot testing of dual-phase extraction (DPE) and SVE. This well is located adjacent to an area where the highest PCE concentrations were initially detected in groundwater. The groundwater extracted from this well depresses the groundwater surface, resulting in hydraulic containment of this source concentrations and a reduction in COCs migration to the north and to the west of the Brine Unit.

- PW-02. The location of Extraction well PW-2 is north of the Control Room and Lab Building in the Brine Unit. This well is used to extract groundwater from the source area on the north side of the Enclosure Building.

- PW-03/PW-03R. As part of plant upgrades, the Enclosure Building is being renovated and expanded. The current location of PW-03 is located within the planned building expansion, therefore a replacement well (PW-03R) is proposed approximately 40 feet southwest of the Enclosure Building. Groundwater extracted from this well results in hydraulic containment of the source area beneath the Enclosure Building where the PCE spill occurred.

- PW-04. Extraction well PW-04 was installed near monitoring well MW-07. This well is used to hydraulically contain the COCs in groundwater north of the Brine Unit.

- RMDW-01, RMDW-02 and RMDW-03 will be located at the south end of the Brine Unit and caustic tanks area to control and treat COCs in groundwater south of the Brine Unit. The locations and extraction rates for these wells were determined by using the site-wide groundwater model.

4.2.2 Remediation System Process

The IRM system will continue operate as in the past with modifications to improve control, capture, and treatment of COCs south of the Brine Unit. A piping and instrumentation diagram of the modifications to remediation system is presented in the Remedial Measure design plans in **Appendix A**. The groundwater will be recovered from the extraction wells using electrical submersible pumps. The extracted groundwater will be routed through conveyance lines installed below ground and above ground as necessary to an influent groundwater manifold housed in a retrofitted steel container (equipment container). The extracted groundwater will be pumped directly into the air stripper.

An air stripping unit will be housed in the equipment container with the other process equipment. The groundwater extracted from the recovery wells will be routed to the proposed air stripping unit for treatment. The air stripping unit is sized to treat a flow rate of up to 120 gallons per minute at a PCE concentration of up to 5,000 µg/L. The estimated effluent concentration after treatment with the air stripping unit is less than 5 µg/L. At the startup of the remediation system, influent and effluent samples will be collected from the air stripping unit and analyzed for site-specific VOCs using EPA Method 8260, pH using EPA Method 9040C, and alkalinity using EPA Method 2320. The results of these samples, along with the groundwater extraction rates, will be used to evaluate the performance of the extraction wells and the air stripping unit.

Same as in the past, treated water will be discharged through the storm water sewer to synthetically lined holding ponds at SABIC's wastewater treatment plant (WWTP) for treatment. The treated water from the WWTP is discharged in compliance with SABIC's existing National Pollutant Discharge Elimination System (NPDES) permit.

4.2.2.1 Well PW-03 Abandonment

As part of plant upgrades, the Enclosure Building is being renovated and expanded. The current location of PW-03 is within the planned building expansion footprint, therefore, PW-03 will require abandonment and replacement. Well PW-3 will be abandoned in accordance with procedures provided in Appendix B of the most recent edition of the Alabama Environmental Investigation and Remediation Guidance (AEIRG). The polyvinyl chloride (PVC) casing will be removed by pulling the PVC casing from the borehole using the lifting mechanism of a drilling rig, tapered wedge assembly, or other appropriate equipment. Because of its brittleness, the PVC may be difficult to remove without perforating the casing. In accordance with the AEIRG, if the

PVC casing breaks, or the surface completion prevents the pulling of the casing from the borehole, the casing will be cut at least two feet below surface and grouted in place. After removing the casing, the borehole will be backfilled with grout. The grout will be placed into the borehole from the bottom to the top using a positive displacement method (e.g., tremie method). The top two feet of the borehole and concrete vault will be poured with concrete to insure a secure surface seal (i.e., surface plug). A geologist, who is experienced with well abandonment, will oversee the abandonment activities. The well construction log for PW-03 is included in **Appendix B**.

4.2.2.2 Extraction Well Construction

Extraction wells PW-01, PW-02 and PW-04 were installed to a depth of approximately 30 feet bgs extending to the top of the confining layer (e.g., Mooreville Chalk). Extractions wells PW-03R, RMDW-01, RMDW-02 and RMDW-03 will also be installed to approximately 30 feet bgs. Borehole and installation logs for PW-01, PW-02 and PW-04 are provided in **Appendix B**. Borehole and installation logs for new extraction wells will be provided in a construction completion report for the IRM system expansion

Boreholes for the proposed extraction wells will be approximately 12 inches in diameter and installed using the same rotosonic drilling method as described in the ADEM-approved Addendum 03 Report (Arcadis, 2013a). The proposed extraction wells will be constructed of 6-inch diameter, flush-joint PVC casing. The screened intervals of the pumping wells will extend from approximately 10 to 30 feet bgs and will be constructed of 0.010-inch, flush-joint, vee-wire 316 stainless steel well screen. The annular space of the boreholes from 8 feet to 30 feet bgs will use a 20/30-sand pack and a 30/65 fine sand seal will be installed from approximately 6 to 8 feet bgs. A cement/bentonite seal will be installed in the remaining annular space up to the bottom of the vault.

A 6-inch diameter seal will be used at the top of the extraction wells, to support the pump. Electrical leads will be routed through the seal and terminated in a junction box mounted in the vault. Water conveyance, electrical conduits, and conductors will be installed below ground.

The submersible pumps for extraction wells are designed to operate within a range of flow rates such that recovery of groundwater can be adjusted to meet changing conditions. Submersible pumps for extraction wells PW-01, PW-02, PW-03R and PW-04 will be capable of operating within a range of 5 to 15 gpm, while submersible pumps for extraction wells RMDW-01, RMDW-02 and RMDW-03 will be capable of operating

within a range of 3 to 11 gpm. Submersible pumps for the extraction wells will be Grundfos® (or equivalent) electric submersible pumps. The electrical submersible pumps are equipped with an internal check valve, chemical-resistant rubber hose, support cable, and electrical power supply cable. Construction specifications and drawings are provided in **Appendix A**.

4.2.2.3 Electrical Pump Controls

Based on operational experience since June 2015, groundwater recovery rates at the extraction wells vary. The groundwater extraction pumps are expected to operate continuously, however in some cases, operation of the submersible pumps may dry the well and require the pump to be shutdown to prevent damage to the pump. At extraction wells PW-01, PW-02, PW-03R and PW-04, an amperage and voltage monitor will be used to detect changes in amperage or voltage that may indicate a dry well. If a pump is shut off, it will be automatically restarted within a preset time delay of between 2 minutes and 1 hour. The restart time delay for the pumps is currently set at 20 minutes but may be adjusted based on encountered conditions.

For extraction wells RMDW-01, RMDW-02 and RMDW-03, a liquid level transmitter will be deployed in the extraction wells to monitor groundwater elevation in each well. Submersible pumps will be turned on and off based on the water level in the extraction wells. Set points will be determined during system start up. Additionally, groundwater elevation monitoring in extraction wells will provide additional information on extraction well performance (i.e. changes in specific yield).

4.2.2.4 Groundwater Extraction Manifold

The groundwater discharge lines from the individual extraction wells will be routed to a manifold in the equipment container. Each line of the manifold will be equipped with a check valve, flow meter, flow control valve, shutoff valve and temperature transmitter. Groundwater exiting the manifold will be combined into a header pipe and routed to the air stripper for treatment. Following treatment, groundwater will be discharge into a 4-inch diameter schedule 80 chlorinated PVC (CPVC) conveyance line from the equipment container to the collection piping for SABIC's WWTP.

4.2.2.5 Operations and Maintenance

Prior to system startup, groundwater samples and field data will be collected from monitoring wells in the Brine Unit area to provide baseline data. Samples will be

collected from Brine Unit area monitoring wells and observation wells in accordance with the AEIRG and procedures in SABIC work plans previously approved by the ADEM. The results of the groundwater sample analyses and the field data will be compared with data collected during O&M events to evaluate the performance of the remedial system.

O&M events will be conducted weekly for the first month, monthly for the first year and either quarterly or semiannually thereafter; based on system performance. During O&M visits, adjustments will be made to the system as needed to optimize the system, based on the data collected. The performance of the system will be enhanced through the fine-tuning of extraction rates and vacuums. These fine-tuning adjustments are intended to enhance the performance of the system.

4.2.2.6 O&M Reporting

A construction certification report to include startup results will be submitted to ADEM within 60 days of system activation. The report will include data collected during the first monthly sampling event. The startup report will also include an evaluation of system performance and recommendations for modifications, if necessary. The data collected during the O&M visits will be presented as site-specific checklists, data tables, and figures in the reports. An evaluation of the data, conclusions, and recommendations, if any, for modifications to the remedial system will be discussed in the report.

4.2.3 Implementation Timeline and Evaluation

The system will be activated after completion of the baseline groundwater sampling. Startup activities are estimated to take up to two weeks to complete. The water flow rates will be adjusted as necessary during the system startup period to achieve the desired groundwater capture zone. During the startup phase, depth to groundwater will be measured daily in the Brine Unit monitoring wells and observation wells. This data will be used to estimate the drawdown, capture zone, and influence of the hydraulic containment system. The data collected during system startup will also be used to calibrate the site hydrologic model.

4.3 Remedial Measures Effectiveness Evaluations

The remedial system operational and monitoring data will be compiled to evaluate the effectiveness of the remedial program. The evaluation may consist of continued

operation of the remedial system, modifications to the remedial system, decommissioning of the remedial system, or implementation of a different remedial technology. If it is determined that effectiveness of the remedial system needs to be improved, groundwater recirculation is an option that will be evaluated first. Groundwater recirculation can be easily adapted into a groundwater extraction system; much of the required infrastructure will already be present, and it would enhance the performance of the existing remedial system rather than replace it. Remedial measures evaluations will be provided in the Annual Report in accordance with the Cleanup Agreement.

5.0 Long-Term Monitoring

Routine quarterly and semi-annual monitoring events have been conducted since July 2013. A sufficient number of continuous monitoring events have been completed to evaluate the frequency and number of wells that need to be monitored to show continued treatment, remedial effectiveness, and Cleanup Agreement compliance. Therefore, the long-term monitoring program requires re-evaluation, updates, and modification. The long-term monitoring network is provided on **Figure 9** and Table III.1 of the Cleanup Agreement.

The current monitoring well network consists of 27 monitoring wells and 5 observation wells for a total of 32 groundwater locations, which are used to:

- Monitor groundwater to document COCs concentrations at the site over time,
- Monitor groundwater to ensure that COCs are not transported offsite; and,
- Measure the effectiveness of the remedial system.

5.1.1 Effectiveness Well Locations

Effectiveness wells were installed during various phases of the groundwater investigation and are used to evaluate the reduction of COC concentrations and monitor effectiveness of the remedial measures. Effectiveness (EFF) wells consist of 18 monitoring wells (MW-1 through MW-12, MW-14 through MW-17, MW-19, and MW-27) and 5 observation wells (OW-1 through OW-5). As provided in written communications to the ADEM and in accordance with the Cleanup Agreement, EFF wells MW-3R and OW-4R replaced MW-3 and OW-4, respectively, due to damage to these wells during construction activities. Based on over six continuous years of groundwater elevation measurements, well MW-19 is located hydraulically upgradient

of an existing boundary well (MW-26), so well MW-19 will be modified from a boundary well to an EFF well.

5.1.2 Boundary Well Locations

Boundary wells consisting of 7 monitoring wells (MW-13, MW-18, MW-20, MW-21, MW-22, MW-25, and MW-26) were designed to evaluate the current and future extent of the migration of COC in groundwater. The boundary wells are used to verify that COCs are not migrating off-site at concentrations exceeding remedial goals.

5.1.3 Background Well Locations

Background wells consist of two monitoring wells (MW-23 and MW-24). The background wells were selected due to the distance from the COC plume and the plant footprint and to allow for comparisons to background water quality.

5.2 Sampling Program

Sampling performed as part of the Long-Term Monitoring Program will be completed in accordance with the following ADEM, EPA, and previously approved plans:

- The most recent version of the AEIRG;
- EPA Region 4 Science and Ecosystem Support Division (SESD) Field Branches Quality System and Technical Procedures (replaces the Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM);
- SABIC groundwater and surface water sampling plans and Addendums previously approved by the ADEM; and,
- The Cleanup Agreement.

5.2.1 Modified Sample Collection Frequency

The Cleanup Agreement was modified in May 2016 with adjustments to the groundwater sample collection frequency from quarterly to semi-annual. The reduction in sample frequency was justified by the successful response and reduced PCE mass resulting from IRM system operations that began in June 2015.

Based on the results of 17 monitoring events completed from July 2013 to August 2018, the monitoring frequency was optimized in accordance with EPA's Long-Term Monitoring Optimization guidance (EPA, 2005b) and the AEIRG. The sampling schedule is documented in the SABIC Long-Term Monitoring Technical Memorandum in **Appendix C**. The Technical Memorandum provides trend analyses used to update the sample frequency established in the May 2016 Cleanup Agreement modification. The analysis of monitoring frequency included establishing a trend for the PCE in each well then optimizing the sampling frequency based on the results.

In summary, sampling frequency optimization conducted for the existing monitoring network resulted in 21 out of the 32 monitoring wells identified for annual monitoring and 11 of the wells identified for continued semi-annual monitoring. The optimization indicated that the remedial effectiveness, plume movement, and statistical trends will be sufficiently monitored using the optimized sampling frequency developed using EPA's guidance. **Table 1** provides the monitoring network and sampling schedule resulting from the sample schedule optimization.

5.2.2 Sample Analyte Selection

Each groundwater sample will be analyzed for VOCs using EPA Method 8260, pH using Method 9040C, and alkalinity using Method 2320. Field parameters, including dissolved oxygen (DO), turbidity, pH, conductivity, oxidation reduction potential (ORP), and temperature will be measured in all active wells in the long-term monitoring network during each sampling event.

5.3 Remedial Effectiveness Evaluation

5.3.1 Trend Analyses

Time-series plots and intrawell Shewhart-Cumulative Sum (CUSUM) control charts will be used annually to evaluate trends of PCE concentration for effectiveness wells. PCE is referenced in this section because it is the primary COC; however, all COCs will be evaluated, if detected. Time-series plots will also provide for visual interpretations of trends. Trends will be evaluated only for wells where PCE was detected for a sufficient number of sampling events to develop valid trends. Trends will also be developed for alkalinity and pH in groundwater.

5.3.2 Effectiveness Wells Monitoring

Effectiveness wells are monitored to benchmark remedial effectiveness across the extent of the COC plumes. The effectiveness monitoring wells will be evaluated based on comparison of alkalinity, pH, and PCE predicted by the site-wide groundwater model to detected alkalinity, pH, and PCE concentration in groundwater samples. The site-wide groundwater model is capable of predicting concentrations at effectiveness wells through a planning horizon of 30 years or more.

5.3.3 Boundary Wells Monitoring

Sample results from the boundary wells collected during the periodic sampling events will be compared to the PCE remedial goal (i.e., Groundwater Protection Standard) of 5 µg/L and pH remedial goal of less than 8.5 SU. A series of actions will be based on the comparisons. These actions may include:

1. If sample results from boundary well samples are below the GWPS, this will indicate that the COC plume is not migrating beyond the boundary wells.

2. If sample results are above the GWPS, this will trigger the collection and analysis of a verification sample from the monitoring well with the exceedance within 30 days of SABIC's receipt of the final laboratory data from the periodic sampling event showing an increase over the remedial goal for PCE of 5 µg/L or pH of 8.5 SU:

    a. If the verification sample result is below the remedial goal, periodic monitoring will resume and SABIC will include all verification sampling results in the annual report.

    b. If the verification sample result is above the remedial goal, SABIC will notify ADEM of the verified exceedance within 30 days of receipt of the final laboratory data for the verification samples. The notification letter will include sampling results from the periodic and verification sampling events and notification that SABIC will increase the frequency of periodic sampling at affected boundary wells until concentrations in the affected wells are below the remedial goal or for a minimum of four consecutive events with increased sampling frequency. An assessment of the cause of the exceedance(s) will be performed following the fourth event.

c. If the concentrations of COC have not decreased below their respective remedial goal in the affected boundary wells within the four subsequent/ consecutive sampling events, an Assessment Plan will be developed. The Assessment Plan will evaluate groundwater within the vicinity of the boundary well(s) with a concentration above the remedial goal and will be submitted to ADEM.

d. Additional remedial measures will be implemented if justified by the results of the Assessment Plan to maintain control of groundwater at the site and/or modify the boundary well network, as needed.

5.4 Monitoring Well Network Optimization

The long-term monitoring program will be re-evaluated annually during operation of the remedial system. Spatial and temporal trends, groundwater modeling, and qualitative analyses may be used to evaluate the long-term monitoring well network.

5.4.1 Spatial Analysis

Spatial analyses of the distribution of COCs throughout the site and correlation of concentrations between monitoring wells may be performed to re-evaluate/identify the optimum number and location of boundary and effectiveness wells in the network. Spatial analyses may include “spatial tolerance” metrics to estimate the efficacy of the network when selected wells are removed sequentially from the network and/or groundwater modeling shows additional monitoring wells are needed where data gaps are predicted to exist. Monitoring wells may be removed from routine sample collection (not water level measurements) where analysis shows COC concentrations are predicted as highly unlikely to increase.

5.4.2 Temporal Analysis

Temporal analyses of the distribution of COCs in monitoring wells at the site may be performed to re-evaluate/identify the optimum frequency of sampling events at boundary and effectiveness wells in the network. Techniques developed by the EPA (EPA, 2005b) and the Air Force Center for Environmental Excellence (AFCEE, 2005) will be used for temporal analyses.

5.5 Reporting

In accordance with Part V of the Cleanup Agreement, the effectiveness of the system and long-term monitoring program will be evaluated annually after startup and continued until all remedial activities have been completed and goals met as indicated by the ADEM. The reports will include data from groundwater monitoring, analysis of data, remedial actions (if any), and conclusions regarding the effectiveness of the monitoring program. If the analysis of the data warrants any change to the remedial action program, SABIC will include recommendations for revisions in the annual report. The annual reports will include:

- Site history or reference to previously submitted site history.
- Descriptions of remedial measures activities over the past year.
- Groundwater monitoring activities, including:
    - Sample locations and dates
    - Analytical methods
    - Method reporting limits for each constituent reported
- A map of the groundwater monitoring system,
- Potentiometric surface maps,
- Isoconcentration maps,
- Tables of boundary well concentrations with comparison to the current remedial goal,
- Tables of effectiveness well concentrations with comparison to model-predicted concentrations,
- Trend analysis, and
- Recommendations for optimizing the interim remedial measures and/or the long-term monitoring well program.

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Table

Table 1 Long-Term Groundwater Monitoring Network and Sampling Schedule

WELL NUMBER	WELL TYPE	WELL LATITUDE	WELL LONGITUDE	UNIT(S) MONITORED	WELL DEPTH (ft)	GROUND ELEVATION (ft. MSL)	TOP-OF-RISER (ft. MSL)	SCREENED INTERVAL (ft. MSL)		SAMPLING SCHEDULE
MW-1	EFF	86°31'26.34"W	32°18'30.36"N	PCE & Caustic	29.00	234.85	234.51	220.51	205.51	Semi-Annual
MW-2	EFF	86°31'27.50"W	32°18'33.43"N	PCE & Caustic	28.71	233.53	233.38	219.67	204.67	Semi-Annual
MW-3R	EFF	86°31'26.84"W	32°18'28.31"N	PCE & Caustic	28.30	234.89	234.09	220.79	205.79	Annual
MW-4	EFF	86°31'23.61"W	32°18'33.63"N	PCE & Caustic	29.40	233.23	235.84	221.44	206.44	Semi-Annual
MW-5	EFF	86°31'23.55"W	32°18'28.84"N	PCE & Caustic	33.40	235.2	234.86	216.46	201.46	Annual
MW-6	EFF	86°31'32.76"W	32°18'29.59"N	PCE & Caustic	27.95	232.85	235.65	217.70	207.70	Semi-Annual
MW-7	EFF	86°31'23.73"W	32°18'35.58"N	PCE & Caustic	33.10	232.61	235.84	212.74	202.74	Semi-Annual
MW-8	EFF	86°31'34.33"W	32°18'36.44"N	PCE & Caustic	31.45	230.63	233.60	212.15	202.15	Annual
MW-9	EFF	86°31'43.49"W	32°18'46.08"N	PCE & Caustic	29.35	230.99	234.07	214.72	204.72	Annual
MW-10	EFF	86°31'51.64"W	32°18'50.38"N	PCE & Caustic	30.25	230.54	233.69	213.44	203.44	Semi-Annual
MW-11	EFF	86°31'41.13"W	32°18'27.83"N	PCE & Caustic	37.40	235.54	238.70	216.30	201.30	Annual
MW-12	EFF	86°31'35.49"W	32°18'18.55"N	PCE & Caustic	31.11	231.83	234.93	213.82	203.82	Annual
MW-13	BDY	86°31'16.60"W	32°18'15.32"N	PCE & Caustic	31.55	231.69	234.95	213.40	203.40	Annual
MW-14	EFF	86°31'06.36"W	32°18'23.80"N	PCE & Caustic	35.00	237.06	239.94	214.94	204.94	Annual
MW-15	EFF	86°31'02.50"W	32°18'44.86"N	PCE & Caustic	29.00	237.62	240.66	221.66	211.66	Annual
MW-16	EFF	86°31'40.49"W	32°18'59.22"N	PCE & Caustic	27.05	228.51	231.53	214.48	204.48	Annual
MW-17	EFF	86°31'20.54"W	32°18'57.65"N	PCE & Caustic	26.30	231.59	234.95	218.65	208.65	Annual
MW-18	BDY	86°32'06.10"W	32°19'00.16"N	PCE & Caustic	30.55	231.25	234.17	213.62	203.62	Annual
MW-19	EFF	86°32'07.46"W	32°18'52.23"N	PCE & Caustic	30.88	228.96	232.06	211.18	201.18	Semi-Annual
MW-20	BDY	86°31'56.29"W	32°18'32.39"N	PCE & Caustic	30.10	233.67	236.83	216.73	206.73	Annual
MW-21	BDY	86°31'56.56"W	32°18'18.17"N	PCE & Caustic	29.10	231.13	234.10	215.00	205.00	Annual
MW-22	BDY	86°31'34.53"W	32°18'03.87"N	PCE & Caustic	17.63	211.77	214.33	201.70	196.70	Annual
MW-23	BKG	86°31'17.29W	32°17'37.13"N	PCE & Caustic	31.95	196.19	199.40	177.45	167.45	Annual
MW-24	BKG	86°30'17.21"W	32°18'13.65"N	PCE & Caustic	29.95	226.13	229.17	209.22	199.22	Annual
MW-25	BDY	86°31'29.49"W	32°19'18.54"N	PCE & Caustic	28.18	220.68	222.89	204.71	194.71	Annual
MW-26	BDY	86°32'16.12"W	32°18'58.33"N	PCE & Caustic	22.40	220.72	223.56	211.16	201.16	Annual
MW-27	EFF	86°31'25.89"W	32°18'36.02"N	PCE & Caustic	31.88	233.03	235.92	214.04	204.04	Semi-Annual
OW-1	EFF	86°31'26.79"W	32°18'32.00"N	PCE & Caustic	28.90	234.19	233.71	224.81	204.81	Semi-Annual
OW-2	EFF	86°31'26.79"W	32°18'31.44"N	PCE & Caustic	31.35	234.31	233.77	222.42	202.42	Annual
OW-3	EFF	86°31'26.83"W	32°18'31.20"N	PCE & Caustic	30.40	234.57	234.11	223.71	203.71	Semi-Annual
OW-4R	EFF	86°31'26.81"W	32°18'30.37"N	PCE & Caustic	28.40	234.81	234.41	226.01	206.01	Semi-Annual
OW-5	EFF	86°31'25.56"W	32°18'30.42"N	PCE & Caustic	29.40	235.26	234.82	225.42	205.42	Annual
PW-1	REC	86°31'26.79"W	32°18'31.63"N	PCE & Caustic	26.10	234.21	233.47	227.37	207.37	Quarterly
PW-2	REC	86°31'24.90"W	32°18'33.89"N	PCE & Caustic	31.29	233.48	232.61	221.32	201.32	Quarterly
PW-3R	REC	86°31'25.19"W	32°18'30.97"N	PCE & Caustic	31.13	235.09	234.48	223.35	203.35	Quarterly
PW-4	REC	86°31'23.85"W	32°18'35.30"N	PCE & Caustic	30.86	232.24	231.27	220.41	200.41	Quarterly
RMDW-1	REC	TBD	TBD	PCE & Caustic	TBD	TBD	TBD	TBD	TBD	Quarterly
RMDW-2	REC	TBD	TBD	PCE & Caustic	TBD	TBD	TBD	TBD	TBD	Quarterly
RMDW-3	REC	TBD	TBD	PCE & Caustic	TBD	TBD	TBD	TBD	TBD	Quarterly

* Well Type:

EFF – Effectiveness Monitoring Well

BKG – Background Well

BDY - Boundary Monitoring Well

REC – Recovery Well

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Figures

LEGEND

- APPROXIMATE SABIC PROPERTY BOUNDARY
- PLANT FENCE LINE
- BRINE RECOVERY UNIT

0 0.5 1

Miles

SABIC
BURKVILLE, ALABAMA
REMEDIAL PLAN

SITE LOCATION MAP AND TOPOGRAPHY

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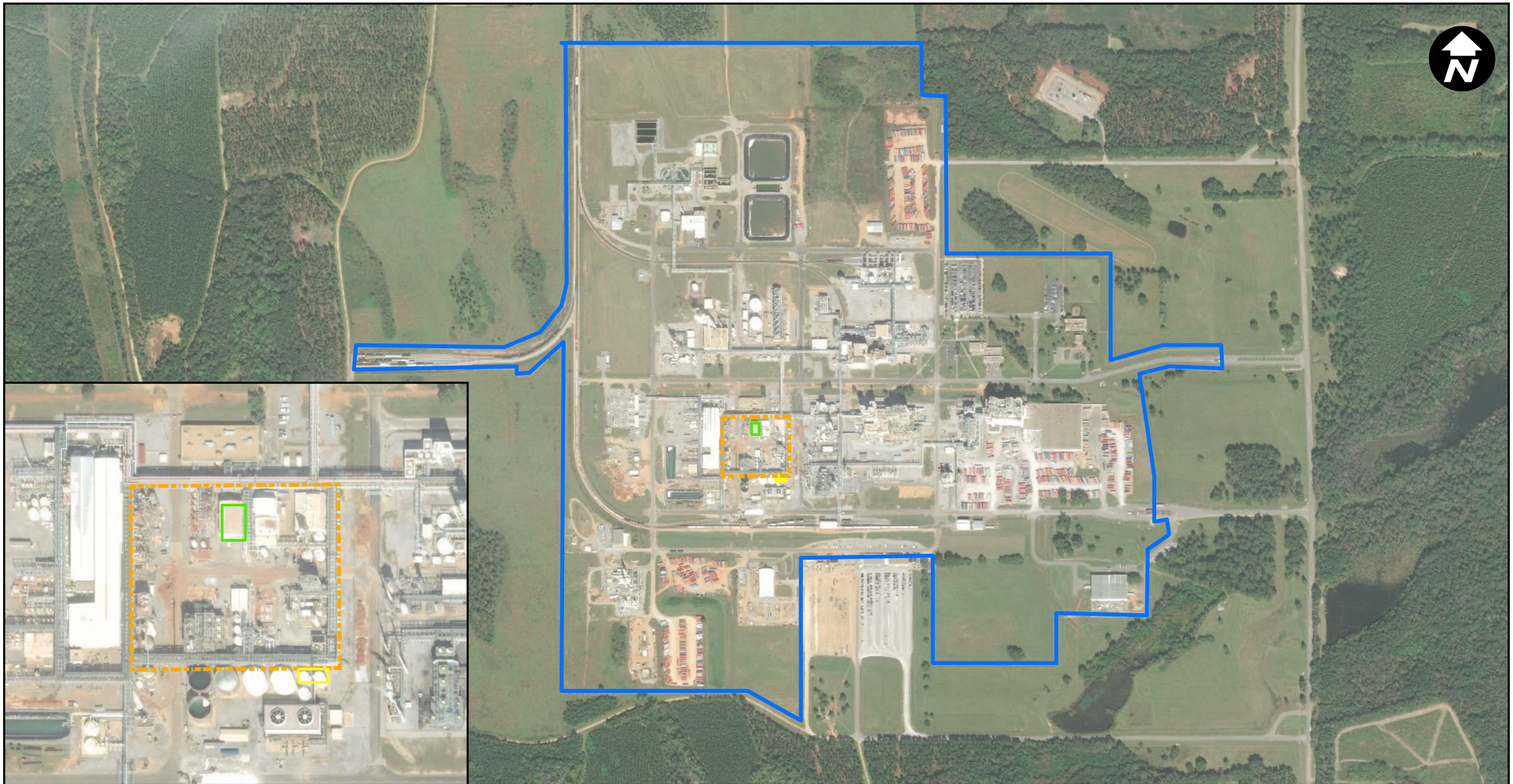
FIGURE
1



LEGEND

- PLANT FENCE LINE
- BRINE UNIT LOCATION
- CAUSTIC STORAGE TANKS
- COMPRESSION BUILDING

0 1,000 2,000

SCALE IN FEET

SABIC
BURKVILLE, ALABAMA
REMEDIAL PLAN

SITE LAYOUT MAP

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FIGURE
2

Alabama River

N

0 5 10

Miles

LEGEND

- APPROXIMATE SABIC PROPERTY BOUNDARY
- Alluvial, coastal, and low terrace deposits
- Clayton Formation
- Coker Formation
- Cusseta Sand Member of the Ripley Formation
- Demopolis Chalk
- Emuckfaw Group undifferentiated in part
- Eutaw Formation
- Gordo Formation
- High terrace deposits
- Kowaliga Gneiss
- Mooreville Chalk
- Prairie Bluff Chalk
- Ripley Formation
- Tuscaloosa Group undifferentiated
- Water

SABIC
BURKVILLE, ALABAMA
REMEDIAL PLAN

SITE GEOLOGY

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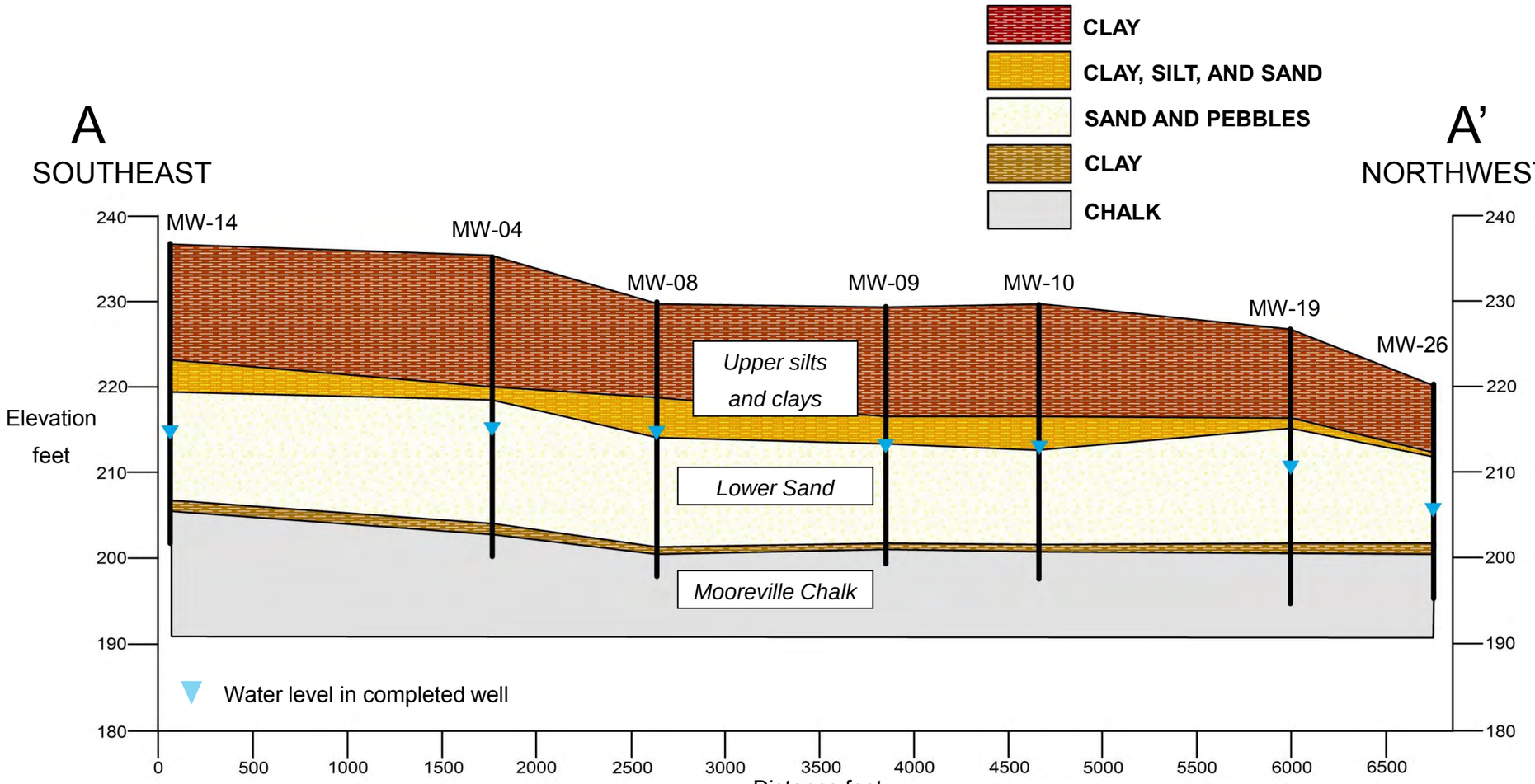
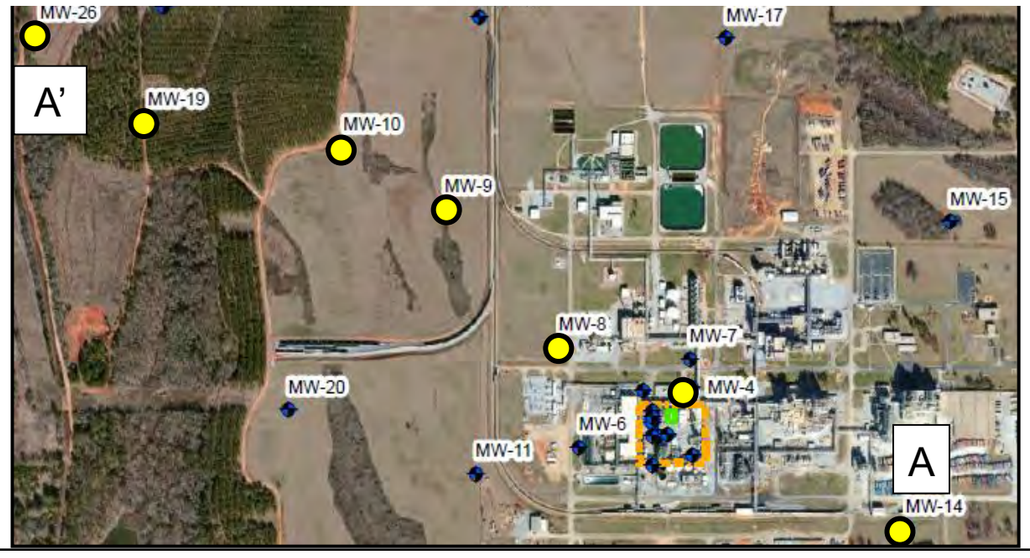
FIGURE
3





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SABIC

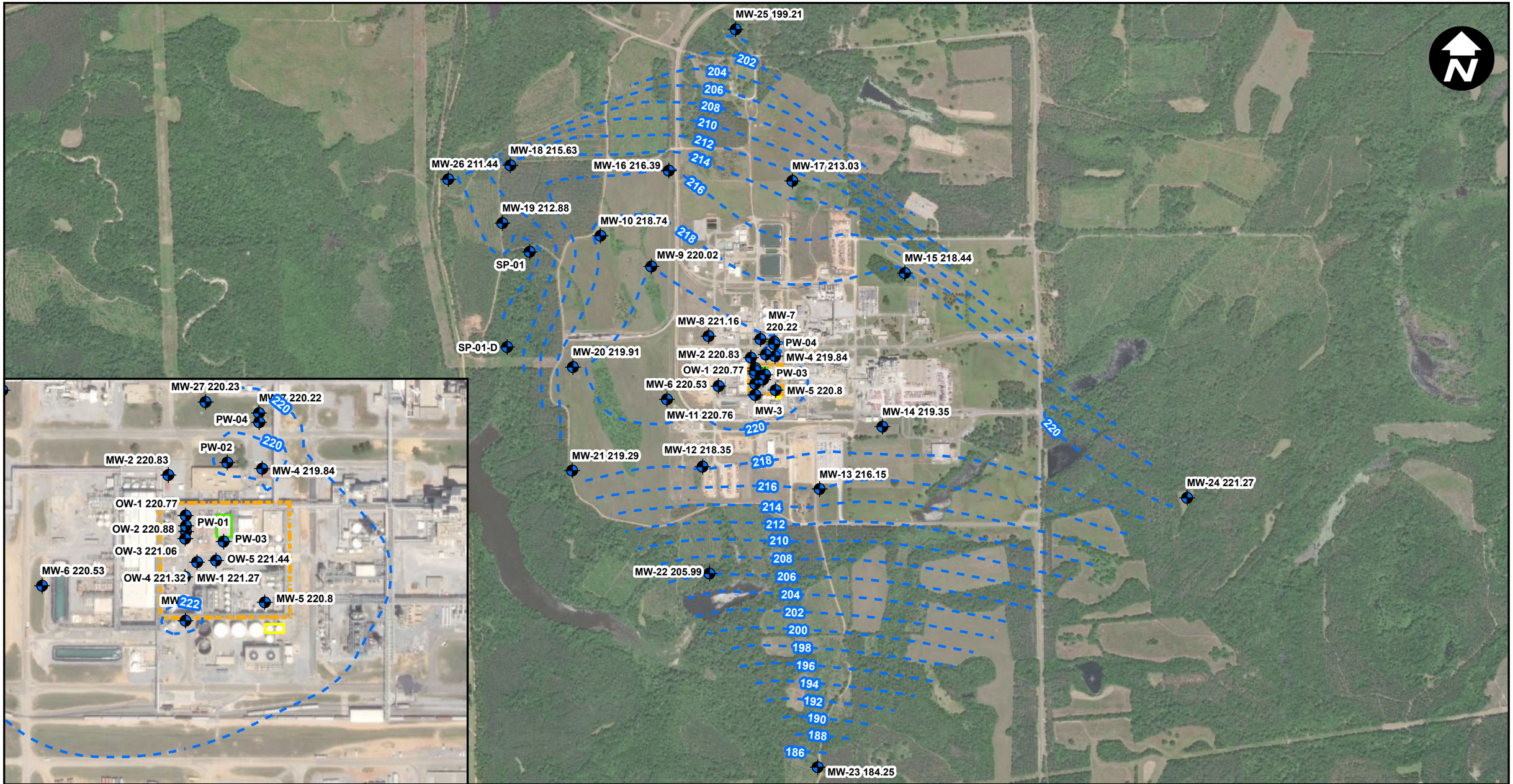
BURKVILLE, ALABAMA

REMDIAL PLAN

Figure 4
CROSS SECTION

Note:

Vertical exaggeration = 50x



LEGEND

- MW-ID ELEVATION — MONITORING WELL AND GROUNDWATER ELEVATION (FEET AMSL)
- ELEV — GROUNDWATER ELEVATION CONTOUR
- BRINE UNIT LOCATION
- CAUSTIC STORAGE TANKS
- COMPRESSION BUILDING

0 1,000 2,000

SCALE IN FEET

SABIC
BURKVILLE, ALABAMA
REMDIAL PLAN

March 2019 Groundwater Elevations and Contours

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FIGURE 5

MW-25 <MRL
MW-18 <MRL
MW-26 <MRL
MW-16 <MRL
MW-17 <MRL
MW-19 0.005
MW-10 0.054
SP-01 <MRL
MW-9 0.043
MW-15 <MRL
0.005 mg/L
0.01 mg/L
0.025 mg/L
PW-04 0.003
MW-7 0.003
SP-01-D 0.001
MW-8 0.008
MW-27 <MRL
MW-4 0.331
MW-2 0.018
PW-01 0.32
PW-02 NS
MW-20 0.003
0.01 mg/L
OW-1 0.038
MW-1 0.002
PW-03 NS
OW-3 0.124
MW-6 0.016
OW-2 0.056
OW-5 <MRL
0.05 mg/L
MW-11 0.004
OW-4R 0.036
MW-5 <MRL
MW-3 NS
MW-14 <MRL
MW-12 0.007
MW-21 <MRL
MW-13 <MRL
MW-22 <MRL
0 1,000 2,000 Feet
0 100 200 Feet
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND

- MONITORING WELL AND PCE LEVEL

PCE Concentration mg/L

Contour

- 0.005 mg/L
- 0.01 mg/L
- 0.025 mg/L
- 0.05 mg/L
- 0.1 mg/L
- BRINE UNIT LOCATION
- CAUSTIC STORAGE TANKS
- COMPRESSION BUILDING

SABIC
BURKVILLE, ALABAMA
REMEDIAL PLAN

March 2019 PCE ISOCONCENTRATIONS

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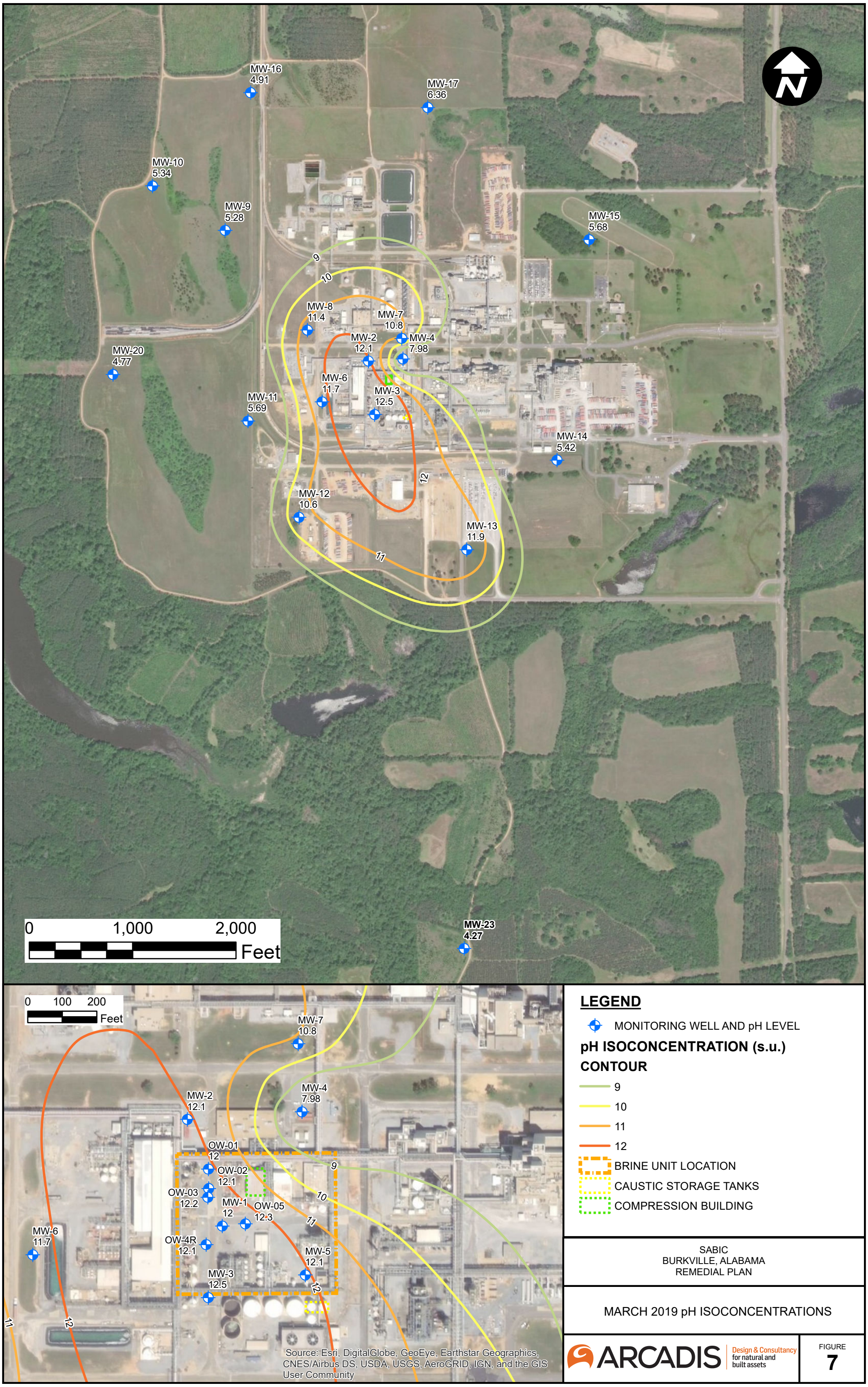
FIGURE
6



LEGEND

- MONITORING WELL AND pH LEVEL

pH ISOCONCENTRATION (s.u.) CONTOUR

- 9
- 10
- 11
- 12
- BRINE UNIT LOCATION
- CAUSTIC STORAGE TANKS
- COMPRESSION BUILDING

SABIC
BURKVILLE, ALABAMA
REMEDIAL PLAN

MARCH 2019 pH ISOCONCENTRATIONS

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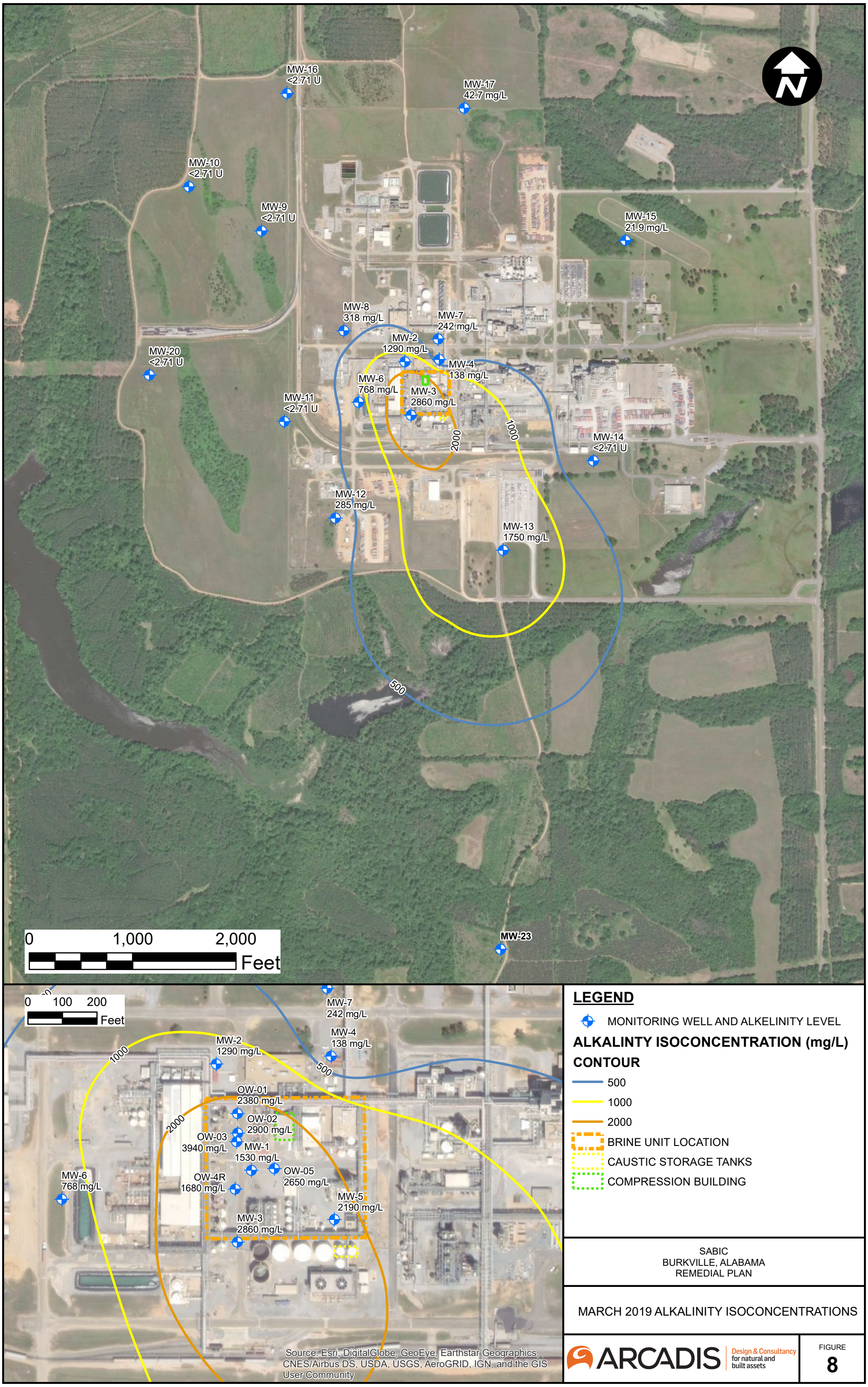
FIGURE
7



LEGEND

- MONITORING WELL AND ALKELINITY LEVEL

ALKALINTY ISOCONCENTRATION (mg/L) CONTOUR

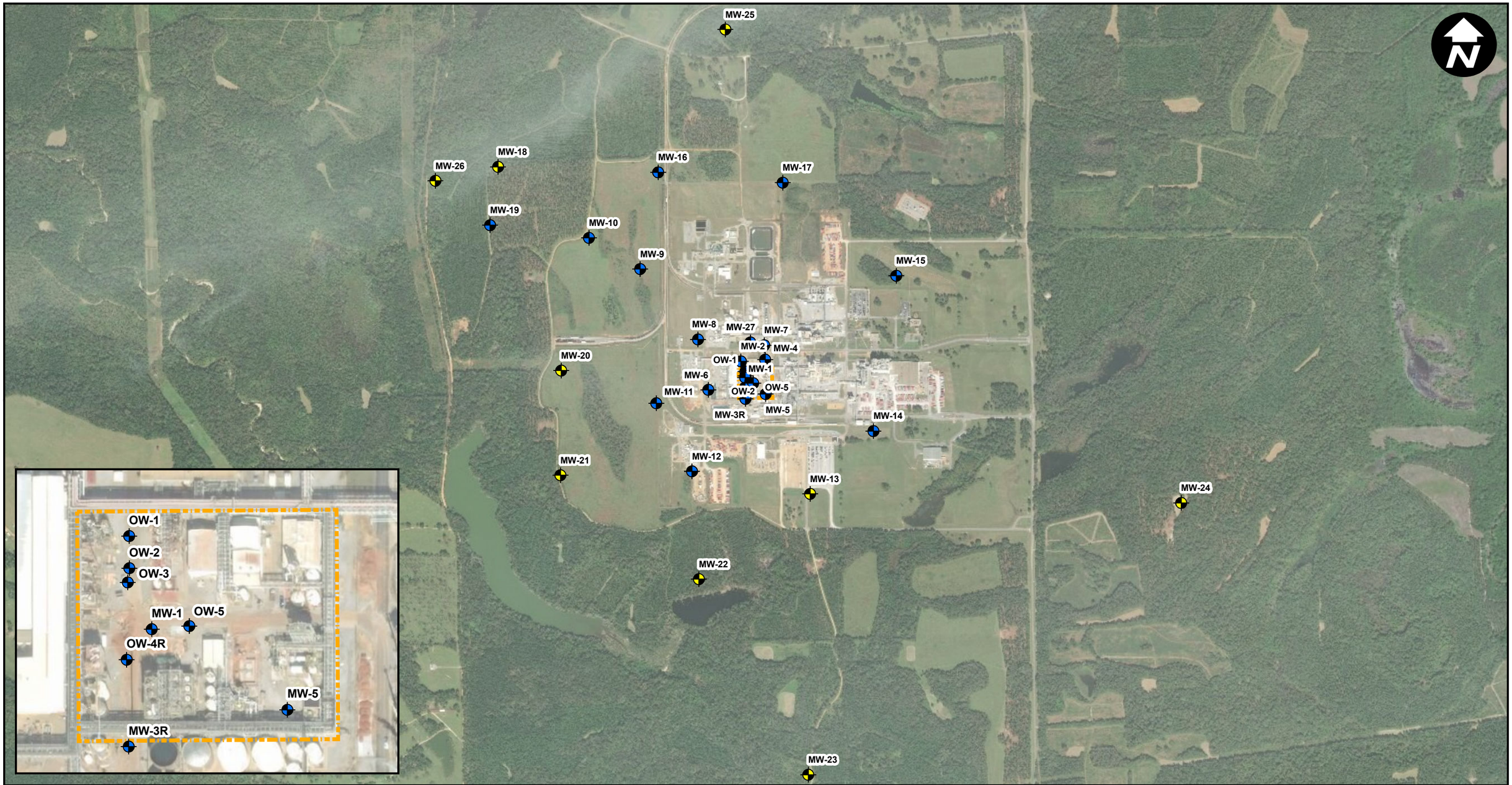
- 500
- 1000
- 2000
- BRINE UNIT LOCATION
- CAUSTIC STORAGE TANKS
- COMPRESSION BUILDING

SABIC
BURKVILLE, ALABAMA
REMEDIAL PLAN

MARCH 2019 ALKALINITY ISOCONCENTRATIONS

ARCADIS Design & Consultancy for natural and built assets

FIGURE
8



LEGEND

Monitoring Well Type

- BOUNDARY WELL (BACKGROUND MW-23 AND MW-24)
- EFFECTIVENESS WELL
- BRINE UNIT LOCATION

NOTE: LOCATION OF REPLACEMENT WELLS MW-3R AND OW-4R ARE APPROXIMATE

0 1,000 2,000

SCALE IN FEET

SABIC
BURKVILLE, ALABAMA
REMEDIAL PLAN

BOUNDARY AND EFFECTIVENESS WELLS

ARCADIS Design & Consultancy for natural and built assets

FIGURE 9

ARCADIS

Appendix A

Remedial System Design Plans

CITY: WPB, FL DIV/GROUP: EN DB: B.OLIVA LD: PIC: PM: W.VOGELSONG TM: D.MCGLONE LYR:ON=*;OFF=*REF*
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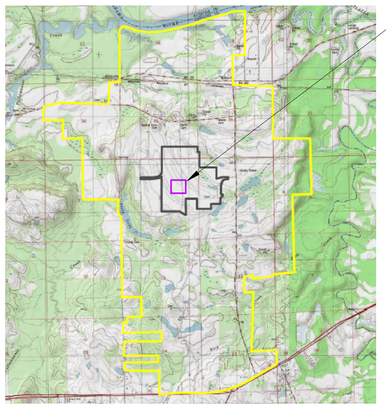
DESIGN DRAWINGS

BRINE SYSTEM EXPANSION

SABIC
ONE PLASTICS DRIVE,
BURKVILLE, ALABAMA
LOWNDES COUNTY



LOCATION MAP
NOT TO SCALE

APRIL 2019

ARCADIS

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INDEX TO DRAWINGS

SITE HEALTH AND SAFETY

1. CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL HEALTH AND SAFETY CODES AT ALL TIMES.
2. ALL EMPLOYEES OF THE CONTRACTOR WHO MAY COME IN CONTACT WITH CONTAMINATED SOIL OR GROUNDWATER SHALL BE CURRENT WITH THEIR 40-HOUR HAZWOPER TRAINING AND 8-HOUR REFRESHER.
3. ALL CONTRACTOR STAFF WHO WILL WORK ON-SITE MUST HAVE OSHA 10 HOUR HEALTH AND SAFETY TRAINING COMPLETION CERTIFICATE.
4. THE CONTRACTOR SHALL ABIDE BY ARCADIS HASPS AND APPLICABLE SABIC HEALTH AND SAFETY PROTOCOLS/GUIDELINES.
5. CONTRACTOR IS TO FOLLOW SABIC SITE ORIENTATION TRAINING AND ALL PLANT PROCEDURES AND PROTOCOLS AT ALL TIMES.
6. CONTRACTOR IS TO FOLLOW SABIC SITE ORIENTATION TRAINING AND ALL PLANT PROCEDURES AND PROTOCOLS AT ALL TIMES. CONTRACTOR IS RESPONSIBLE FOR PROVIDING AND MAINTAINING SAFE ACCESS TO WORK AREAS AT ALL TIMES.
7. CONTRACTOR RESPONSIBLE FOR OBTAINING AND COMPLYING WITH ALL SABIC PERMITS
8. CONTRACTOR RESPONSIBLE FOR COMPLYING WITH THE INTERNATIONAL BUILDING, PLUMBING AND MECHANICAL CODES.
9. CONTRACTOR RESPONSIBLE FOR PROVIDING LIGHTED BARRICADES AND OTHER SAFETY EQUIPMENT AS NECESSARY TO PROTECT ALL WORKERS 24 HOURS A DAY DURING CONSTRUCTION. BARRICADES TO BE IN ACCORDANCE WITH MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS (MUTCD), FEDERAL HIGHWAY ADMINISTRATION (FHA). USE BARRICADE TAPE, CONES AND OTHER SAFETY DEVICES AS INSTRUCTED IN THE SABIC SITE ORIENTATION TRAINING.
10. THE CONTAMINANTS OF CONCERN INCLUDE CVOCS THAT HAVE BEEN DETECTED IN THE SITE'S GROUNDWATER. ADDITIONAL SITE INFORMATION MAY BE PROVIDED UPON REQUEST.
11. IT IS CONTRACTOR'S RESPONSIBILITY FOR EDUCATING ITS SUPERVISORS, EMPLOYEES, AND SUBCONTRACTORS OF ALL HEALTH AND SAFETY REQUIREMENTS. CONTRACTOR IS RESPONSIBLE FOR WORKER SAFETY AND MAINTENANCE OF TRAFFIC DURING CONSTRUCTION.
12. AT A MINIMUM, ALL ON-SITE CONTRACTOR PERSONNEL SHALL BE IN LEVEL D WHICH IS DEFINED AS HARD HAT, STEEL-TOED SHOES, AND SAFETY GLASSES.
13. CONTRACTOR SHALL PROVIDE SAFETY SIGNS FOR TRENCHING.
14. EXCLUSION ZONES SHALL BE CLEARLY SECTIONED OFF USING, BUT NOT RESTRICTED TO, DELINEATORS, CAUTION TAPE, AND FENCING.
15. WORK TO BE PERFORMED BETWEEN 7:00AM – 5:00PM, MONDAY THROUGH FRIDAY.
16. ALL WORK UNDER THIS CONTRACT SHALL BE PERFORMED IN A MANNER WHICH DOES NOT DISRUPT SABIC'S NORMAL BUSINESS ACTIVITIES, OUTSIDE OF THE CONSTRUCTION AREA.

GENERAL NOTES

1. DETERMINING THE ACTUAL LOCATION OF ANY EXISTING UTILITY IS THE CONTRACTORS RESPONSIBILITY. BEFORE COMMENCING WORK, IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONTACT THE VARIOUS UTILITY COMPANIES WHICH MAY HAVE BURIED OR AERIAL UTILITIES WITHIN OR NEAR THE CONSTRUCTION AREA. (PROVIDE 48 HOURS MINIMUM NOTICE TO ALL UTILITY COMPANIES PRIOR TO BEGINNING INSTALLATION CONSTRUCTION). THE CONTRACTOR IS FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT OCCUR DUE TO CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES. THE OWNER AND ENGINEER ASSUME NO LIABILITY FOR ANY DAMAGES SUSTAINED OR COSTS INCURRED BECAUSE OF THE CONTRACTOR'S OPERATIONS IN THE VICINITY OF EXISTING UTILITIES OR STRUCTURES, NOR FOR TEMPORARY BRACING AND SHORING OF SAME. SCHEDULE AND EXECUTE ALL WORK INVOLVING EXISTING UTILITIES TO MINIMIZE INTERRUPTION OF SERVICES. WHENEVER SUCH INTERRUPTION IS NECESSARY FOR COMPLETION OF THE WORK, NOTIFY THE ENGINEER AND THE OWNER AT LEAST 48 HOURS IN ADVANCE. ALL WORK TO REPAIR/RESTORE UTILITY SERVICE SHALL BE PERFORMED AS REQUIRED BY THE APPROPRIATE UTILITY. IF IT IS NECESSARY TO SHORE, BRACE, OR SWING A UTILITY, CONTACT THE UTILITY COMPANY OR DEPARTMENT AFFECTED AND OBTAIN THEIR PERMISSION REGARDING THE METHOD TO USE FOR SUCH WORK. ALL COSTS RELATED TO SERVICE, MAINTENANCE, INTERRUPTION, REPAIR, RELOCATION AND RESTORATION ARE TO BE INCLUDED IN THE CONTRACTOR'S BID. ANY DELAY OR INCONVENIENCE CAUSED TO THE CONTRACTOR BY THE VARIOUS UTILITIES SHALL BE INCIDENTAL TO THE CONTRACT, AND NO EXTRA COMPENSATION SHALL BE PAID.
2. FIELD CONDITIONS MAY NECESSITATE SLIGHT ALIGNMENT AND/OR GRADE DEVIATIONS FROM THOSE WHICH ARE INDICATED ON THE PLANS. ANY DEVIATIONS OR ADJUSTMENTS SHALL FIRST BE APPROVED BY THE ENGINEER BEFORE BEING PERFORMED.
3. THE CONTRACTOR IS RESPONSIBLE FOR ALL CONSTRUCTION STAKING TO INCLUDE HORIZONTAL AND VERTICAL CONTROL FOR ALIGNMENT OF WORK.
4. ALL TREES, SHRUBS, ETC., ALONG THE LINES OF CONSTRUCTION SHALL BE PROTECTED.
5. RESTORE ALL PROPERTY AFFECTED BY THIS WORK TO A CONDITION EQUAL TO OR BETTER THAN EXISTED BEFORE COMMENCING CONSTRUCTION WORK, UNLESS SPECIFICALLY EXEMPTED BY THE DRAWINGS. RESTORATION WORK INCLUDES, BUT IS NOT LIMITED TO PAVEMENT, BASE, SUBGRADE, CONCRETE CURBS, THERMOPLASTIC TRAFFIC MARKINGS, SIDEWALKS, SODDING, ETC. THE CONTRACTOR SHALL RECONSTRUCT ALL FACILITIES TO PRE-CONSTRUCTION GRADES AND DIMENSIONS, THE ACQUISITION OF SUCH ADDITIONAL INFORMATION SHALL BE THE CONTRACTOR'S RESPONSIBILITY, AND AT HIS EXPENSE. RECONSTRUCT ALL FACILITIES TO PRE-CONSTRUCTION GRADES AND DIMENSIONS, UNLESS OTHERWISE NOTED. WATER, FERTILIZE AND SUPPLY ALL ITEMS AND CARE NECESSARY TO MAINTAIN THE HEALTH OF ALL NEW VEGETATION AND VEGETATION REPLACEMENT, AT NO EXPENSE TO THE OWNER, IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
6. PROVIDE ANY TEMPORARY CONTROLS AND/OR STRUCTURES REQUIRED TO MAINTAIN SUITABLE AND SAFE WORKING CONDITIONS AT ALL TIMES. SUCH ITEMS SHALL BE REMOVED ONCE THAT PORTION OF WORK HAS BEEN COMPLETED.
7. STORE CONSTRUCTION EQUIPMENT AND MATERIALS ONLY IN THOSE AREAS APPROVED BY THE ENGINEER. SECURITY OF CONSTRUCTION EQUIPMENT AND MATERIALS IS THE RESPONSIBILITY OF THE CONTRACTOR.
8. UPON COMPLETION OF THE PROJECT, PROVIDE AN AS-BUILT SURVEY OF ALL IMPROVEMENTS IN AUTOCAD FORMAT UTILIZING THE CONSTRUCTION PLANS AS A BASIS. THE AS-BUILT SURVEY MUST BE PREPARED BY A ALABAMA REGISTERED SURVEYOR AND MAPPER. AS A MINIMUM, AS-BUILT DRAWINGS FOR PIPELINE CONSTRUCTION SHALL SHOW CONSTRUCTED HORIZONTAL LOCATIONS OF ALL BENDS, FITTINGS AND VALVES. THE AS-BUILT SURVEY SHALL BE TIED INTO THE STATE PLANE COORDINATE SYSTEM.
9. SPECIAL EMPHASIS ON EXCAVATION SAFETY AND TRENCH CONSTRUCTION:
   A. OSHA'S EXCAVATION SAFETY STANDARDS 29, CFR PART 1926.650-652 SUBPART P, IS CONSIDERED AS COMPLIMENTARY TO THESE CONTRACT DOCUMENTS. IF THERE IS ANY DUPLICATION, REDUNDANCY OR CONFLICT BETWEEN THE STIPULATIONS OF THESE CONTRACT DOCUMENTS AND THOSE STANDARDS, THE MOST STRINGENT REQUIREMENT SHALL GOVERN.
   B. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT EXCAVATIONS DO NOT ENDANGER WORKMEN, EXISTING STRUCTURES, UTILITIES, OR OTHER FACILITIES. IF SUCH CONDITIONS OCCUR WHICH MAY ENDANGER WORKMEN, EXISTING STRUCTURES, UTILITIES, OR OTHER FACILITIES, IMMEDIATELY INSTALL AND MAINTAIN ADEQUATE SHEETING AND BRACING PER OSHA SPECIFICATIONS. CEASE ALL WORK UNTIL THE SHEETING AND BRACING HAS BEEN PROPERLY AND COMPLETELY INSTALLED. INSTALL THE SHEETING AND BRACING IN A MANNER THAT WILL ALLOW REMOVAL WITHOUT INJURING OR ENDANGERING WORKMEN, THE WORK, ADJACENT STRUCTURES, ETC. PROMPTLY AND COMPLETELY FILL ALL VOIDS CAUSED BY THE WITHDRAWAL OF SHEETING WITH SAND AND COMPACT TO A DEGREE EQUAL TO THE SURROUNDING SOIL. REMOVE THE SHEETING AS THE WORK PROGRESSES OR, AT THE DISCRETION OF THE ENGINEER, CUT THE SHEETING OFF BELOW FINISHED GRADE AND LEAVE IN PLACE.
10. THE CONTRACTOR SHALL MAINTAIN ACCESS TO PRIVATE PROPERTY AT ALL TIMES.
11. ALL DISTURBED GRASSED AREAS SHALL BE FULLY RESTORED WITH SOD TO MATCH THAT WHICH EXISTED PRIOR TO CONSTRUCTION. ANY SOD LAID ON AN INCLINE SHALL BE PROPERLY PINNED.
12. ALL IRRIGATION SERVICES DISTURBED BY CONSTRUCTION SHALL BE FULLY RESTORED.

GENERAL NOTES FOR UTILITY CONSTRUCTION

1. PROPOSED PULLBOX LOCATIONS SHOWN ON THESE PLANS ARE APPROXIMATE AND ACTUAL PLACEMENT LOCATIONS MUST BE FIELD VERIFIED AND APPROVED BY ENGINEER.
2. UNDER NO CIRCUMSTANCES SHALL PIPE BE LAID IN A WET TRENCH OR STRUCTURES BE CONSTRUCTED IN A WET EXCAVATION.
3. IF NECESSARY, USE TEMPORARY SHEETING OR TRENCH BOXES TO MINIMIZE THE SIZE OF THE EXCAVATIONS AND TO PROTECT ADJACENT EXISTING ROADWAYS, UTILITIES AND OTHER FACILITIES. THERE SHALL BE NO ADDITIONAL COST TO THE OWNER.
4. PERFORM SURFACE RESTORATION IMMEDIATELY FOLLOWING SUCCESSFUL PRESSURE TESTING, INCLUDING ROADWAY, DRIVEWAY, LANDSCAPING, GRASSING OR OTHER. RESHAPE DITCHES TO EXISTING CONTOURS. GRASSING SHALL BE WHERE EXISTING GRASS HAS BEEN DAMAGED BY CONSTRUCTION.
5. NO MACHINE EXCAVATION SHALL BE PERFORMED WITHIN 5 FEET OF A GAS MAIN.
6. CONTRACTOR SHALL CONTACT BY CALLING ALABAMA 811 OR 1-800-292-8525 AT LEAST 48 HOURS PRIOR TO EXCAVATION. ALL PROPOSED CONSTRUCTION SHALL BE WHITE-LINE PAINTED PRIOR TO CONTACTING.
7. PAVEMENT SUBGRADE, SHALL BE COMPACTED TO 95% ASTM D1557 MODIFIED PROCTOR UNLESS SPECIFIED OTHERWISE.
8. EXCESS SOIL GENERATED DURING CONSTRUCTION IS TO BE STOCK PILED ON SITE AND COVERED TOP, BOTTOM, AND SIDES WITH A PLASTIC LINER.
9. CONTRACTOR IS RESPONSIBLE FOR PROVIDING ROAD PLATES, LIGHTED TRAFFIC CONTROLS, AND ANY MAINTENANCE OF TRAFFIC CONTROLS, AS NEEDED TO KEEP ALL ROADWAYS OPEN DURING TRENCHING ACTIVITIES.
10. ARCADIS TO COLLECT SAMPLES FROM EXCAVATED SOIL DURING TRENCHING ACTIVITIES PRIOR TO USING NATIVE SOIL AS BACKFILL.
11. NATIVE SOIL NOT SUITABLE FOR BACKFILL MATERIAL WILL BE STOCKPILED ON VISQEEN AND COVERED AT ALL TIMES.
12. CERTIFIED CLEAN TYPE III MATERIAL IS REQUIRED FOR REPLACING ANY NATIVE SOIL NOT SUITABLE FOR USE AS BACKFILL.

CONVEYANCE PIPELINE REQUIREMENTS

1. FOR DIRECTIONAL DRILLING, THE CONTRACTOR SHALL BUNDLE PROPOSED CONVEYANCE PIPELINES AND ELECTRICAL CONDUITS APPROPRIATELY TO ALLOW FOR A SINGLE BORE CONFIGURATION.
2. CONTRACTOR SHALL MAINTAIN 18" MINIMUM COVER OVER PROPOSED CONVEYANCE PIPELINES AND 24" MINIMUM COVER OVER ELECTRICAL CONDUITS.
3. A MINIMUM HORIZONTAL CLEARANCE OF 36" AND VERTICAL CLEARANCE OF 18" SHALL BE MAINTAINED BETWEEN PROPOSED FACILITIES AND ALL EXISTING INFRASTRUCTURE.
4. RECOVERY WELLS SHALL BE INSTALLED BY OTHERS ARE NOT PART OF THIS CONTRACT WORK.
5. RECOVERED WATER CONVEYANCE PIPELINES SHALL BE SCHEDULE 80 CHLORINATED POLYVINYL CHLORIDE (CPVC) PIPE PER ASTM D1784, CELL CLASSIFICATION 23477, CPVC TYPE IV GRADE 1 AS MANUFACTURED BY SPEARS, CHARLOTTE PIPE, IPEX OR APPROVED EQUIVALENT.
6. FITTINGS SHALL BE SCHEDULE 80 CHLORINATED POLYVINYL CHLORIDE (CPVC) PIPE PER ASTM D1784, CELL CLASSIFICATION 23477, CPVC TYPE IV GRADE 1 AS MANUFACTURED BY SPEARS, CHARLOTTE PIPE, IPEX OR APPROVED EQUIVALENT.
7. SOLVENT WELD CONNECTIONS SHALL USE QUALITY SOLVENT CEMENTS AND PRIMER FORMULATED FOR INDUSTRIAL SERVICE APPLICATION, PIPE SIZE AND TYPE OF JOINT. WHILE PIPE AND FITTINGS MAY BE COMPATIBLE WITH INTENDED MEDIUM, THE SOLVENT CEMENT MAY NOT BE. CONSULT THE MANUFACTURER FOR SUITABILITY OF USE. READ AND FOLLOW THE CEMENT AND PRIMER MANUFACTURERS APPLICATIONS AND CURE TIME INSTRUCTIONS THOROUGHLY. ALL SOLVENT CEMENT AND PRIMER MUST BE APPROVED BY THE ENGINEER.
8. THE ELECTRICAL CONDUIT, ELBOWS, AND COUPLINGS SHALL BE SCHEDULE 40 POLYVINYL CHLORIDE (PVC) CONDUIT PER ANSI/DL651 AND NEMA TC-2 AS MANUFACTURED BY J.M. EAGLE, HERITAGE PLASTICS OR APPROVED EQUIVALENT. USE APPROPRIATE SOLVENT CEMENT AND PRIMER.
9. CONTRACTOR SHALL INSTALL A CONTINUOUS 3-INCH WIDE DETECTABLE METAL TAPE (TERRA TAPE OR EQUAL), 1-FOOT ABOVE THE PIPE, AT EACH BORING PIT AND AT LOCATIONS WHERE INSTALLATION IS BY THE OPEN CUT TRENCH METHOD. TAPE SHALL BE MARKED AND COLOR-CODED TO IDENTIFY THE PIPE USE.

EROSION CONTROL NOTES

1. NO UNAUTHORIZED DISTURBANCE OF ANY WETLANDS WILL BE PERMITTED. TEMPORARILY INSTALL SILT FENCES, BARRIERS OR HAY BALES IMMEDIATELY ADJACENT TO, AND UPLAND FROM, ALL EXISTING WETLANDS PRIOR TO CONSTRUCTION ACTIVITIES WHICH MIGHT IMPACT THE WETLANDS. REMOVE ALL WETLAND PROTECTION MEASURES AFTER THE PROJECT HAS BEEN ACCEPTED BY THE OWNER. PERFORM THIS WORK AT NO EXPENSE TO THE OWNER AND COMPLY WITH FLORIDA DEPARTMENT OF TRANSPORTATION'S "ROADWAY AND TRAFFIC DESIGN STANDARDS", INDEX No. 102 (2010 EDITION) AND THE "FLORIDA EROSION AND SEDIMENT CONTROL INSPECTOR'S MANUAL".
2. ALL CONSTRUCTION ACTIVITIES SHALL INCORPORATE BEST MANAGEMENT PRACTICES TO CONTROL EROSION, SEDIMENTATION, AND THE POTENTIAL FOR DOWNSTREAM WATER QUALITY DEGRADATION. CONSTRUCTION PRACTICES INCLUDE:
   A. CONSTRUCT TEMPORARY SEDIMENTATION BASINS OR EARTHEN BERMS AT DOWN-GRADIENT ENDS OF NEWLY GRADED AREAS TO PROVIDE FOR SEDIMENT AND TURBIDITY REMOVAL.
   B. LIMIT SITE CLEARING TO THOSE AREAS REQUIRED FOR A PARTICULAR PHASE OF CONSTRUCTION. EXISTING TREES AND VEGETATION TO REMAIN WHEREVER POSSIBLE.
   C. TURBIDITY BARRIERS, HAY BALES AND OTHER EROSION CONTROL MEASURES SHALL REMAIN IN PLACE UNTIL CONSTRUCTION ACTIVITIES ARE COMPLETE AND THE POTENTIAL FOR EROSION IS ELIMINATED.
3. DO NOT EMPLOY SILT FENCES IN A MANNER TO CAUSE THEM TO ACT AS A DAM ACROSS PERMANENTLY FLOWING WATERCOURSES. USE SILT FENCES AT UPLAND LOCATIONS, AND TURBIDITY BARRIERS IN PERMANENT WATER BODIES, REGARDLESS OF WATER DEPTH.

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Professional Engineer's No.: 37041-E
State: AL | Date Signed: | Project Mgr.: (MGR)
Designed by: JP | Drawn by: WDB | Checked by: JP

ARCADIS Design & Consultancy for natural and built assets
ARCADIS U.S., INC.

SABIC ● ONE PLASTICS DRIVE, BURKVILLE, ALABAMA
BRINE SYSTEM EXPANSION

GENERAL NOTES AND SPECIFICATIONS I

ARCADIS Project No.: 13283045.0000.00002
Date: APRIL 2019

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1728 3RD AVENUE NORTH
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TEL. (205)-930-5965

G-2

GENERAL MECHANICAL NOTES

1. CONTRACTOR RESPONSIBLE FOR SUPPLY AND ASSEMBLY OF ALL PIPING AND APPURTENANCES FROM WELL HEADS TO TREATMENT SYSTEM AREA.
2. ALL PIPING AND PIPING SUPPORTS WILL COMPLY WITH THE SABIC DESIGN GUIDE SPECIFICATIONS # 1840.05, REV 1, 7/28/14
3. ALL PIPING MATERIALS WILL COMPLY WITH THE SABIC PIPING MATERIALS SPECIFICATIONS 15052 ATTACHMENT 2, REV 4, 5/11/2007.

CONVEYANCE PIPELINE PRESSURE TESTING

CONTRACTOR SHALL COMPLETE PIPE TESTS FOR ALL PIPING. THE ENGINEER SHALL OBSERVE THE PIPE TESTS.

PIPE TESTS FOR LIQUID SERVICE SHALL BE CONDUCTED USING CLEAN POTABLE WATER. PIPES SHALL BE CAPPED BEFORE TESTING AND EQUIPMENT SUCH AS FLOW METERS, PRESSURE RELIEF VALVES, ETC., SHOULD BE ISOLATED TO PREVENT DAMAGE. THE PIPING SYSTEM MAY BE TESTED IN SECTIONS WITH THE APPROVAL FROM THE ENGINEER.

HYDROSTATIC PRESSURE LEAK TESTS OF CPVC PRESSURE PIPING SYSTEMS SHOULD BE CONDUCTED IN ACCORDANCE WITH THE FOLLOWING.

- RESTRAINT –THE PIPELINE TEST SECTION MUST BE RESTRAINED AGAINST MOVEMENT IN THE EVENT OF CATASTROPHIC FAILURE. JOINTS MAY BE EXPOSED FOR LEAKAGE EXAMINATION PROVIDED THAT RESTRAINT IS MAINTAINED.
- THE TESTING EQUIPMENT CAPACITY AND THE PIPELINE TEST SECTION SHOULD BE SUCH THAT THE TEST SECTION CAN BE PRESSURIZED AND EXAMINED FOR LEAKS WITHIN TEST DURATION TIME LIMITS. LOWER CAPACITY TESTING AND PRESSURIZING EQUIPMENT MAY REQUIRE A SHORTER TEST SECTION.
- TEST EQUIPMENT AND THE PIPELINE TEST SECTION SHOULD BE EXAMINED BEFORE PRESSURE IS APPLIED TO ENSURE THAT CONNECTIONS ARE TIGHT, NECESSARY RESTRAINTS ARE IN PLACE AND SECURE, AND COMPONENTS THAT SHOULD BE ISOLATED OR DISCONNECTED ARE ISOLATED OR DISCONNECTED. ALL LOW PRESSURE FILLING LINES AND OTHER ITEMS NOT SUBJECT TO THE TEST PRESSURE SHOULD BE DISCONNECTED OR ISOLATED.
- THE TEST SECTION SHOULD BE COMPLETELY FILLED WITH THE TEST LIQUID, TAKING CARE TO BLEED OFF ANY TRAPPED AIR. VENTING AT HIGH POINTS MAY BE REQUIRED TO PURGE AIR POCKETS WHILE THE TEST SECTION IS FILLING. VENTING MAY BE PROVIDED BY BLEED VALVES OR EQUIPMENT VENTS.
- THE TEST PROCEDURE CONSISTS OF INITIAL EXPANSION, AND TEST PHASES. FOR THE INITIAL EXPANSION PHASE, THE TEST SECTION IS PRESSURIZED TO EXPANSION PRESSURE (110 PSI) AND MAKE–UP TEST LIQUID IS ADDED AS REQUIRED TO MAINTAIN THE EXPANSION PRESSURE FOR FOUR (4) HOURS. FOR THE TEST PHASE, THE PRESSURE IN THE PIPING IS REDUCED BY 10 PSI. THIS IS THE TARGET TEST PRESSURE (100 PSI). IF THE TARGET TEST PRESSURE REMAINS STEADY (WITHIN 5% OF THE TARGET TEST PRESSURE) FOR AN HOUR, LEAKAGE IS NOT INDICATED.
- IF LEAKS ARE DISCOVERED, DEPRESSURIZE THE TEST SECTION BEFORE REPAIRING LEAKS. CORRECTLY MADE FUSION JOINTS DO NOT LEAK. LEAKAGE AT A JOINT MAY INDICATE IMMINENT CATASTROPHIC RUPTURE. DEPRESSURIZE THE TEST SECTION IMMEDIATELY IF LEAKAGE IS DISCOVERED. IF THE PRESSURE LEAK TEST IS NOT COMPLETED DUE TO LEAKAGE, EQUIPMENT FAILURE, ETC., THE TEST SECTION SHOULD BE DE–PRESSURIZED AND REPAIRS MADE. ALLOW THE TEST SECTION TO REMAIN DEPRESSURIZED FOR AT LEAST EIGHT (8) HOURS BEFORE RETESTING.

DURING THE PRESSURE TEST, THE PIPING SYSTEM SHALL BE INSPECTED FOR LEAKS AND ANY LEAKS SHALL BE FLAGGED FOR REPAIR. THE PIPING SECTION SHALL BE DRIP TIGHT WITH NO SIGNS OF LEAKAGE.

IF THE TEST RESULTS ARE NOT CONSIDERED TO BE ACCEPTABLE BY THE ENGINEER, THEN THE CONTRACTOR SHALL IDENTIFY AND REPAIR THE LEAKS. THE PIPE(S) MUST BE RE–TESTED AFTER THE REPAIRS UNTIL ACCEPTABLE TEST RESULTS ARE ACHIEVED.

WRITTEN RECORDS OF THE PIPE TEST SHALL BE MADE BY THE CONTRACTOR OF EACH PIPE SEGMENT AND SUBMITTED TO THE ENGINEER. THE TEST RECORDS SHALL INCLUDE THE FOLLOWING:

- DATE OF TEST;
- DESCRIPTION OF PIPE SEGMENT TESTED;
- TEST PRESSURE, AIR TEMPERATURE AND TIME BEFORE/AFTER TEST;
- REMARKS (INCLUDING DESCRIPTION OF TEST RESULTS, DESCRIPTION OF LEAKS, AND LEAK REPAIRS); AND,
- SIGNATURE OF CONTRACTOR AND ENGINEER.

PIPING AND PIPING APPURTENANCE MATERIALS – WELL VAULTS AND TREATMENT BUILDING

1. PIPING MATERIALS AND PIPING APPURTENANCES ARE IDENTIFIED ON THE PIPING AND INSTRUMENTATION DIAGRAMS THAT ARE INCLUDED IN THE CONSTRUCTION DRAWINGS. ADDITIONAL SPECIFICATIONS ARE PROVIDED IN THIS SECTION. IF THERE ARE ANY DISCREPANCIES BETWEEN THESE SPECIFICATIONS AND THE CONSTRUCTION DRAWINGS, THE ENGINEER SHALL BE CONSULTED TO RESOLVE THE DISCREPANCY.
2. PIPE MATERIALS IN WELL VAULTS AND WITHIN THE TREATMENT BUILDING SHALL BE TYPE 4, GRADE 1, SCHEDULE 80 CPVC PIPE AND FITTINGS CONFORMING TO ASTM D1784 AND D1785, UNLESS OTHERWISE NOTED ON THE DRAWINGS.
3. CPVC FITTINGS: SCHEDULE 80 – PVC PRESSURE FITTINGS SHALL CONFORM TO ASTM D1784.
4. SOLVENT WELD CONNECTIONS USE QUALITY SOLVENT CEMENTS AND PRIMER FORMULATED FOR INDUSTRIAL SERVICE APPLICATION, PIPE SIZE AND TYPE OF JOINT. WHILE PIPE AND FITTINGS MAY BE COMPATIBLE WITH INTENDED MEDIUM, THE SOLVENT CEMENT MAY NOT BE. CONSULT THE MANUFACTURER FOR SUITABILITY OF USE. READ AND FOLLOW THE CEMENT AND PRIMER MANUFACTURERS APPLICATIONS AND CURE TIME INSTRUCTIONS THOROUGHLY. ALL SOLVENT CEMENT AND PRIMER MUST BE APPROVED BY THE ENGINEER.
5. FLANGE CONNECTIONS SHALL BE ANSI CLASS 150 FLANGES UNLESS OTHERWISE NOTED. JOIN FLANGES WITH FULL–FACE GASKETS, 1/8 INCH THICK. GASKET MATERIAL SHALL BE VITON FOR WATER SERVICE. PROVIDE MACHINE MADE OR DIE STAMPED GASKETS WITH INSIDE AND OUTSIDE EDGES CONCENTRIC. OVERSIZE BOLT HOLES TO PREVENT CRIMPING OF GASKET WHEN INSTALLED.
6. PISTON CHECK VALVES USED IN THE WELL VAULTS AT THE TREATMENT SYSTEM SHALL BE PVC IPEX VR SERIES PISTON CHECK VALVES WITH VITON O–RING SEALS AND SHUTTER. PISTON CHECK VALVES SHALL BE INSTALLED IN A HORIZONTAL POSITION.
7. IN INSTALLATIONS WHICH REQUIRE THE VERTICAL INSTALLATION OF CHECK VALVES, CHECK VALVES SHALL BE PLASTOMATIC PVC SPRING CHECK VALVES SERIES CKS WITH VITON O–RING SEALS AND PFA COATED SPRING.
8. ALL OTHER MATERIALS NOT SPECIFICALLY DESCRIBED, BUT REQUIRED FOR A COMPLETE AND PROPER INSTALLATION OF THE WORK OF THIS SECTION, SHALL BE NEW, FIRST QUALITY OF THEIR RESPECTIVE KIND, AND AS SELECTED BY CONTRACTOR SUBJECT TO THE APPROVAL OF ENGINEER.
9. PIPE AND PIPING APPURTENANCES SHALL BE PROPERLY STORED TO PREVENT DAMAGE. ANY DAMAGED MATERIALS WILL BE REPLACED BY THE CONTRACTOR AT NO COST TO THE PROJECT.

PIPING INSTALLATION – WELL VAULTS AND TREATMENT BUILDING

1. THE PIPING INSTALLERS PROVIDED BY THE CONTRACTOR SHALL BE THOROUGHLY TRAINED AND EXPERIENCED IN THE NECESSARY CRAFTS AND FAMILIAR WITH THE SPECIFICATIONS PROVIDED HERE.
2. CONSTRUCTION DRAWINGS SHOW GENERAL ARRANGEMENT, DIRECTION, AND SIZE OF PIPES AND ARE NOT INTENDED TO SHOW EVERY OFFSET, VALVE, AND FITTING, OR EVERY STRUCTURAL DIFFICULTY THAT MAY BE ENCOUNTERED. INSTALL THE PIPING AND APPURTENANCES TO SUIT, AND IN ACCORDANCE WITH THE PIPING AND INSTRUMENTATION DIAGRAM PROVIDED IN THE CONSTRUCTION DRAWING PACKAGE. VERIFY ALL MEASUREMENTS AT THE SITE.
3. INSTALL ALL PIPING IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AS APPROVED BY ENGINEER.
4. THE CONTRACTOR SHALL PROVIDE ADEQUATE PIPE SUPPORTS FOR BOTH HORIZONTAL AND VERTICALLY–MOUNTED PIPES.
5. THE PIPING SHALL BE POSITIONED TO MINIMIZE TRIPPING HAZARDS AND MAINTAIN HEAD CLEARANCE WHERE POSSIBLE. WALKWAYS SHALL BE INSTALLED OVER PIPES INSTALLED AT GROUND LEVEL IN FOOT–TRAFFIC AREAS.PRESSURE GAUGES, FLOW METERS, AND OTHER INSTRUMENTATION SHALL BE INSTALLED IN LOCATIONS THAT ARE EASILY READABLE AND ACCESSIBLE FOR MAINTENANCE.
6. ALL PIPE FITTINGS AND MATERIALS SHALL BE CAREFULLY INSPECTED IN THE FIELD BEFORE INSTALLATION. CRACKED, BROKEN, WARPED, OUT–OF–ROUND, AND DAMAGED PIPE JOINTS, INCLUDING DAMAGED PIPELINING OR COATINGS OR SPECIALS, AS DETERMINED BY THE ENGINEER, SHALL NOT BE INSTALLED. SUCH REJECTED PIPE SHALL BE CLEARLY TAGGED IN SUCH A MANNER AS TO NOT DEFACE OR DAMAGE IT, AND THE PIPE SHALL THEN BE REMOVED FROM THE SITE BY THE CONTRACTOR AT HIS OWN EXPENSE.
7. THE EXACT LOCATIONS OF DRAINS, VENTS, SAMPLE TAPS, AND PRESSURE GAUGES SHALL BE DETERMINED IN THE FIELD DURING CONSTRUCTION. ALL PIPING SHALL BE EASILY DRAINED.
8. LABELING OF EQUIPMENT AND PIPING SHALL INCLUDE, BUT NOT BE LIMITED TO FLOW DIRECTIONAL ARROWS, EQUIPMENT IDENTIFICATION PLACARDS, AND SAFETY PLACARDS.
9. THE PIPING IS NOT REQUIRED TO BE PAINTED OR COATED OTHER THAN ANY COATINGS PROVIDED BY MATERIALS MANUFACTURERS

PIPE HANGERS AND SUPPORTS – WELL VAULTS AND TREATMENT BUILDING

1. INSTALL STRUCTURAL SUPPORTS TO SUPPORT PIPE WITH A SAFETY FACTOR OF FIVE, UNLESS OTHERWISE NOTED ON DRAWINGS.
2. ALL PIPING SHALL BE SUPPORTED EVERY 6 FEET.
3. INSTALL IN ACCORDANCE WITH ASTM B31.9, ASTM F708, AND MSS SP89 AS APPLICABLE.
4. SUPPORT PIPE WITHIN TWO FEET OF END OF ALL PIPE RUNS.
5. SUPPORT RIDER PIPING INDEPENDENTLY OF CONNECTED HORIZONTAL PIPING.
6. PROVIDE ADDITIONAL SUPPORT FOR CONCENTRATED LOADS SUCH AS FLANGES, VALVES, OR SPECIALTIES, AND AT CHANGES IN DIRECTION.
7. SUPPORT ALL VALVES, FITTINGS, AND TUBING SUCH THAT ALL SWING JOINTS MAKE AND BREAK FREELY AND SUCH THAT UNDUE STRESS IS NOT PLACED ON TUBING BY VALVES OR OTHER IN–LINE COMPONENTS

CONSTRUCTION SCHEDULE

1. THE CONTRACTOR SHALL CONFIRM A CONSTRUCTION SCHEDULE WITH THE ENGINEER'S PROJECT MANAGER AT LEAST 14 DAYS PRIOR TO ANY WORK AT THE SITE.
2. THE PROPOSED CONSTRUCTION SCHEDULE SHALL BE PRESENTED IN A TIMELINE FORMAT SHOWING ESTIMATED STAR DATE, DURATION, AND COMPLETION TIMES FOR EACH ACTIVITY. ANY DEVIATION FROM THE ORIGINALLY PROPOSED SCHEDULE MUST BE COMMUNICATED TO THE ENGINEER'S PROJECT MANAGER WITHIN 24 HOURS.

AS–BUILT DRAWINGS

1. THE CONTRACTOR SHALL PROVIDE AS BUILT RECORD DRAWINGS (RED LINES) SHOWING ACTUAL DETAILS, DIMENSIONS, AND OTHER PERTINENT FEATURES THAT VARY FROM THE ORIGINAL DESIGN.

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Professional Engineer's Name: **JOHN F. PERELLA, P.E.**

Professional Engineer's No.: 37041-E

State	Date Signed	Project Mgr.
AL		(MGR)
Designed by: JP	Drawn by: WDB	Checked by: JP

ARCADIS Design & Consultancy for natural and built assets

ARCADIS U.S., INC.

SABIC • ONE PLASTICS DRIVE, BURKVILLE, ALABAMA

BRINE SYSTEM EXPANSION

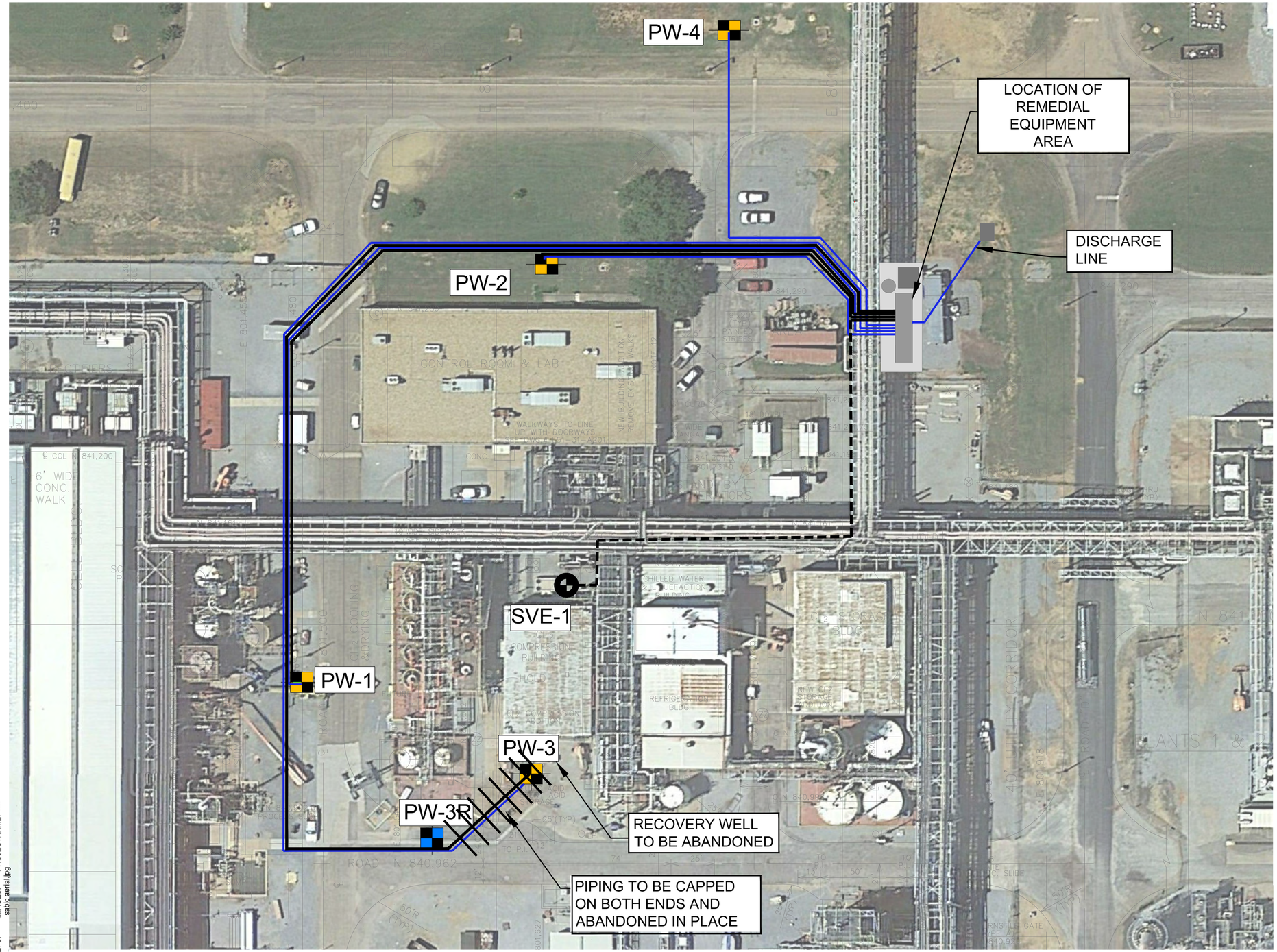
GENERAL NOTES AND SPECIFICATIONS II

ARCADIS Project No. 13283045.0000.00002

Date APRIL 2019

ARCADIS
1728 3RD AVENUE NORTH
SUITE 300
BIRMINGHAM, ALABAMA
TEL. (205)-930-5965

G-3



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Professional Engineer's Name
JOHN F. PERELLA, P.E.
Professional Engineer's No.
37041-E

State	Date Signed	Project Mgr.
AL		(MGR)
Designed by	Drawn by	Checked by
JP	WDB	JP

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BRINE SYSTEM EXPANSION

PW-3R DEMOLITION PLAN

ARCADIS Project No.
13283045.0000.00002

Date
APRIL 2019

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D-1

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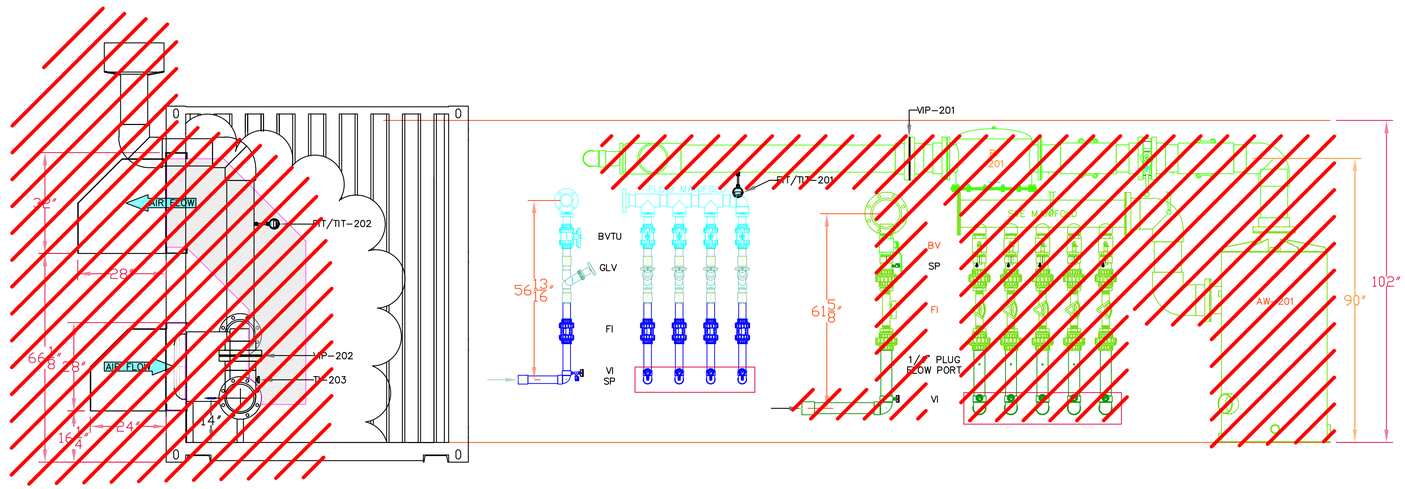

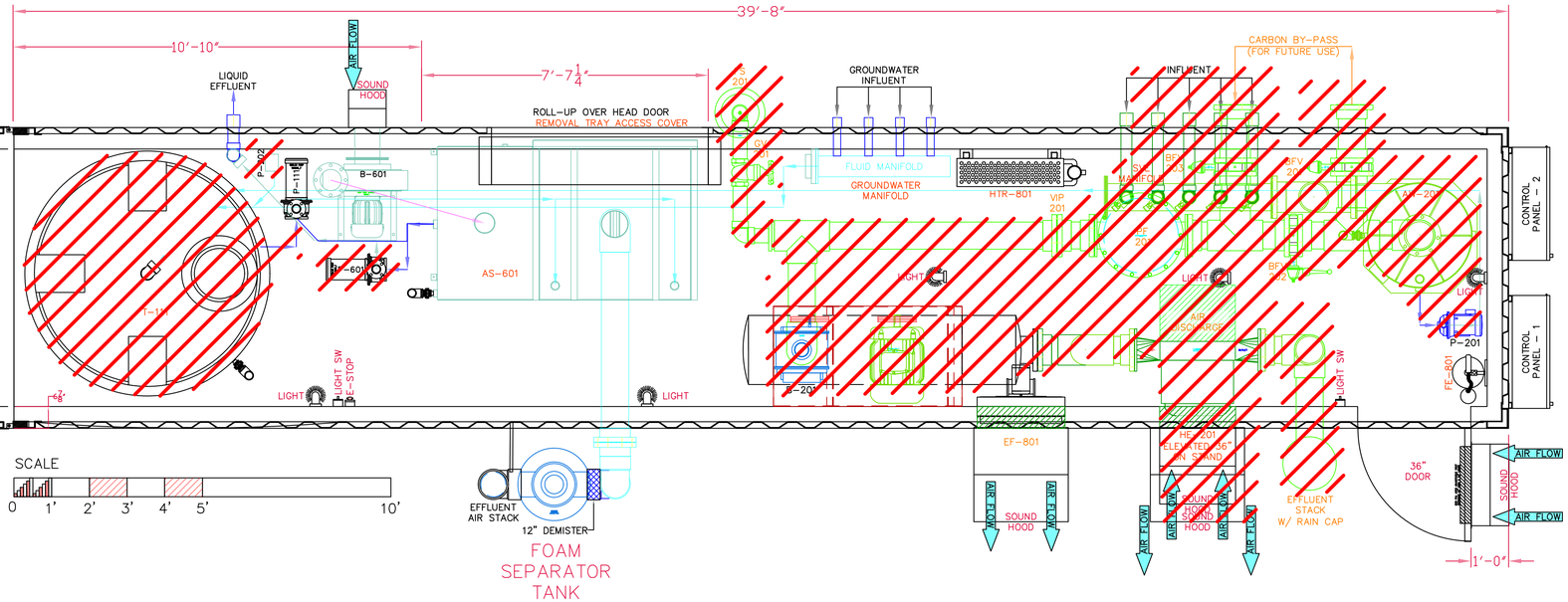

LEGEND

PIPING AND EQUIPMENT TO TO BE REMOVED

GRAPHIC SCALE AS SHOWN

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Professional Engineer's No.: 37041-E

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AL		(MGR)

Designed by	Drawn by	Checked by
JP	WDB	JP

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ARCADIS U.S., INC.

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BRINE SYSTEM EXPANSION

TREATMENT SYSTEM DEMOLITION PLAN #1 EXISTING SYSTEM LAYOUT

ARCADIS Project No.
13283045.0000.00002

Date
APRIL 2019

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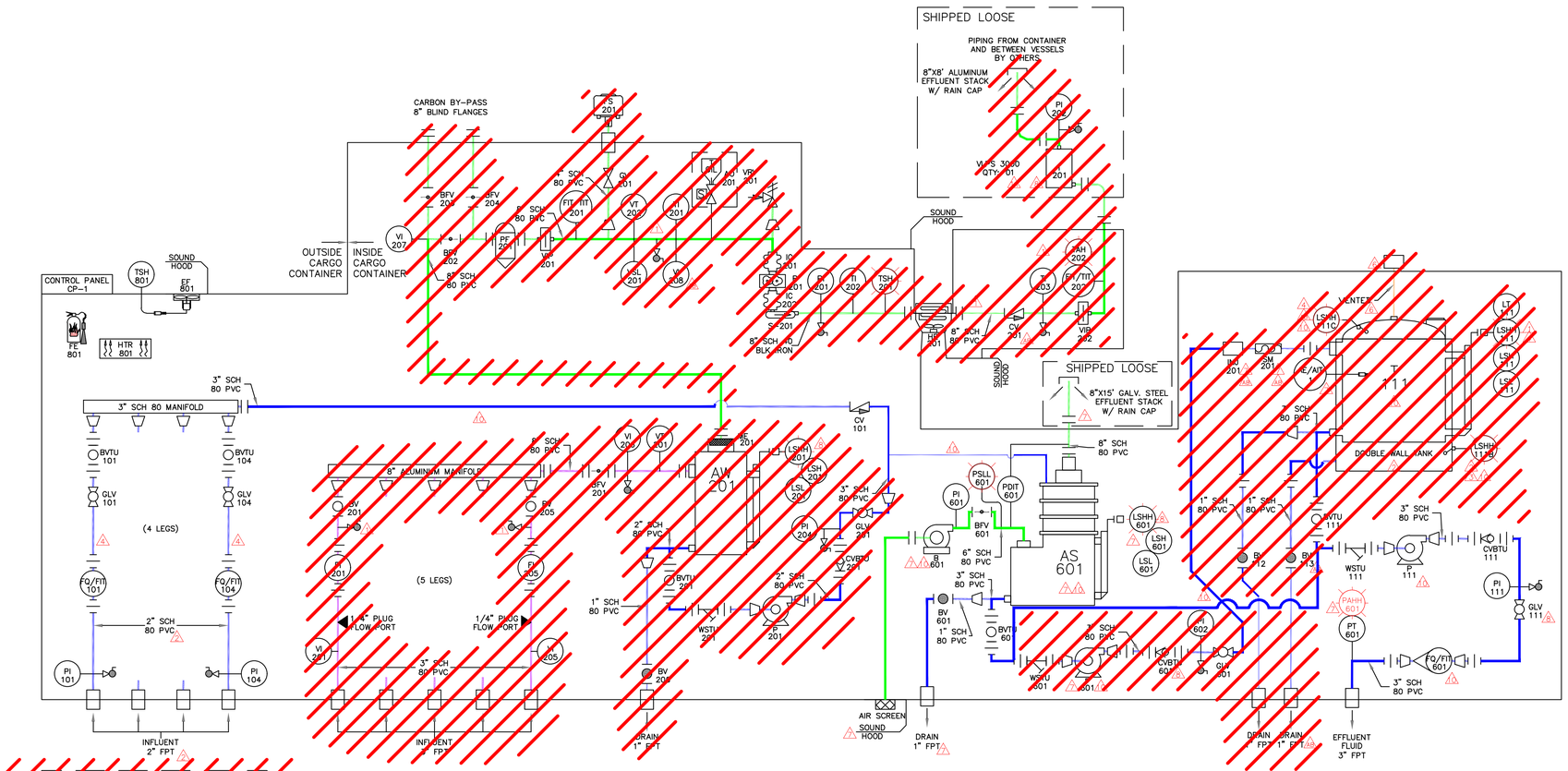

LEGEND

PIPING AND EQUIPMENT TO TO BE REMOVED

LEGEND

EF XXX	EXHAUST FAN 230-460V/.5HP/60HZ	BV XXX	BALL VALVE NORMALLY CLOSE		COUPLER	FT/TIT XXX	FLOW INDICATOR TRANSMITTER/TEMPERATURE INDICATOR TRANSMITTER	LSL XXX	LEVEL SWITCH LOW	PSLL XXX	PRESSURE SWITCH LOW LOW		EQ TANK 1500 GALLONS 16" VENTED MANWAY		UNION	VIP XXX	VORTAB INSERTION PANEL
AW XXX	AIR WATER SEPARATOR AW-220 8" MNPT INLET 8" MNPT OUTLET	BVTU XXX	BALL VALVE TRUE UNION NORMALLY OPEN		CRITICAL DEVICE	FQ/FIT XXX	FLOW TOTAUZER / FLOW INDICATOR TRANSMITTER	LSH XXX	LEVEL SWITCH HIGH	P XXX	PUMP 1HP 3/60/480V (P-201) 10HP 3/60/480V (P-111)	TI XXX	TEMPERATURE INDICATOR	VRV XXX	VACUUM RELIEF VALVE	WSTU XXX	WYE STRAINER TRUE UNION
R XXX	BLOWER ROOTS ROTARY LOBE 25HP 3/60/480V (B-201)	GV XXX	GATE VALVE		FIRE EXTINGUISHER	GV XXX	GATE VALVE	LSHH XXX	LEVEL SWITCH HIGH HIGH		REDUCER	TE XXX	TEMPERATURE PROBE	VI XXX	VACUUM INDICATOR	PAHH XXX	PRESSURE ALARM HIGH HIGH
BFV XXX	BUTTERFLY VALVE	GLV XXX	GLOBE VALVE		FLANGES	HE XXX	HEAT EXCHANGER AA-750 2HP 3/60/480V	PT XXX	PARTICULATE FILTER		REVISION DEFICATIONS	TSH XXX	TEMPERATURE SWITCH HIGH	VT XXX	VACUUM TRANSMITTER	LAH XXX	LEVEL SWITCH ALARM HIGH
CVBTU XXX	CHECK VALVE BALL TRUE UNION	HTR XXX	HEATER		FILTER SILENCER	PDIT XXX	PRESSURE DIFFERENTIAL INDICATOR TRANSMITTER				SAMPLE PORT	TSHH XXX	TEMPERATURE SWITCH HIGH HIGH	VSLL XXX	VACUUM SWITCH LOW LOW		LINE COLOR CODE
CONTROL PANEL XXX	CONTROL PANEL	IC XXX	ISOLATION COUPLER		FLOW INDICATOR	PI XXX	PRESSURE INDICATOR				SILENCER	TT XXX	TEMPERATURE TRANSMITTER	T XXX	VAPOR LOW PRESSURE STEEL CARBON TANK VLPS-5000 8" INLET/OUTLET		MULTIPHASE PIPING
					INJECTOR	PT XXX	PRESSURE TRANSMITTER			P XXX	SUBMERSIBLE PUMP 1.5HP 3/60/480V (P-101 TO P-104)	SM XXX	STATIC MIXER				AIR PIPING
										P XXX	METERING PUMP						AIR VENT PIPING
																	LIQUID PIPING

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Professional Engineer's No.	37041-E	
State	Date Signed	Project Mgr.
AL		(MGR)
Designed by	Drawn by	Checked by
JP	WDB	JP

ARCADIS Design & Consultancy for natural and built assets

ARCADIS U.S., INC.

SABIC ● ONE PLASTICS DRIVE, BURKVILLE, ALABAMA

BRINE SYSTEM EXPANSION

TREATMENT SYSTEM DEMOLITION PLAN #2 EXISTING SYSTEM P&ID

ARCADIS Project No. 13283045.0000.00002

Date APRIL 2019

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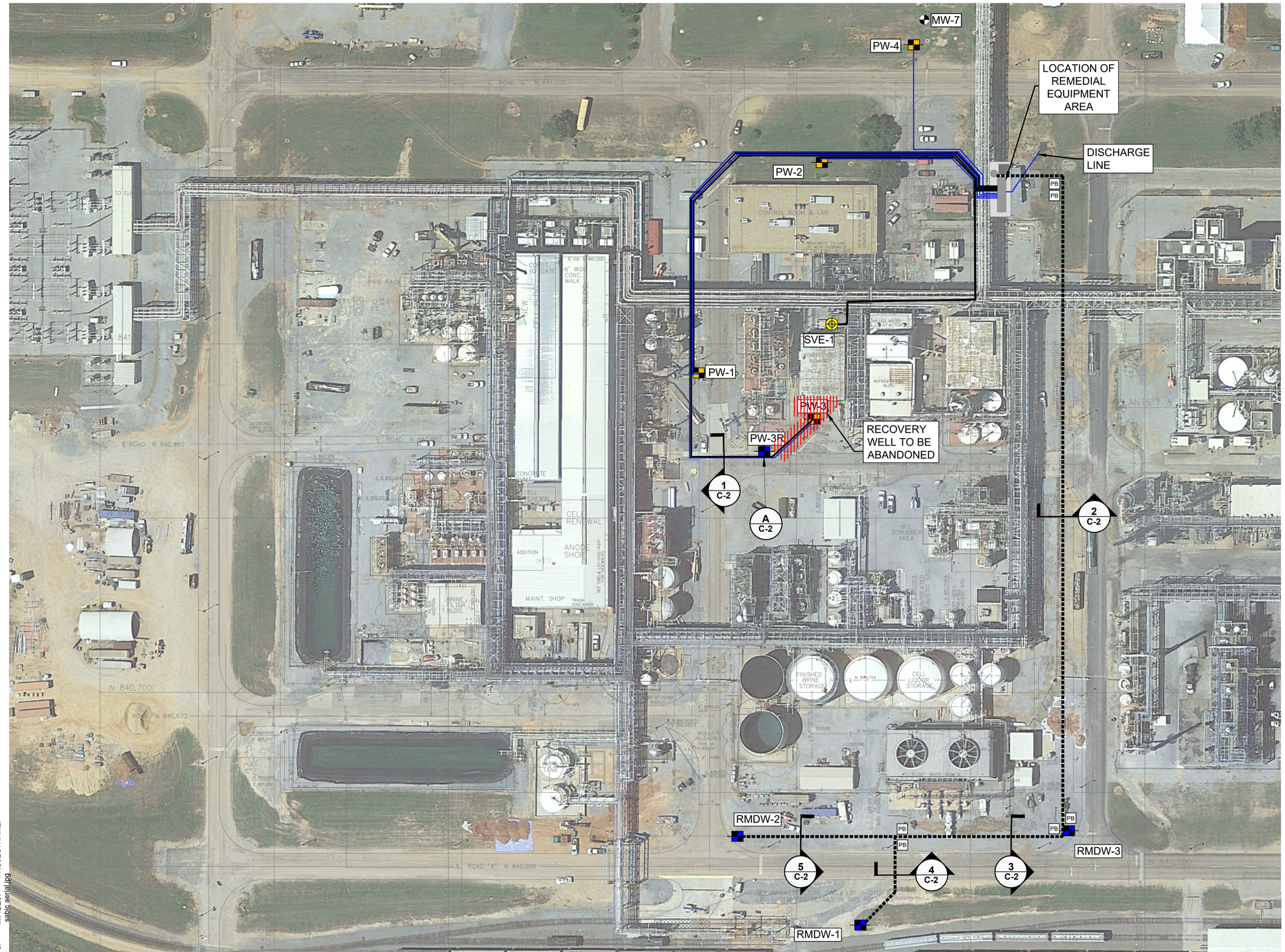

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ARCADIS U.S., INC.

SABIC ● ONE PLASTICS DRIVE, BURKVILLE, ALABAMA
BRINE SYSTEM EXPANSION

CONVEYANCE PIPING PLAN

ARCADIS Project No.
13283045.0000.00002

Date
APRIL 2019

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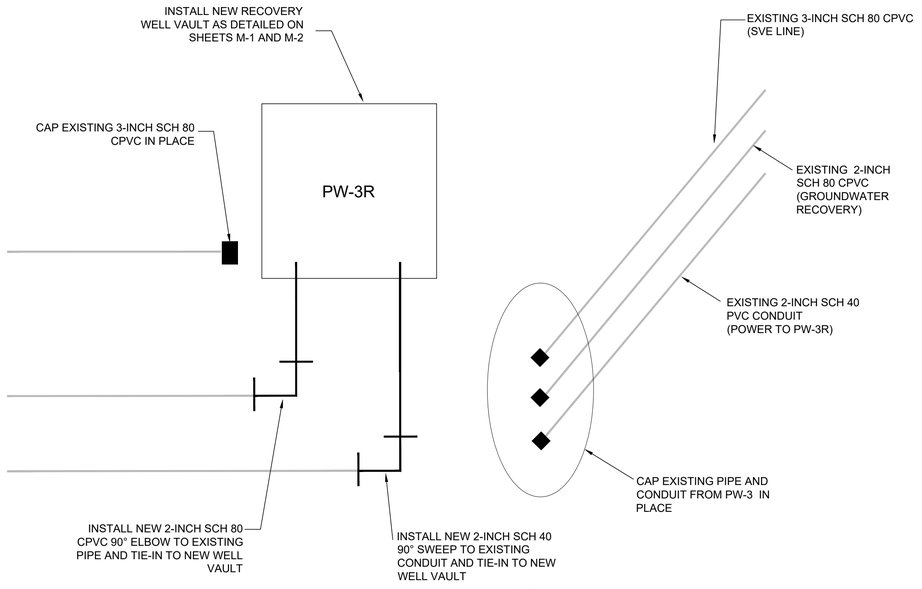
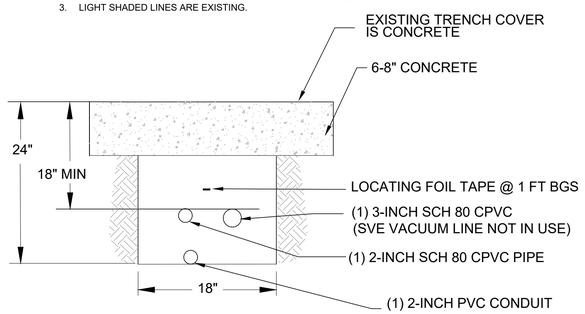


PIPING AND CONDUIT TIE-IN DETAIL A C-1

NOT TO SCALE

NOTES:
1. CUT EXISTING 2-INCH PVC CONDUIT WITH SUFFICIENT DISTANCE TO ALLOW EXISTING CONDUCTORS TO ENTER THE NEW WELL VAULT AND MAKE NECESSARY CONNECTION WITH NO SPLICES.
2. DARK SHADED LINES ARE NEW/PROPOSED TO BE INSTALLED.
3. LIGHT SHADED LINES ARE EXISTING.

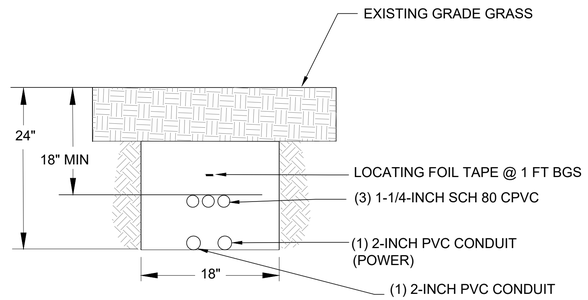


TRENCH SECTION DETAIL 1 C-1

NOT TO SCALE

NOTE:

1. TRENCH SECTION IS EXISTING. DETAIL SHOWN FOR INFORMATIONAL PURPOSES ONLY.



TRENCH SECTION DETAIL 2 C-1

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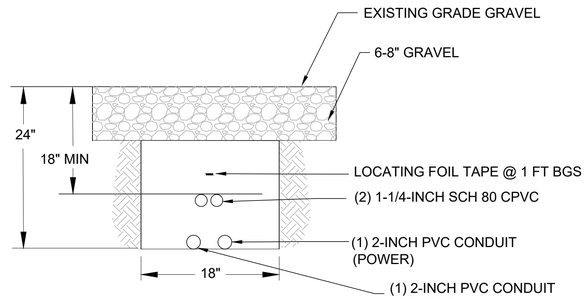

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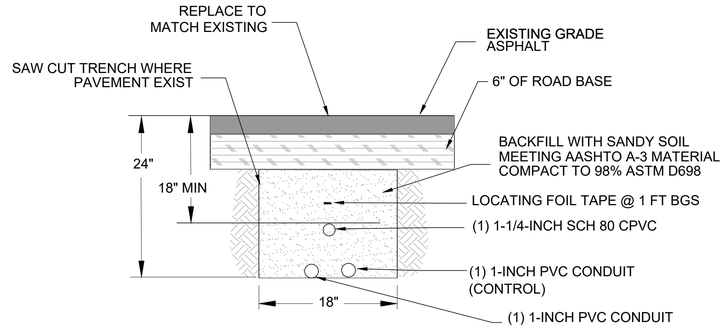

TRENCH SECTION DETAIL 4 C-1

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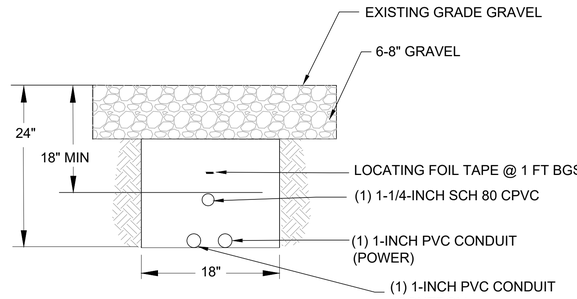

TRENCH SECTION DETAIL 5 C-1

NOT TO SCALE

NOTES:

- MINIMUM DEPTH OF ELECTRICAL LINES TO BE 2 FT BGS.
- CONTRACTOR RESPONSIBLE FOR PROVIDING FENCING, STEEL ROAD PLATES AND LIGHTED SAFETY CONTROLS AROUND TRENCHES DURING CONSTRUCTION ACTIVITIES, AS INSTRUCTED IN THE SABIC SITE ORIENTATION TRAINING.
- BACKFILL MATERIAL TO BE APPROVED BY ARCADIS.
- CONTRACTOR IS RESPONSIBLE FOR PROVIDING PRIVATE UTILITY LOCATE PRIOR TO TRENCHING ACTIVITIES.
- ELECTRICAL WIRE AWG SIZING TO BE APPROVED BY ARCADIS AND SABIC PRIOR TO INSTALLATION.
- CONTRACTOR TO VERIFY ESTIMATED PIPING DISTANCES PRIOR TO BID.
- ALL PIPING MATERIALS WILL COMPLY WITH THE SABIC PIPING MATERIALS SPECIFICATIONS 15052 ATTACHMENT 2, REV 4, 5/11/2007.
- CONTRACTOR IS RESPONSIBLE FOR PROVIDING ROAD PLATES, LIGHTED TRAFFIC CONTROLS, AND ANY MAINTENANCE OF TRAFFIC CONTROLS, NEEDED TO KEEP ALL ROADWAYS OPEN DURING CONSTRUCTION.
- ARCADIS WILL COLLECT SAMPLES FROM EXCAVATED SOIL DURING TRENCHING ACTIVITIES PRIOR TO USING NATIVE SOIL AS BACKFILL.
- NATIVE SOIL NOT SUITABLE FOR BACKFILL MATERIAL WILL BE STOCKPILED ON VISQUEEN AND COVERED AT ALL TIMES.
- CERTIFIED CLEAN TYPE III MATERIAL IS REQUIRED FOR REPLACING ANY NATIVE SOIL NOT SUITABLE FOR USE AS BACKFILL.

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Designed by	Drawn by	Checked by
JP	WDB	JP

ARCADIS U.S., INC.

SABIC ● ONE PLASTICS DRIVE, BURKVILLE, ALABAMA
BRINE SYSTEM EXPANSION

TRENCH DETAIL AND CROSS SECTION

ARCADIS Project No.: 13283045.0000.00002
Date: APRIL 2019

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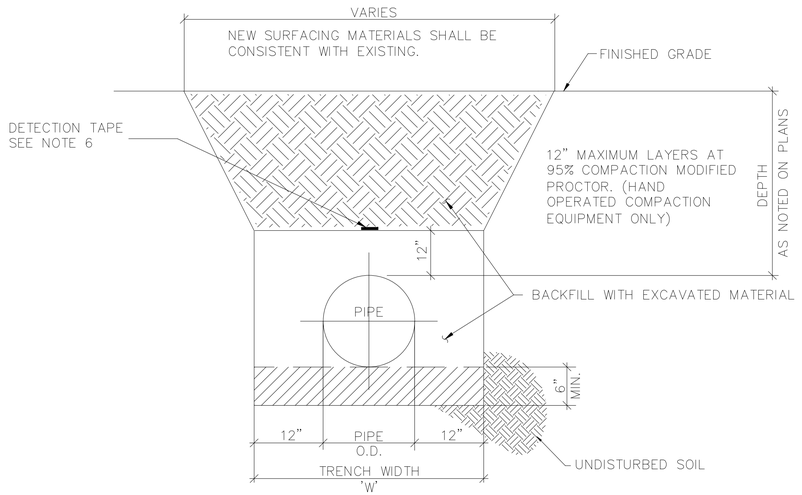
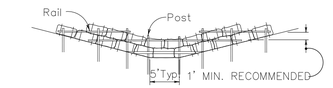


UNIMPROVED AREAS

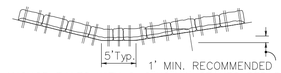
GENERAL TRENCH DETAIL NOTES:

1. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT EXCAVATIONS DO NOT ENDANGER WORKMEN, EXISTING STRUCTURES, UTILITIES, OR OTHER FACILITIES. COMPLY WITH OSHA'S EXCAVATION SAFETY STANDARDS 29, CFR PART 1926.650–652 SUBPART P.
2. SHEETING OR A TRENCH BOX SHALL BE UTILIZED AS REQUIRED TO MEET SAFETY STANDARDS.
3. COMPACTION PERCENTAGES SHOWN REFER TO MODIFIED PROCTOR MAXIMUM DRY DENSITY (ASTM D1557).
4. MAINTAIN TRENCH WIDTH "W" TO THIS LEVEL.
5. TRENCH WIDTH "W" = PIPE O.D. PLUS 2'–0". IN TRENCHES WHERE MULTIPLE CONDUITS ARE LAID SIDE BY SIDE, THE TRENCH SHALL BE 2'–0" WIDER THAN THE ENTIRE CONDUIT GALLERY CONFIGURATION.
6. PLACE 3" WIDE IDENTIFICATION/WARNING TAPE 12–INCHES OVER CENTER OF PIPE.
7. VERIFY THAT THERE ARE NO SHARP OR DELITERIOUS OBJECTS THAT MAY DAMAGE THE PIPE FOR A MINIMUM DEPTH OF 6–INCHES BELOW THE BOTTOM OF THE PIPE BARREL FOR THE FULL WIDTH OF THE TRENCH.
8. COMPACT WITH HAND OPERATED COMPACTING EQUIPMENT (HAND COMPACTED) ONLY.
9. DEWATERING SYSTEM SHALL BE UTILIZED BY THE CONTRACTOR IN ACCORDANCE WITH GOOD STANDARD PRACTICE AND MUST BEE EFFICIENT ENOUGH TO LOWER THE WATER LEVEL IN ADVANCE OF EXCAVATION TO KEEP THE TRENCH BOTTOM AND SIDED FORM AND DRY, (2' MINIMUM BELOW THE TRENCH BOTTOM. NO POLLUTED WATER SHALL BE DISCHARGED INTO SANITARY SEWER, STORM SYSTEM, OR BODIES OF WATER.
10. A MINIMUM OF 18" COVER SHALL BE MAINTAINED OVER PIPING AND 24" OVER CONDUITS UNLESS OTHERWISE NOTED ON THE PLANS.



ANCHOR LOWER BALES WITH 2–2" X 2"X4' STAKES PER BALE. ANCHOR TOP BALES TO LOWER BALES WITH 2–2" X 2"X4' STAKES PER BALE.

ELEVATION TYPE II

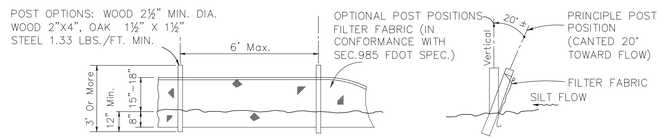


ANCHOR BALES WITH 2–2"X2"X4' STAKES PER BALE

ELEVATION TYPE I

APPLICATION AND SPACING: THE USE OF TYPES I & II BALE BARRIERS SHOULD BE LIMITED TO THE CONDITIONS OUTLINED IN CHART I, SHEET 1 OF 3, INDEX NO. 102 (2010 EDITION)

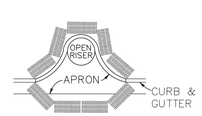
BARRIER FOR UNPAVED DITCHES



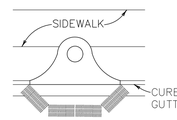
ELEVATION SECTION

NOTE: SILT FENCE TO BE PAID FOR UNDER THE CONTRACT UNIT PRICE FOR STAKED SILT FENCE (LF).

TYPE III SILT FENCE

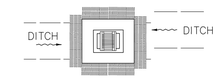


PARTIAL INLET



ANCHOR BALES WITH 2– 2"X2"X4' STAKES PER BALE.

COMPLETED INLET



DITCH BOTTOM INLET

PROTECTION AROUND INLETS OR SIMILAR STRUCTURES

NOTES:

1. EROSION CONTROL DEVICES SHALL BE PROPERLY MAINTAINED THROUGHOUT CONSTRUCTION TO PREVENT THE INFILTRATION OF PROJECT SITE SOILS INTO A PUBLIC DRAINAGE SYSTEM.
2. FOR ADDITIONAL DETAILS, REFER TO F.D.O.T. INDEX #102, 103, AND 104. (2010 EDITION)
3. SEE PLANS FOR LOCATION OF PROPOSED EROSION CONTROL DEVICES.

CITY: DIV/GROUP: DB: LD: PIC: PM: TM: LYR:ON=*;OFF=*REF*
C:\BIM\OneDrive - ARCADIS\BIM 360 Docs\SABIC INNOVATIVE PLASTICS\SABIC BURKEVILLE, AL\2019\13283045.0000.0000201-DWG\SABIC EROSION CONTROL.dwg LAYOUT: C-3 SAVED: 4/18/2019 11:26 PM ACADVER: 23.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: FDEP.CTB
PLOTTED: 4/23/2019 4:08 PM BY: BERNDGEN, WENDY
XREFS: IMAGES: PROJECTNAME: ----

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Professional Engineer's Name		
JOHN F. PERELLA, P.E.		
Professional Engineer's No.		
37041-E		
State	Date Signed	Project Mgr.
AL		(MGR)
Designed by	Drawn by	Checked by
JP	WDB	JP

ARCADIS Design & Consultancy for natural and built assets

ARCADIS U.S., INC.

SABIC ● ONE PLASTICS DRIVE, BURKVILLE, ALABAMA
BRINE SYSTEM EXPANSION

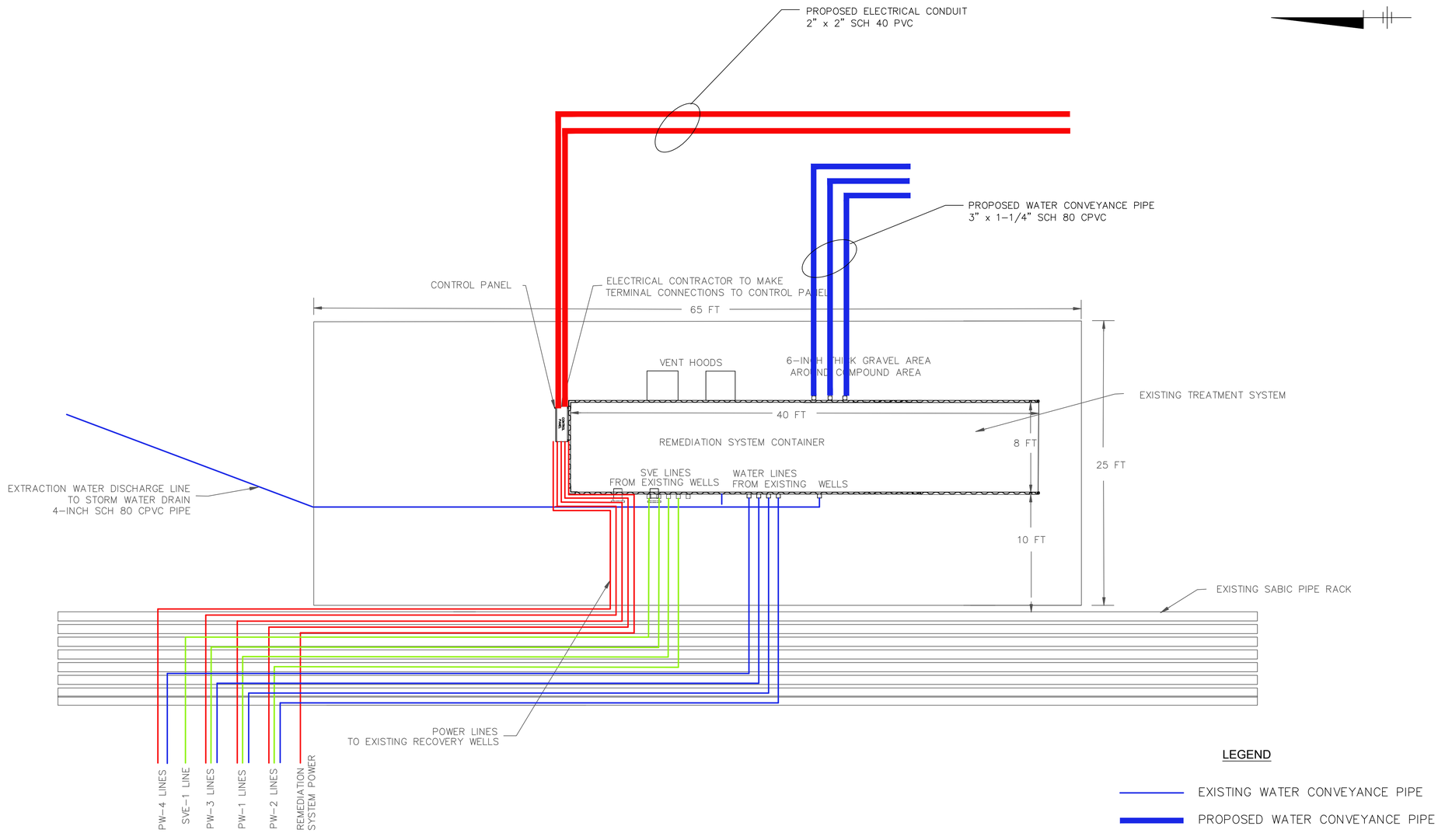
TRENCH AND EROSION CONTROL DETAILS

ARCADIS Project No. 13283045.0000.00002

Date APRIL 2019

ARCADIS
1728 3RD AVENUE NORTH
SUITE 300
BIRMINGHAM, ALABAMA
TEL. (205)-930-5965

C-3



NOTES:

- CONTRACTOR TO MAKE CONNECTIONS AS NEEDED.
- SET EQUIPMENT CONTAINER IN PLACE WITH A CRANE. LEVEL AS NECESSARY.
- SET GAC IN PLACE WITH CRANE, LEVEL AS NECESSARY.
- CONTRACTOR RESPONSIBLE FOR ELECTRICAL CONNECTIONS TO THE SYSTEM AND TO RECOVERY WELLS.
- CONTRACTOR IS RESPONSIBLE FOR ALL PIPING AND CONNECTIONS TO THE SYSTEM.
- ELECTRICAL WIRE AWG SIZING TO BE APPROVED BY ARCADIS AND SABIC PRIOR TO INSTALLATION.

LEGEND

- EXISTING WATER CONVEYANCE PIPE
- PROPOSED WATER CONVEYANCE PIPE
- EXISTING ELECTRIC CONDUIT
- PROPOSED ELECTRIC CONDUIT
- EXISTING SVE CONVEYANCE

ALL PIPING AND PIPING SUPPORTS WILL COMPLY WITH THE SABIC DESIGN GUIDE SPECIFICATION SPEC#1840.05 REVISION 1, 7/28/14
ALL PIPING MATERIALS WILL COMPLY WITH THE SABIC PIPING MATERIALS SPECIFICATIONS 15052 ATTACHMENT 2, REV 4, 5/11/2007

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XREFS: IMAGES: PROJECTNAME: ---
area.jpg
Brine Plant Aerial.jpg
O30085H5.TIF
O30085H5.TIF

0 5' 10'
GRAPHIC SCALE

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

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Professional Engineer's Name: JOHN F. PERELLA, P.E.		
Professional Engineer's No.: 37041-E		
State: AL	Date Signed:	Project Mgr.: (MGR)
Designed by: JP	Drawn by: WDB	Checked by: JP

ARCADIS Design & Consultancy for natural and built assets

ARCADIS U.S., INC.

SABIC ● ONE PLASTICS DRIVE, BURKVILLE, ALABAMA
BRINE SYSTEM EXPANSION

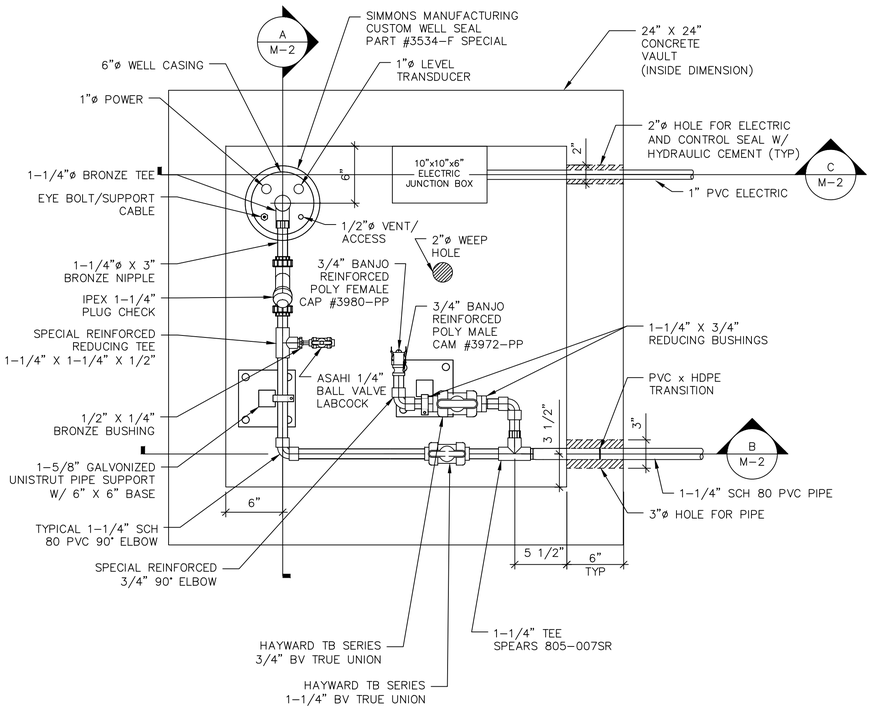
REMEDIATION SYSTEM COMPOUND LAYOUT

ARCADIS Project No.
13283045.0000.00002

Date
APRIL 2019

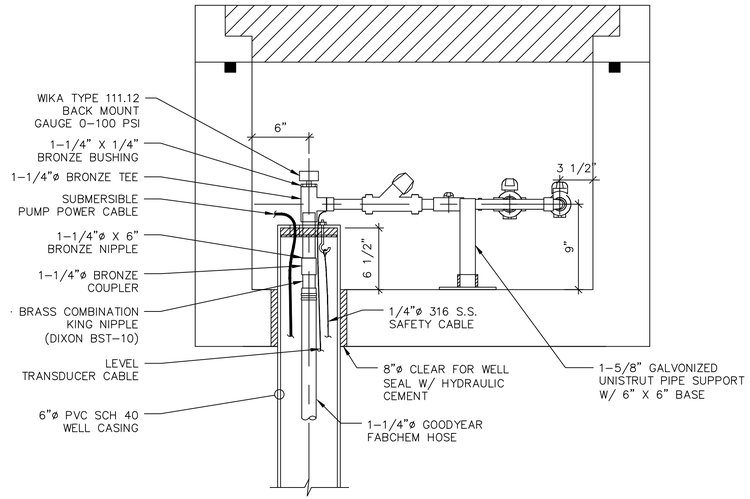
ARCADIS
1728 3RD AVENUE NORTH
SUITE 300
BIRMINGHAM, ALABAMA
TEL. (205)-930-5965

M-1



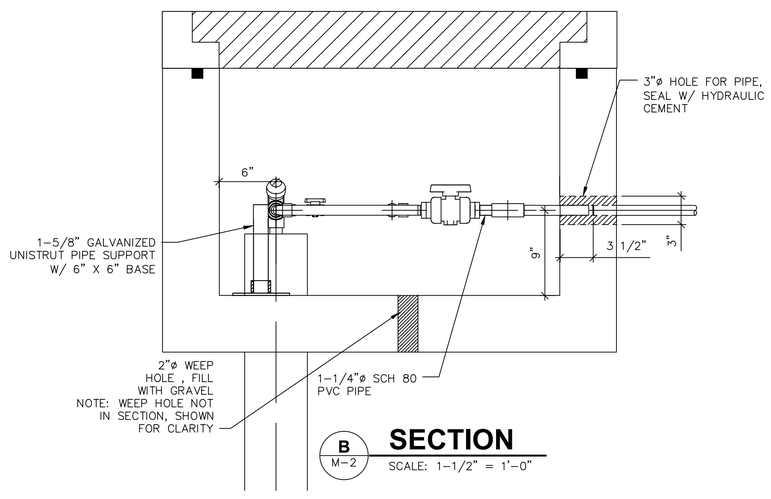
PLAN VIEW

NOT TO SCALE



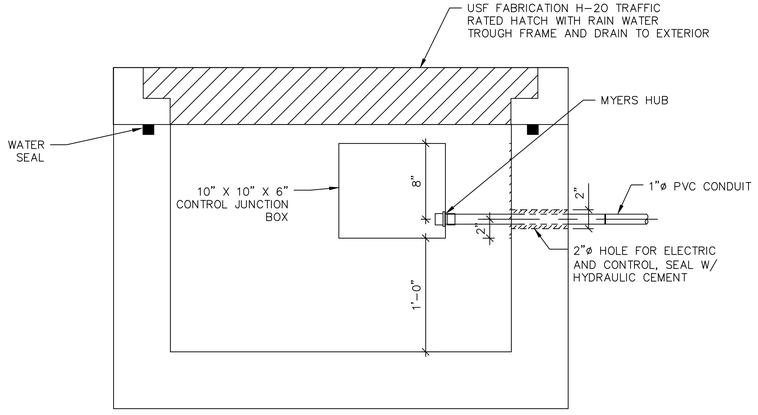
A M-2 **SECTION**

SCALE: 1-1/2" = 1'-0"



B M-2 **SECTION**

SCALE: 1-1/2" = 1'-0"



C M-2 **SECTION**

SCALE: 1-1/2" = 1'-0"

0 1' 2'

FULL SIZE = 1-1/2" = 1'-0"
HALF SIZE = 3" = 1'-0"

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Professional Engineer's Name
JOHN F. PERELLA, P.E.

Professional Engineer's No.
37041-E

State	Date Signed	Project Mgr.
AL		(MGR)
Designed by	Drawn by	Checked by
JP	WDB	JP

ARCADIS U.S., INC.

SABIC ● ONE PLASTICS DRIVE, BURKVILLE, ALABAMA
BRINE SYSTEM EXPANSION

PW-3R WELL VAULT PLAN

ARCADIS Project No.
13283045.0000.00002

Date
APRIL 2019

ARCADIS
1728 3RD AVENUE NORTH
SUITE 300
BIRMINGHAM, ALABAMA
TEL. (205)-930-5965

M-2

CITY: DIV/GROUP: DB: LD: PIC: PM: TM: LYR:ON=*;OFF=*REF*
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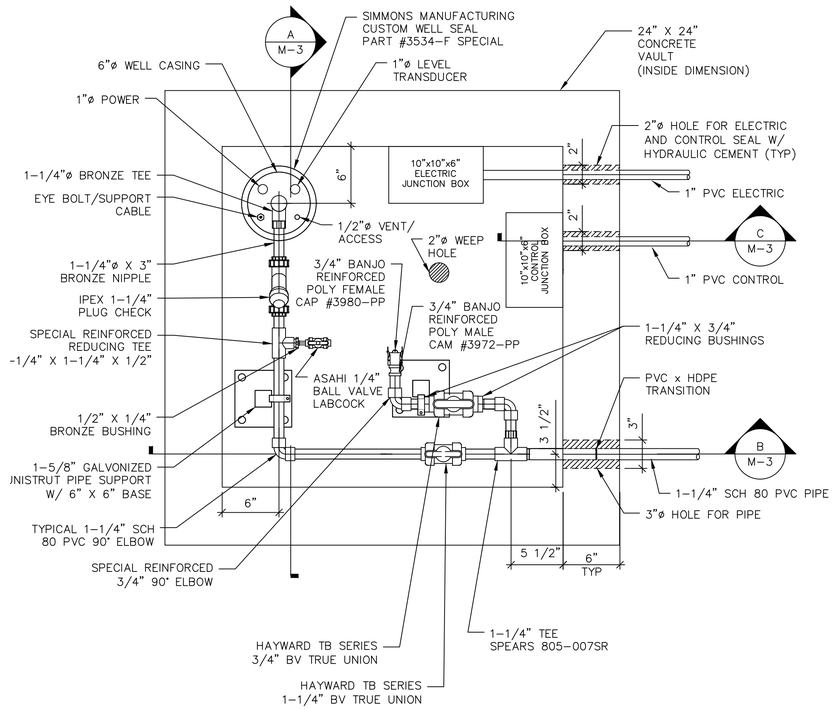
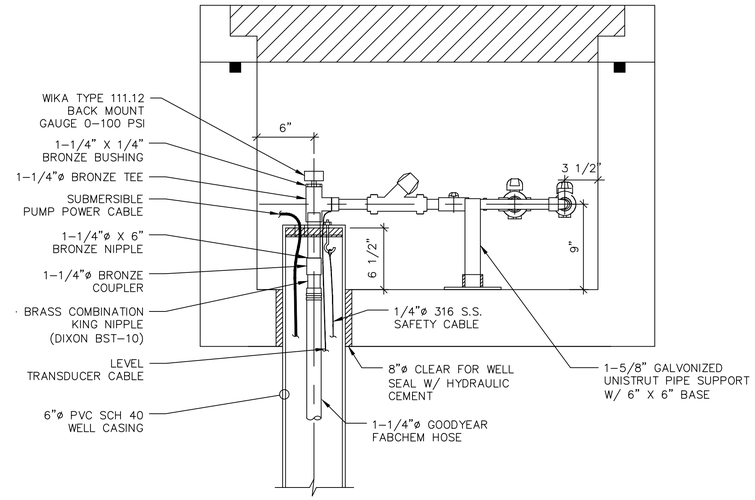


PLAN VIEW

NOT TO SCALE



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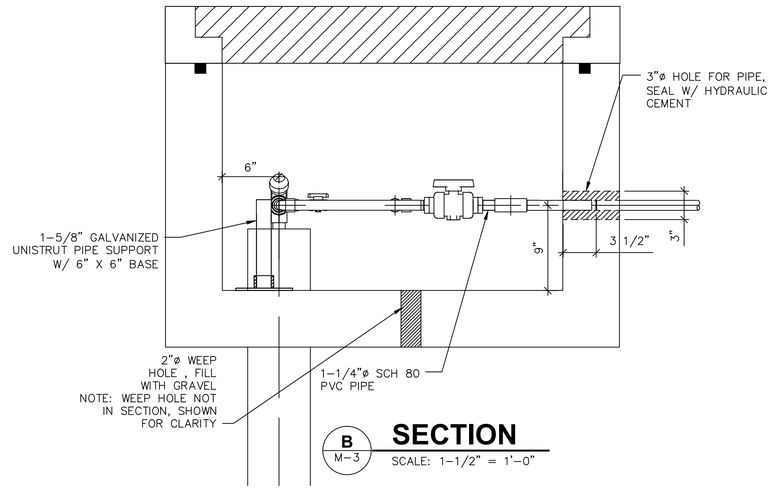
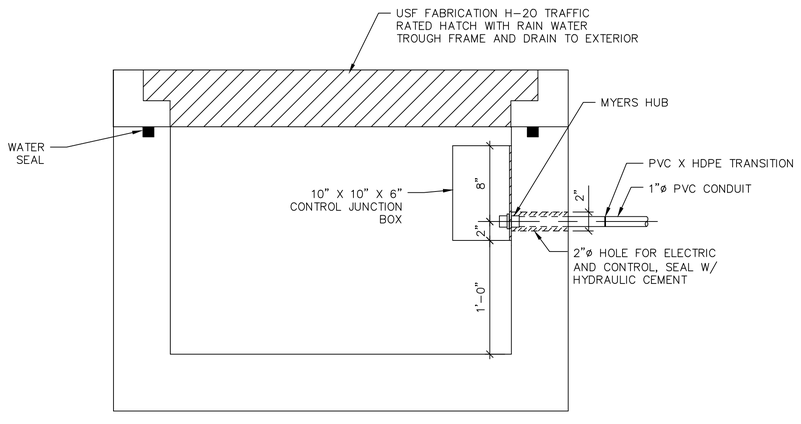
SCALE: 1-1/2" = 1'-0"



B M-3 **SECTION**

SCALE: 1-1/2" = 1'-0"



C M-3 **SECTION**

SCALE: 1-1/2" = 1'-0"

0 1' 2'

FULL SIZE = 1-1/2" = 1'-0"
HALF SIZE = 3" = 1'-0"

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Professional Engineer's Name
JOHN F. PERELLA, P.E.
Professional Engineer's No.
37041-E
State: AL
Date Signed:
Project Mgr.: (MGR)
Designed by: JP
Drawn by: WDB
Checked by: JP

ARCADIS U.S., INC.

ARCADIS Design & Consultancy for natural and built assets

SABIC ● ONE PLASTICS DRIVE, BURKVILLE, ALABAMA

BRINE SYSTEM EXPANSION

RMDW-1, RMDW-2 AND RMDW-3 WELL VAULT PLAN

ARCADIS Project No.
13283045.0000.00002

Date
APRIL 2019

ARCADIS
1728 3RD AVENUE NORTH
SUITE 300
BIRMINGHAM, ALABAMA
TEL. (205)-930-5965

M-3

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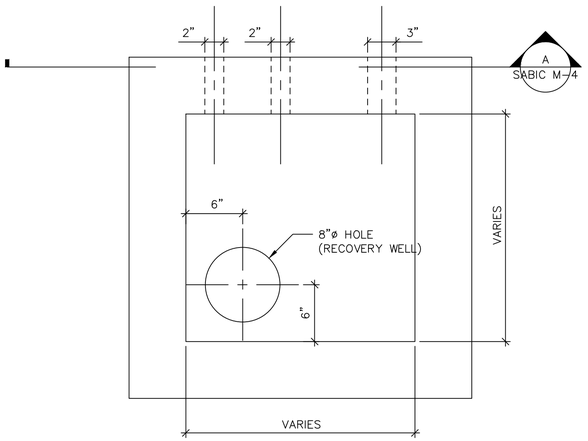
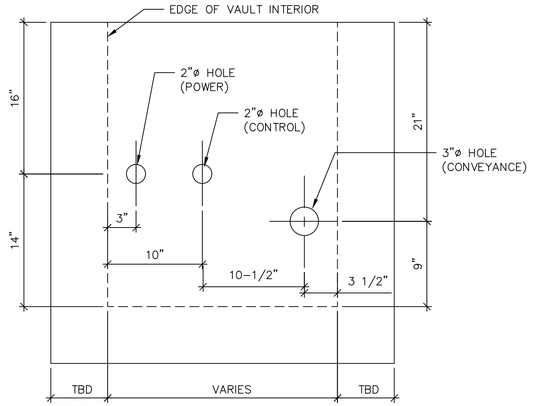




NOTES:

1. INTERIOR VAULT DIMENSIONS: 24" X 24" X 30" DEEP FOR PW-3R, 36" X 36" X 30" DEEP FOR RMDW-1THROUGH RMDW-3.
2. VAULT AND ACCESS HATCH MEETS H-20 STANDARDS.
3. VAULT ACCESS HATCH CONSTRUCTED OF ALUMINUM W/ STAINLESS STEEL HARDWARE.
4. 2" DIA. HOLE FOR CONTROL CONDUIT NOT REQUIRED IN PW3R VAULT.

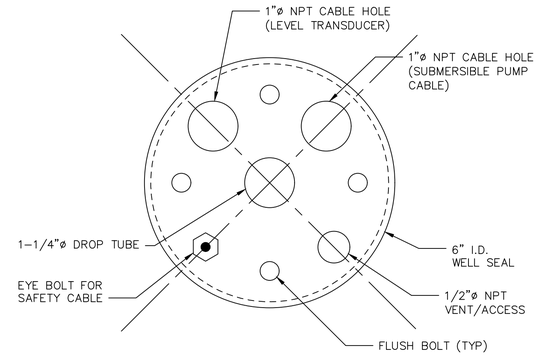
A SECTION

A
SABIC M-4

FULL SIZE SCALE = 1-1/2" = 1'-0"
HALF SIZE SCALE = 3" = 1'-0"

PLAN VIEW

FULL SIZE SCALE = 1-1/2" = 1'-0"
HALF SIZE SCALE = 3" = 1'-0"

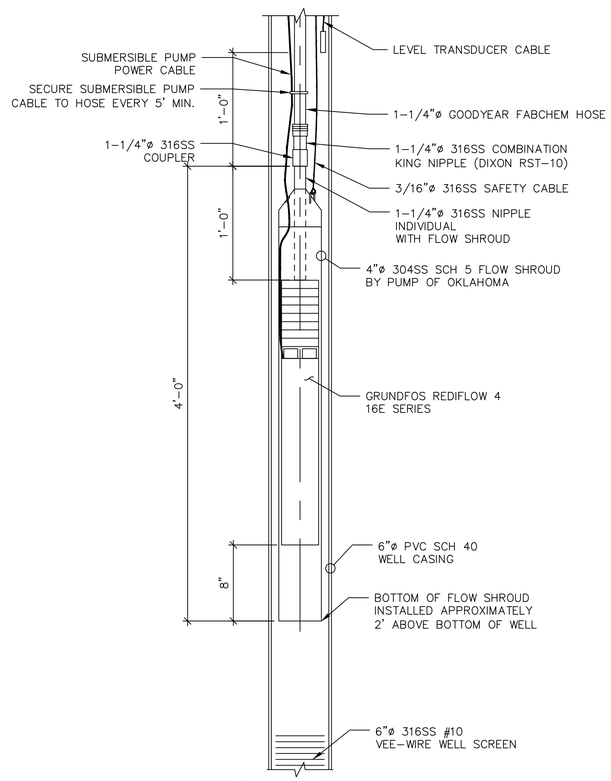


NOTES:

1. WELL SEAL FOR USE ON 6" ø SCH 40 WELL CASING.
2. USE STANDARD GASKET 5.95" O.D. X 3/4".
3. 3/8" TOP PLATE.

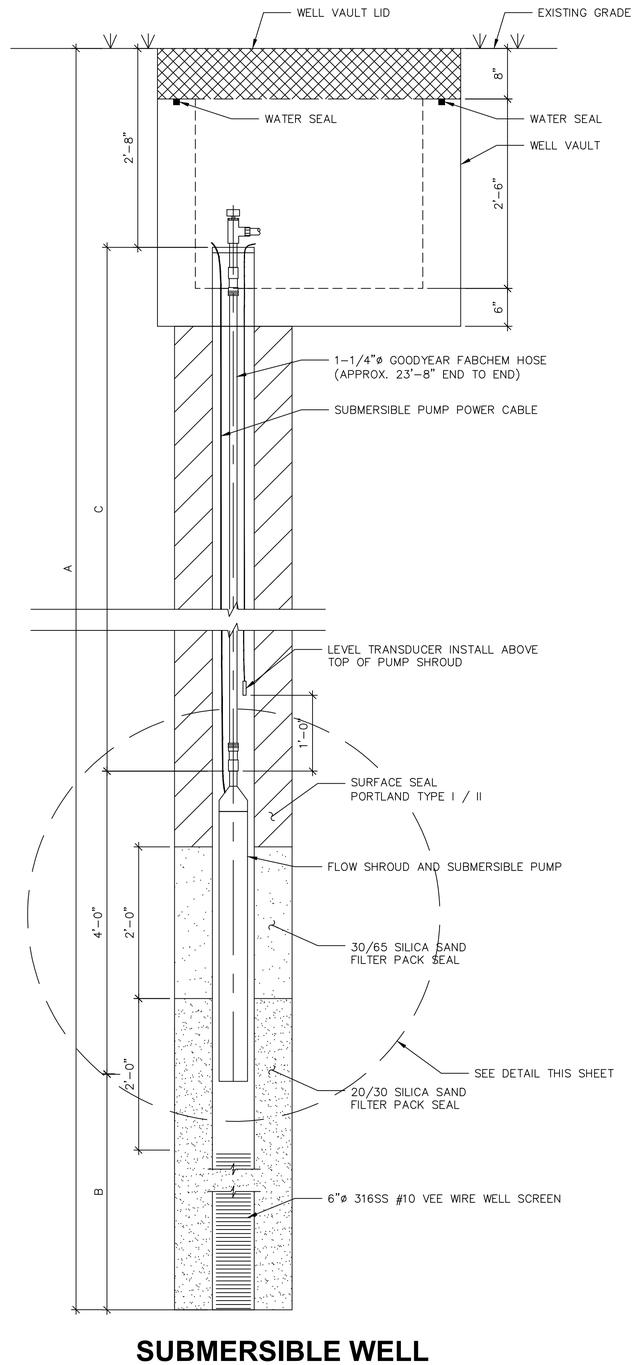
WELL SEAL DETAIL

FULL SIZE SCALE = 6" = 1'-0"
HALF SIZE SCALE = 12" = 1'-0"



DETAIL

FULL SIZE SCALE = 1-1/2" = 1'-0"
HALF SIZE SCALE = 3" = 1'-0"



SUBMERSIBLE WELL

FULL SIZE SCALE = 1-1/2" = 1'-0"
HALF SIZE SCALE = 3" = 1'-0"

WELL ID	DIMENSION A (ft)	DIMENSION B (ft)	DIMENSION C (ft)	PUMP SERIES	MOTOR (HP)
PW-1	30.0	10	21.0	16E7PE	0.75
PW-2	30.0	10	21.0	16E7PE	0.75
PW-3R	30.0	10	21.0	16E7PE	0.75
PW-4	30.0	10	21.0	16E7PE	0.75
RMDW-1	30.0	10	21.0	10E11PE	0.75
RMDW-2	30.0	10	21.0	10E11PE	0.75
RMDW-3	30.0	10	21.0	10E11PE	0.75

NOTE:
PW-3R, RMDW-1, RMDW-2 AND RMDW-3 ARE NEW/PROPOSED.
PW-1, PW-2 AND PW-4 ARE EXISTING.

NOTES:

1. LOCATION OF PUMP AND FLOW SHROUD SHOWN FOR CLARITY. BOTTOM OF FLOW SHROUD SHALL BE 2 FEET ABOVE THE BOTTOM OF THE RECOVERY WELL.
2. LEVEL TRANSDUCER INSTALLED IN RECOVERY WELLS RMDW-1, RMDW-2 AND RMDW-3 ONLY.

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WellDetail

AS NOTED

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Professional Engineer's Name: JOHN F. PERELLA, P.E.
Professional Engineer's No.: 37041-E

State	Date Signed	Project Mgr.
AL		(MGR)
Designed by	Drawn by	Checked by
JP	WDB	JP

ARCADIS Design & Consultancy for natural and built assets
ARCADIS U.S., INC.

SABIC ● ONE PLASTICS DRIVE, BURKVILLE, ALABAMA
BRINE SYSTEM EXPANSION

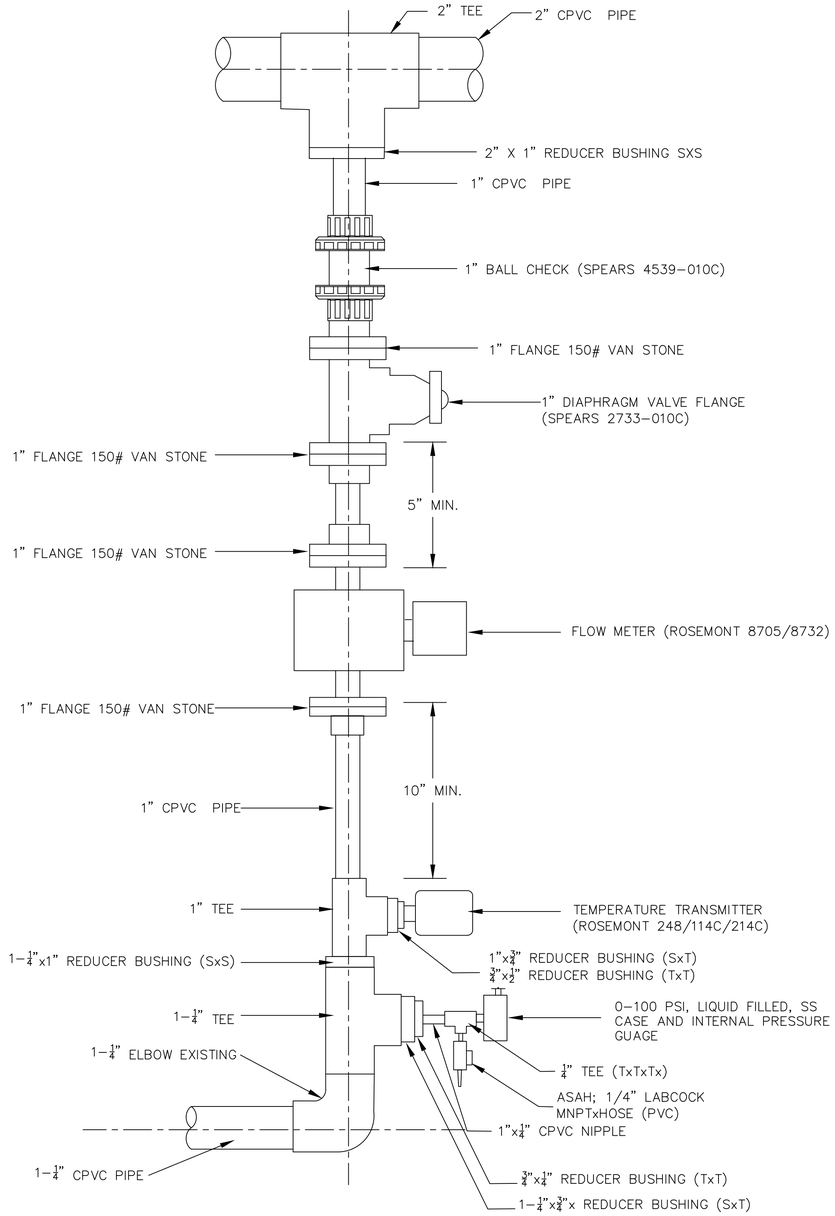
WELL VAULT PLAN AND SECTIONS II

ARCADIS Project No.
13283033.0000.00003

Date
NOVEMBER 2018

ARCADIS
1728 3RD AVENUE NORTH
SUITE 300
BIRMINGHAM, ALABAMA
TEL. (205)-930-5965

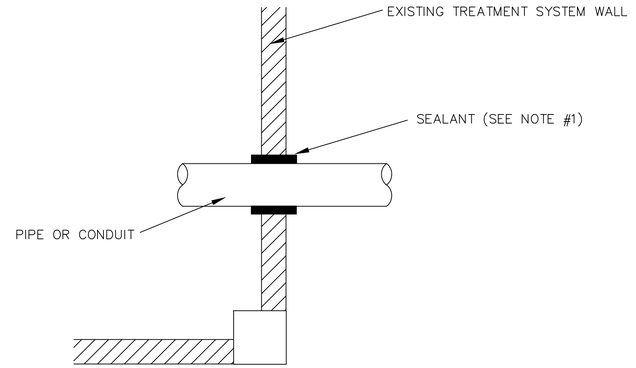
M-4



1 RMDW-1, 2 AND 3 MANIFOLD DETAIL

NOT TO SCALE

NOTES:
1. ALL PIPE AND FITTINGS ARE SCH 80 CPVC UNLESS OTHERWISE NOTED.
2. ALL FLANGE GASKETS ARE FULL FACE FKM/VITON 1/8" THICK..
3. ALL HARDWARE SHALL BE 304 SS.
4. USE ANTI-SEEZE GREASE ON ALL THREADS.



2 TYPICAL TREATMENT SYSTEM WALL PENETRATION

NOT TO SCALE

NOTES:
1. USE SIKAFLEX-1A OR APPROVED EQUIVALENT.
2. DRILL HOLE THROUGH WALL 1/4" TO 3/8" LARGER THAN PIPE OR CONDUIT O.D.
3. SUPPORT PIPE AS REQUIRED.

CITY: DIV/GROUP: DB: LD: PIC: PM: TM: LYR:ON=*;OFF=*REF*
C:\BIM\OneDrive - ARCADIS\BIM 360 Docs\SABIC INNOVATIVE PLASTICS\SABIC BURKEVILLE, AL\2019\13283045.0000.00002\01-DWG\SABIC M-5.dwg LAYOUT: LAYOUT1 SAVED: 4/23/2019 4:51 PM ACADVER: 23.0S (LMS TECH) PAGESETUP:
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XREFS: IMAGES: PROJECTNAME: ----
WALL.jpg

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Project Mgr. (MGR)
Designed by (DSN)
Drawn by WDB
Checked by (CHK)

ARCADIS Design & Consultancy for natural and built assets

ARCADIS U.S., INC.

SABIC • ONE PLASTICS DRIVE, BURKVILLE, ALABAMA
BRINE SYSTEM EXPANSION

RECOVERY WELL MANIFOLD

ARCADIS Project No. 13283045.0000.00002

Date APRIL 2019

ARCADIS
ADDRESS LINE1
ADDRESS LINE2
CITY, STATE
TEL. XXX.XXX.XXXX

M-5

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XREFS: IMAGES: PROJECTNAME: ----
manifold.jpg

LEGEND

- FLEXIBLE HOSE
- CONTROL PANEL OR EQUIPMENT
- SOFTWARE LINK, SYSTEM FUNCTION CONNECTION OR COMMUNICATION LINK
- FO —— FO — FIBER OPTIC CONNECTION
- MAIN PROCESS LINE
- AUXILIARY SYSTEMS
- BUILDING/AREA EXTENTS
- ELECTRIC (ELECTRONIC) SIGNAL
- INJECTION QUILL WITH SPRING CHECK
- MULTI–PURPOSE VALVE
- BALL VALVE
- BUTTERFLY VALVE
- PISTON CHECK VALVE
- GATE VALVE
- SPRING CHECK VALVE
- SWING CHECK VALVE
- BALL CHECK VALVE
- DIAPHRAGM VALVE
- SOLENOID VALVE/ACTUATOR
- SAMPLE PORT
- PRESSURE REGULATING VALVE
- FLANGED CONNECTION/PIPE TRANSITION
- NON–FLANGED PIPE TRANSITION
- UNION
- WELDED CAP
- REDUCER
- T STRAINER
- Y STRAINER
- EJ — EXPANSION JOINT
- VENT
- CAMLOCK
- QUICK CONNECT
- HOSE BARB CONNECTION
- EYE WASH/EMERGENCY SHOWER

- M — MOTOR
- VFD — VARIABLE FREQUENCY DRIVE
- M — SUBMERSIBLE WELL PUMP
- M — CENTRIFUGAL BLOWER
- M — CENTRIFUGAL PUMP
- M — CHEMICAL METERING PUMP
- S — SUMP PUMP
- MAGNETIC FLOW METER
- POSITIVE DISPLACEMENT FLOW METER
- AVERAGING PILOT TUBE FLOW METER
- STATIC MIXER
- SITE GLASS
- FILTER
- BELL FLOAT
- FCV — FLOW CONTROL VALVE
- BACK FLOW PREVENTOR

INSTRUMENT SYMBOLS

	PRIMARY CONTROL PANEL NORMALLY ACCESSIBLE TO OPERATOR	FIELD MOUNTED	AUXILIARY PANEL OR RACK NORMALLY ACCESSIBLE TO OPERATOR
DISCRETE INSTRUMENTS			
SHARED DISPLAY, SHARED CONTROL			
COMPUTER FUNCTION INCLUDING DISTRIB. CNTL. SYS.			
PROGRAMMABLE LOGIC CONTROLLER FUNCTION			

PIPELINE DESIGNATION

6"–S04P
- LINE TYPE
- MATERIAL
- SIZE

MATERIAL:

BRZ – BRASS/BRONZE
CIR – CAST IRON
CST – CARBON STEEL
CPR – COPPER
CVC – CHLORINATED POLYVINYL CHLORIDE
DIR – DUCTILE IRON
FRP – FIBERGLASS
GCS – GALVANIZED CARBON STEEL
HDPE– HIGH DENSITY POLYETHYLENE
LCS – LINED CARBON STEEL

TYPE:

D = DUCT
H = HOSE
C = DOUBLE WALL CONTAINMENT PIPE
P = PIPE
T = TUBE

PET – POLYETHYLENE
POP – POLYPROPYLENE
PVC – POLYVINYL CHLORIDE
RUB – RUBBER
S04 – 304 STAINLESS STEEL
S4L – 304L STAINLESS STEEL
S16 – 316 STAINLESS STEEL
S6L – 316L STAINLESS STEEL
TEF – TEFLON
VIT – VITON
TYG – TYGON

INTERLOCKS

1. RECOVERY WELL PUMP MOTOR FAILURE TO START. NOTIFICATION ALARM.
2. RECOVERY WELL (RWDM–1, RMDW–2 AND RMDW–3) LOW/LOW LIQUID LEVEL ALARM. SHUTDOWN RESPECTIVE RECOVERY WELL. NOTIFICATION ALARM.
3. RECOVERY WELL (RWDM–1, RMDW–2 AND RMDW–3) LOW LIQUID LEVEL. SHUTDOWN RESPECTIVE RECOVERY WELL. NORMAL LEVEL CONTROL FOR RECOVERY WELL PUMP OPERATION.
4. RECOVERY WELL (RWDM–1, RMDW–2 AND RMDW–3) HIGH LIQUID LEVEL. RESTART RESPECTIVE RECOVERY WELL. NORMAL LEVEL CONTROL FOR RECOVERY WELL PUMP OPERATION.
5. RECOVERY WELL LIQUID TEMPERATURE ALARM HIGH. NOTIFICATION ALARM.
6. RECOVERY WELL LIQUID FLOW RATE ALARM LOW. NOTIFICATION ALARM.
7. RECOVERY WELL LIQUID FLOW RATE ALARM HIGH. NOTIFICATION ALARM.
8. * B–100 AIR STRIPPER BLOWER FAILURE TO START. NOTIFICATION ALARM AND SYSTEM SHUTDOWN.
9. AIR STRIPPER DIFFERENTIAL PRESSURE ALARM HIGH. NOTIFICATION ALARM.
10. * AIR STRIPPER SUMP LIQUID LEVEL HIGH/HIGH ALARM. NOTIFICATION ALARM AND SYSTEM SHUTDOWN.
11. * P–200 DISCHARGE PUMP FAILURE TO START. NOTIFICATION ALARM AND SYSTEM SHUTDOWN.
12. DISCHARGE LIQUID FLOW RATE ALARM LOW. NOTIFICATION ALARM.
13. DISCHARGE LIQUID FLOW RATE ALARM HIGH. NOTIFICATION ALARM.
14. DISCHARGE PRESSURE ALARM HIGH. NOTIFICATION ALARM.
15. DISCHARGE PRESSURE ALARM LOW. NOTIFICATION ALARM.

* DENOTES CRITICAL ALARM / SYSTEM SHUTDOWN

INSTRUMENT IDENTIFICATION LETTERS

FIRST LETTER		SUCCEEDING LETTERS		
MEASURE OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A = ANALYSIS		ALARM		
B = BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C = USER'S CHOICE			CONTROL, CLOSED	
D = USER'S CHOICE	DIFFERENTIAL			
E = VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F = FLOW RATE	RATIO (FRACTION)			
G = USER'S CHOICE		GLASS, VIEWING DEVICE		
H = HAND				HIGH
I = CURRENT (ELECTRICAL)		INDICATE		
J = POWER	SCAN			
K = TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L = LEVEL		LIGHT		LOW
M = USER'S CHOICE	MOMENTARY			MIDDLE,INTERMEDIATE
N = USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O = USER'S CHOICE		ORIFICE, RESTRICTION	OPEN	
P = PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q = QUANTITY	INTEGRATE, TOTALIZE			
R = RADIATION		RECORD	RUN	
S = SPEED, FREQUENCY	SAFETY	SWITCH	STOP	
T = TEMPERATURE			TRANSMIT	
U = MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V = VIBRATION, MECH. ANALYSIS			VALVE, DAMPER, LOUVER	
W = WEIGHT, FORCE		WELL		
X = UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y = EVENT, STATUS OR PRESENCE	Y AXIS		RELAY,COMPUTE,CONVERT	
Z = POSITION, DIMENSION	Z AXIS	UNCLASSIFIED	DRIVE, ACTUATOR, FINAL CONTROL ELEMENT	

ABBREVIATIONS:

AC AIR COMPRESSOR
AD AIR DRYER
AI pH INDICATOR
AIT pH INDICATOR TRANSMITTER
AR AIR RECEIVER TANK
AS ANTI–SCALANT
C CENTER LINE
CAH CONDUCTIVITY ALARM HIGH
CFM CUBIC FEET PER MINUTE
CI CONDUCTIVITY INDICATOR
CIP CLEAN IN PLACE
CIT CONDUCTIVITY INDICATOR TRANSMITTER
CO CLEAN OUT
CTE CONDUCTIVITY TEMPERATURE ELEMENT
CY CUBIC YARDS
°C DEGREES CELSIUS
DPAL DIFFERENTIAL PRESSURE ALARM LOW
DPAH DIFFERENTIAL PRESSURE ALARM HIGH
DPIT DIFFERENTIAL PRESSURE INDICATOR TRANSMITTER
DPI DIFFERENTIAL PRESSURE INDICATOR
E ELECTRIC ACTUATOR
ECIP ELECTRODE CLEAN IN PLACE
EM ENVIRONMENTAL MEDIA
ELEV ELEVATION
F FILTER
FE FLOW ELEMENT
FI FLOW INDICATOR
FIT FLOW INDICATING TRANSMITTER
FMO FLOW MONITOR
FQ FLOW TOTALIZER
FT FOOT/ FEET
FT FLOW TRANSMITTER
FV FLOW VALVE
GAC GRANULATED ACTIVATED CARBON
GAL GALLONS
GPD GALLONS PER DAY
HAZ HAZARDOUS
HDPE HIGH DENSITY POLYETHYLENE
HOA HAND/ OFF/ AUTO
HR HOUR
HS HAND SWITCH
IN. INCHES
kg KILOGRAMS
KV TIMER VALVE
L LITER
LAH LEVEL ALARM HIGH
LAHH LEVEL ALARM HIGH HIGH
LAL LEVEL ALARM LOW
LE LEVEL ELEMENT
LP LIQUID PHASE
LS LEVEL SWITCH
LT LEVEL TRANSMITTER
M MOTOR
MAX MAXIMUM
uM MICROMETER
mg MILLIMETER
MIN MINIMUM
MMF MULTIMEDIA FILTER
NA NOT APPLICABLE
NC NORMALLY CLOSED
NO NORMALLY OPEN
NPT NATIONAL PIPE THREAD
% PERCENT
LB POUNDS
PAH PRESSURE ALARM HIGH
PAL PRESSURE ALARM LOW
PI PRESSURE INDICATOR
PIT PRESSURE INDICATOR TRANSMITTER
PSIG PRESSURE PER SQUARE FOOT GAUGE
PR PRESSURE RELIEF VALVE
PRV PRESSURE REGULATING VALVE
PSV PRESSURE SAFETY VALVE
PVR PRESSURE VACUUM RELIEF
QAPP QUALITY ASSURANCE PROJECTION PLAN
NaOH SODIUM HYDROXIDE
SP SAMPLE PORT
T TANK
TAH TEMPERATURE ALARM HIGH
TAHH TEMPERATURE ALARM HIGH HIGH
TI TEMPERATURE INDICATOR
TIT TEMPERATURE INDICATOR TRANSMITTER
TYP TYPICAL
TWV THREE WAY VALVE
V VALVE
VAH VACUUM ALARM HIGH
VAL VACUUM ALARM LOW
VE VACUUM ELEMENT
VIT VACUUM INDICATING TRANSMITTER
XLPE CROSS LINKED POLYETHYLENE
YI STATUS INDICATOR
ZX POSITION INDICATOR

NOTES:
1. ANY FIRST LETTER COMBINED WITH A MODIFIER REPRESENTS A NEW AND SEPARATE MEASURED VARIABLE. EXAMPLES: DP= DIFFERENTIAL PRESSURE; FQ= TOTALIZED OR INTEGRATED FLOW. EXCEPTION IS THE MODIFIER "J" FOR MULTIPOINT SCANNING.
2. FOR ANALYSIS NOT IDENTIFIED BY A SPECIFIC LETTER INTHE TABLE, USE FIRST LETTER "A" NEAR THE INSTRUMENT SYMBOL, SPECIFY THAT NATURE OF THE ANALYSIS. EXAMPLE: pH
3. MEANING OF A "USER'S CHOICE" LETTER SHALL BE CONSISTENT THROUGHOUT A PROJECT, AND SHALL BE SPECIFIED IN THE DRAWING LEGEND.

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Professional Engineer's Name: JOHN F. PERELLA, P.E.
Professional Engineer's No.: 37041-E

State	Date Signed	Project Mgr.
AL		(MGR)
Designed by: JP	Drawn by: WDB	Checked by: JP

ARCADIS Design & Consultancy for natural and built assets
ARCADIS U.S., INC.

SABIC • ONE PLASTICS DRIVE, BURKVILLE, ALABAMA
BRINE SYSTEM EXPANSION

PIPING AND INSTRUMENTATION LEGEND AND SYMBOLS

ARCADIS Project No.: 13283045.0000.00002
Date: APRIL 2019

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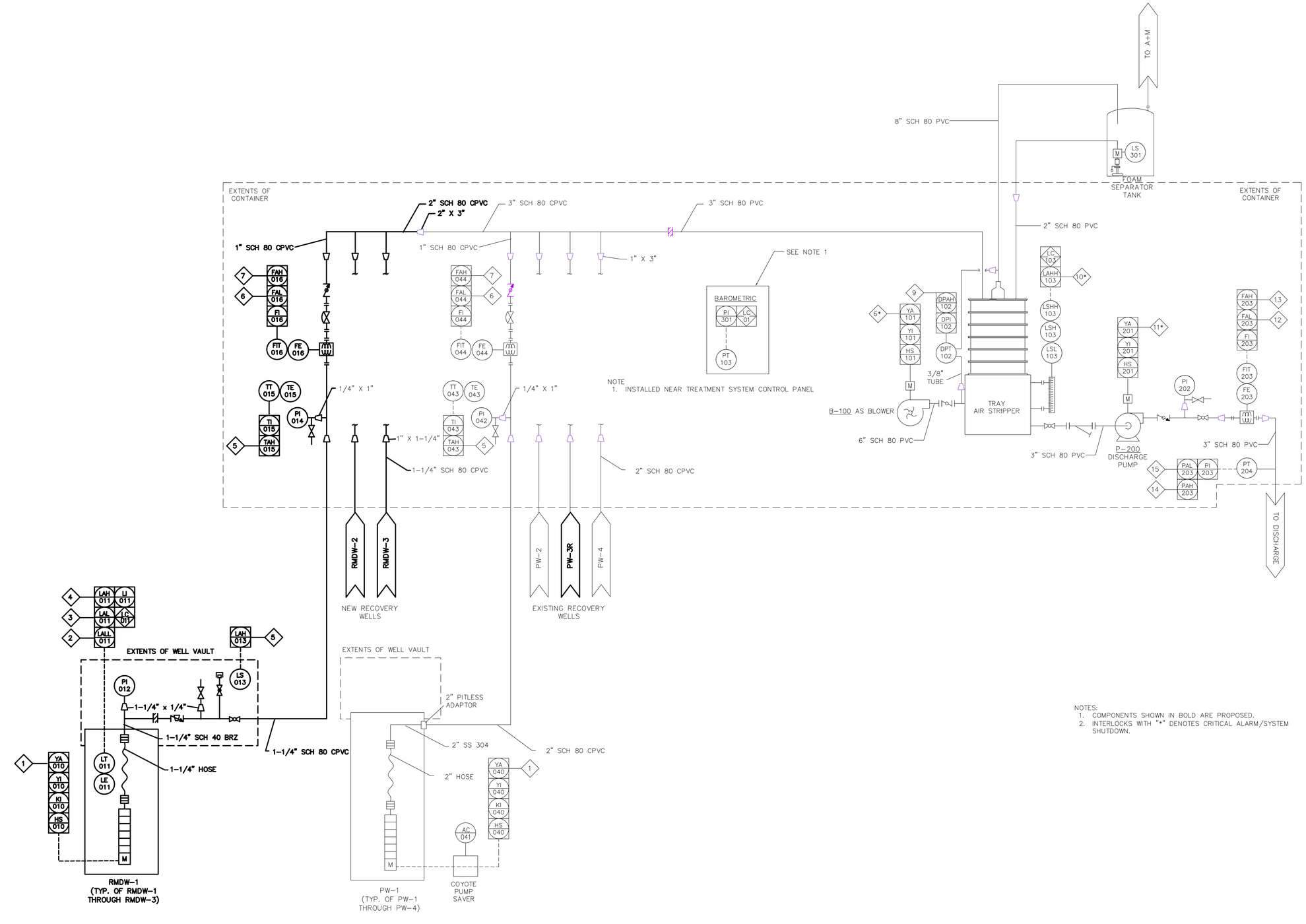
1728 3RD AVENUE NORTH
SUITE 300
BIRMINGHAM, ALABAMA
TEL. (205)-930-5965

I-1



NOTES:
1. COMPONENTS SHOWN IN BOLD ARE PROPOSED.
2. INTERLOCKS WITH "*" DENOTES CRITICAL ALARM/SYSTEM SHUTDOWN.

CITY: DIV/GROUP: DB: LD: PIC: PM: TM: LYR:ON=*;OFF=*REF*
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Professional Engineer's Name: JOHN F. PERELLA, P.E.
Professional Engineer's No.: 37041-E
State: AL | Date Signed: | Project Mgr.: (MGR)
Designed by: JP | Drawn by: WDB | Checked by: JP

ARCADIS U.S., INC.

SABIC • ONE PLASTICS DRIVE, BURKVILLE, ALABAMA

BRINE SYSTEM EXPANSION

PROCESS FLOW DIAGRAM

ARCADIS Project No.: 13283045.0000.00002
Date: APRIL 2019

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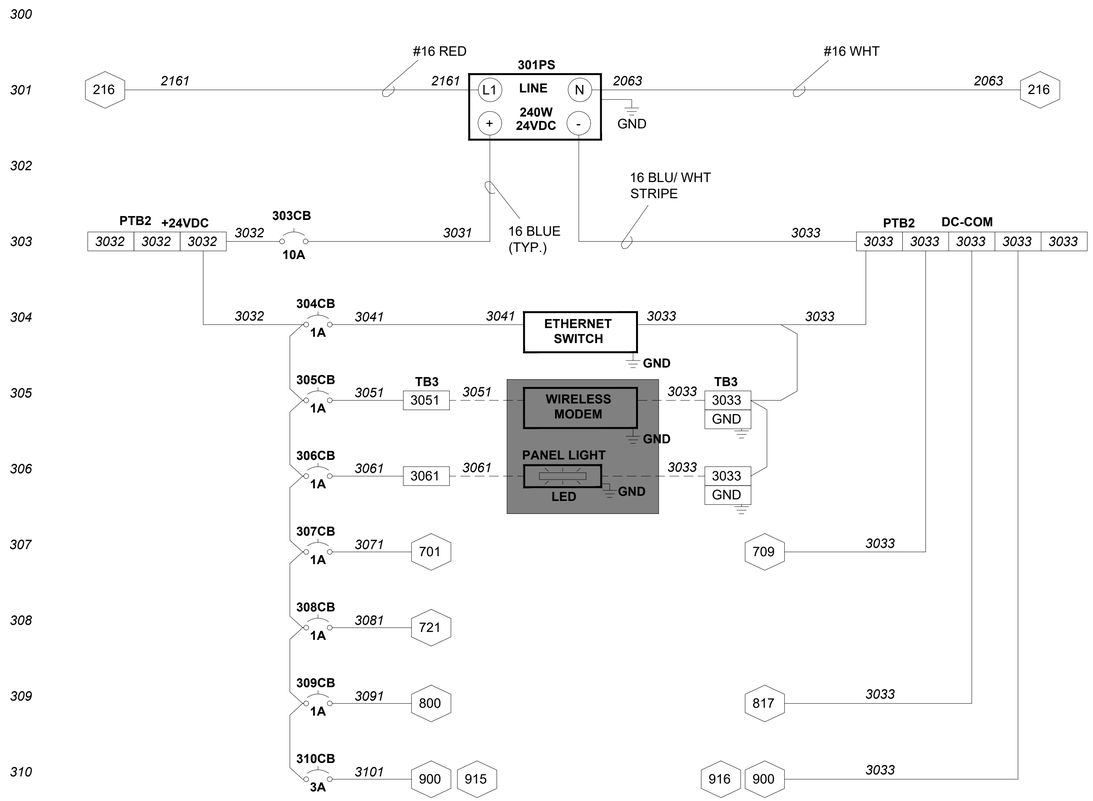
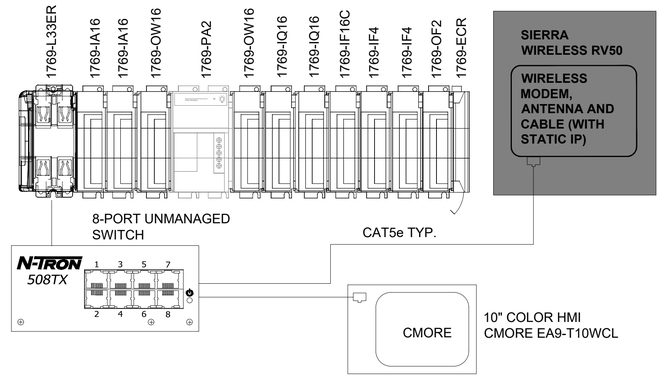
I-2





NETWORK DIAGRAM DETAIL

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Professional Engineer's Name

Professional Engineer's No.

State	Date Signed	Project Mgr.
AL		JP
Designed by	Drawn by	Checked by
MS	MS	MM

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SABIC ● ONE PLASTICS DRIVE, BURKVILLE, ALABAMA

BRINE SYSTEM EXPANSION

NETWORK DIAGRAM / CP-1 UPGRADE

ELECTRICAL

ARCADIS Project No.
13283045.0000.00002

Date
APRIL 2019

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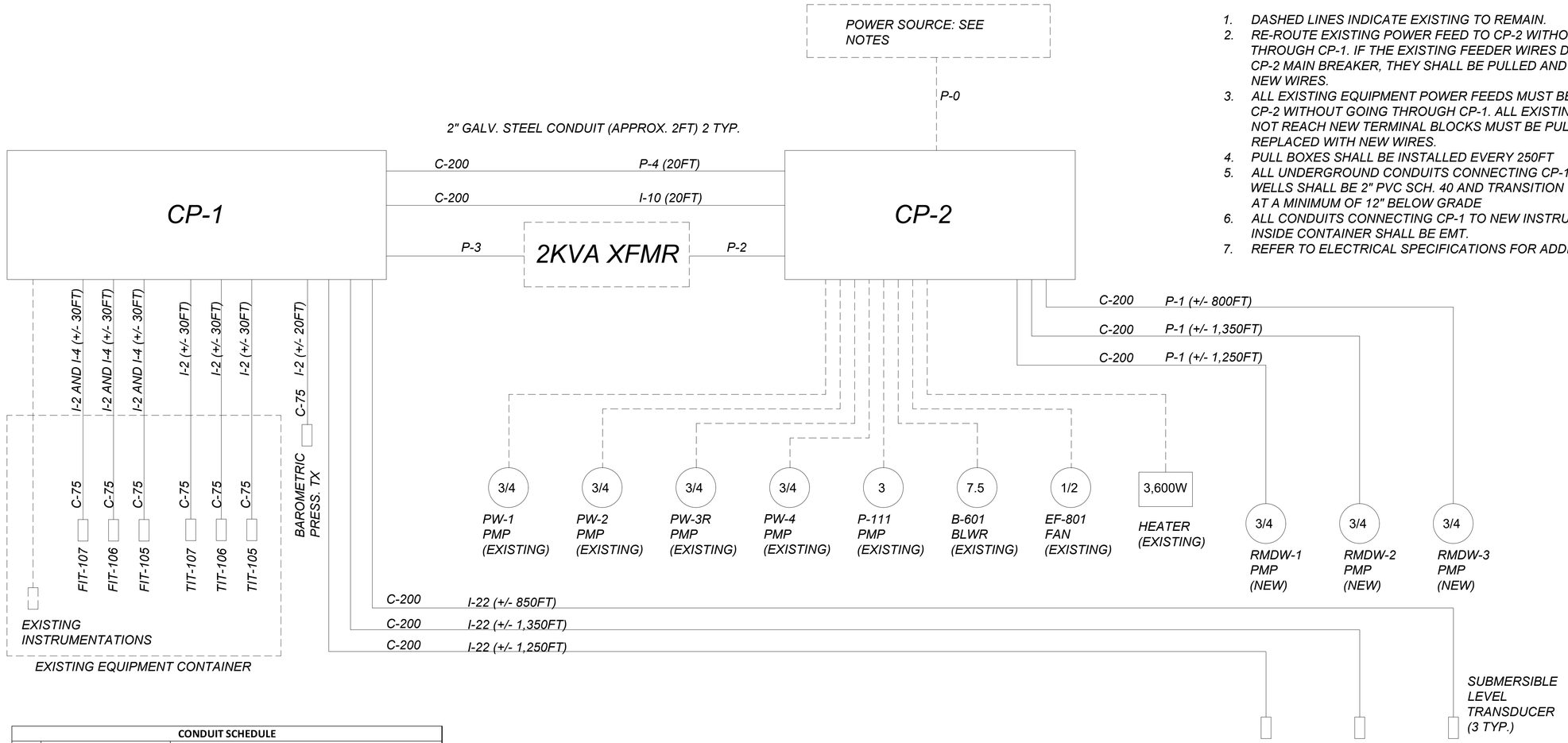
I-3



NOTES:

1. DASHED LINES INDICATE EXISTING TO REMAIN.
2. RE-ROUTE EXISTING POWER FEED TO CP-2 WITHOUT GOING THROUGH CP-1. IF THE EXISTING FEEDER WIRES DO NOT REACH CP-2 MAIN BREAKER, THEY SHALL BE PULLED AND REPLACED WITH NEW WIRES.
3. ALL EXISTING EQUIPMENT POWER FEEDS MUST BE RE-ROUTED TO CP-2 WITHOUT GOING THROUGH CP-1. ALL EXISTING WIRES THAT DO NOT REACH NEW TERMINAL BLOCKS MUST BE PULLED AND REPLACED WITH NEW WIRES.
4. PULL BOXES SHALL BE INSTALLED EVERY 250FT
5. ALL UNDERGROUND CONDUITS CONNECTING CP-1 AND CP-2 TO WELLS SHALL BE 2" PVC SCH. 40 AND TRANSITION TO GALV. SCH. 40 AT A MINIMUM OF 12" BELOW GRADE
6. ALL CONDUITS CONNECTING CP-1 TO NEW INSTRUMENTATIONS INSIDE CONTAINER SHALL BE EMT.
7. REFER TO ELECTRICAL SPECIFICATIONS FOR ADDITIONAL NOTES.

CONDUIT SCHEDULE			
ID REF	WIRE TYPE	DISTANCE	CONDUCTORS AND CABLES
P0	EXISTING		
P1	XHHW	TBD	(1) #10 BRN, (1) #10 ORG, (1) #10 YEL, (1) #10 GRN
P2	THHN	TBD	(1) #12 BRN, (1) #12 ORG, (1) #12 GRN
P3	THHN	TBD	(1) #10 BLK, (1) #10 WHT, (1) #10 GRN
P4	THHN	TBD	(12) #16 RED, (1) #16 WHT
I2	NOTES	TBD	(1) 2 COND. #16 SHIELDED CABLE
I4	NOTES	TBD	(1) 4 COND. #16 SHIELDED CABLE
I10	NOTES	TBD	(22) #16 BLUE, (16) #16 YEL

CONDUIT SCHEDULE	
REF.	SIZE
C-050	1/2"
C-075	3/4"
C-100	1"
C-200	2"

NOTES:
TBD: TO BE DETERMINED BY ELECTRICAL CONTRACTOR
TWO CONDUCTOR SHIELDED CABLE, USE BELDEN PART NUMBER 9954 OR APPROVED EQUAL
FOUR CONDUCTOR SHIELDED CABLE, USE BELDEN PART NUMBER 9954 OR APPROVED EQUAL
ALL JUNCTION BOXES INSIDE VAULTS SHALL BE SS NEMA-4X, OUTSIDE VAULTS SHALL BE CARBON STEEL NEMA- 4

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Professional Engineer's Name
Professional Engineer's No.

State	Date Signed	Project Mgr.
AL		JP
Designed by	Drawn by	Checked by
MS	MS	MM

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SABIC ● ONE PLASTICS DRIVE, BURKVILLE, ALABAMA
BRINE SYSTEM EXPANSION

ELECTRICAL RISER DIAGRAM

ELECTRICAL

ARCADIS Project No. 13283045.0000.00002
Date APRIL 2019

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E-1

Appendix B

Pumping Extraction Well Construction Logs

Log of Boring
& Well Construction

BOREHOLE NO.: **PW-01**

TOTAL DEPTH: **32'**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**SABIC**	DRILLING CO.:	**Boart-Longyear**
SITE LOCATION:	**Burkville, AL**	DRILLER:	**Jeremy Tripke**
JOB NO.:	**13283006.0000**	RIG TYPE:	**Boart Longyear MiniSonic**
LOGGED BY:	**Jason Hughes**	METHOD OF DRILLING:	**10" Sonic**
PROJECT MANAGER:	**Andrew Eversull**	TOC ELEVATION:	**233.47'**
DATE(S) DRILLED:	**6-23-13**	GROUND ELEVATION:	**234.21'**

▼ Water level in completed well ▽ Water level during drilling

ELEVATION	SOIL SYMBOLS	DEPTH	SOIL DESCRIPTION	BORING COMPLETION	WELL DESCRIPTION
230		0	CLAY; low to medium plasticity; no dilatancy; dry; orange-red brown.		Surface Casing
		-5			Cap
					Grout
					Bentonite Seal
225		-10			
220 ▼		-15	CLAY AND SAND; low to medium plasticity; sand very fine to fine; no dilatancy; moist @15; orange-red-brown. NOTE: Sand increasing with depth.		Sand Pack-20/30
			SAND AND PEBBLES; sand very fine to medium, pebbles small to very large @19-22; poorly sorted; moist to wet @18; light brown-brown. NOTE: Sand coarsens with depth, pebbles decrease with depth, quartz pebbles, interval is hot to the touch @17-20. ▽		Screen
215		-20			
210		-25			
			CLAY; low to medium plasticity; slow dilatancy; stiff; light brown-gray.		
205		-30	CHALK; hard; dry; dark gray-gray.		Bentonite Fill

Log of Boring
& Well Construction

BOREHOLE NO.: **PW-2**

TOTAL DEPTH: **31'**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**SABIC**	DRILLING CO.:	**Boart Longyear**
SITE LOCATION:	**Burkville, AL**	DRILLER:	**Jeremy Tripke**
JOB NO.:	**13283011.0000**	RIG TYPE:	**Boart-Longyear Minisonic**
LOGGED BY:	**Cole Pace**	METHOD OF DRILLING:	**10" Sonic**
PROJECT MANAGER:	**Andrew Eversull**	TOC ELEVATION:	
DATE(S) DRILLED:	**9/10/14 - 9/12/14**	GROUND ELEVATION:	

Water level during drilling

Water level in completed well

Elevation	SOIL SYMBOLS	DEPTH	SOIL DESCRIPTION	BORING COMPLETION	WELL DESCRIPTION
0		0	CLAY AND GRAVEL; medium gravel 40%; dry; hard; red-brown.		Surface Casing
					Cap
			CLAY; low to medium plasticity; no dilatancy; dark red. NOTE: No gravel.		Grout
-5		5			
			CLAY; no plasticity; no dilatancy; stiff to very stiff; hard; dry; dark red-brown.		Bentonite Seal
-10		10			
			CLAY AND SAND; no plasticity; stiff; dry; red-yellow. NOTE: No gravel.		
-15		15	SAND; coarse to very soarse; poorly sorted; angular to subangular; moist; light red-brown. NOTE: No gravel.		
			SAND; medium to fine grain; well sorted; subrounded to subangular; very moist to wet; red-brown. NOTE: No gravel.		Sand Pack
-20		20			Screen
			SAND AND GRAVEL; coarse to very coarse , small gravel up to 40%; subrounded to rounded; wet; light brown. NOTE: Gravel increasing with depth.		
-25		25	SAND AND GRAVEL; very coarse , poorly sorted; small gravel up to 40%; subrounded to rounded; wet; light brown. NOTE: Gravel increasing with depth. NOTE: Black nodules observed @ 29-30; no odor; some smearing.		
-30		30			End Cap
			CLAY; very low plasticity; stiff to very stiff; wet; light brown.		Bentonite Plug
			CHALK; hard; dry; dark gray.		
-35		35			

Log of Boring
& Well Construction

BOREHOLE NO.: **PW-3**

TOTAL DEPTH: **31'**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**SABIC**	DRILLING CO.:	**Boart Longyear**
SITE LOCATION:	**Burkville, AL**	DRILLER:	**Jeremy Tripke**
JOB NO.:	**13283011.0000**	RIG TYPE:	**Boart-Longyear Minisonic**
LOGGED BY:	**Cole Pace**	METHOD OF DRILLING:	**10" Sonic**
PROJECT MANAGER:	**Andrew Eversull**	TOC ELEVATION:	
DATE(S) DRILLED:	**09/13/14**	GROUND ELEVATION:	

▽ Water level during drilling ▼ Water level in completed well

Elevation	SOIL SYMBOLS	DEPTH	SOIL DESCRIPTION	BORING COMPLETION	WELL DESCRIPTION
0		0	CLAY; no dilatancy; stiff; hard; dry; dark red-brown.		Surface Casing
					Cap
					Grout
-5		5	CLAY; low to medium plasticity; no dilatancy; stiff; moist; red-brown.		
					Bentonite Seal
-10		10			
-15		15	CLAY AND SAND; low plasticity; sand very fine to fine; subangular to subrounded; moist; orange to red-brown. NOTE: Sand increasing with depth.		
-20 ▽		20	SAND AND GRAVEL; medium to fine grained; samll to medium pebbles 30-40%; light brown to gray-red. NOTE: Sand tightly packed; loosens with depth; coarsens with depth.		Sand Pack
					Screen
-25		25	SAND; some gravel; fine to very fine grained; well sorted; subround to round; medium gravel 20%; light brown. NOTE: Sand loosely packed.		
-30		30	SAND AND GRAVEL; coarse to very coarse; subround to subangular; medium to large gravel 30-40%; red-yellow.		End Cap
			CLAY; low to no plasticity; no dilatancy; stiff to very stiff; light brown.		Bentonite Plug
-35		35	CHALK; hard; dry; dark gray.		

Log of Boring
& Well Construction

BOREHOLE NO.: **PW-4**

TOTAL DEPTH: **Total Depth**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**SABIC**	DRILLING CO.:	**Boart Longyear**
SITE LOCATION:	**Burkville, AL**	DRILLER:	**Jeremy Tripke**
JOB NO.:	**13283011.0000**	RIG TYPE:	**Boart-Longyear Minisonic**
LOGGED BY:	**Cole Pace**	METHOD OF DRILLING:	**10" Sonic**
PROJECT MANAGER:	**Andrew Eversull**	TOC ELEVATION:	
DATE(S) DRILLED:	**09/09/14 - 09/11/2014**	GROUND ELEVATION:	

Water level during drilling

Water level in completed well

Elevation	SOIL SYMBOLS	DEPTH	SOIL DESCRIPTION	BORING COMPLETION	WELL DESCRIPTION
0 to -35		0 to 35	CLAY AND SAND; large gravel 40%; dry; red-brown.		Surface Casing
			CLAY AND GRAVEL; medium plasticity; no dilatancy; very large gravel 30-40%; moist; dark red-brown.		Cap
			CLAY; low to no plasticity; no dilatancy; stiff to very stiff; dry; dark red-brown.		Grout
			CLAY AND SAND; low to medium plasticity; stiff; dry; yellow-red and gray.		Bentonite Seal
			SAND; very fine to medium; well sorted; subrounded to subangular; moist to wet; yellow-brown. NOTE: Coarsens with depth.		Sand Pack
					Screen
			SAND AND PEBBLES; fine to coarse; poorly sorted; quartz pebbles 20-30%; pebbles small to very large; light brown-brown. NOTE: Sand coarsens with depth.		
			CLAY; low to no plasticity; no dilatancy; stiff to very stiff; light brown.		End Cap
			CHALK; hard; dry; dark gray.		Bentonite Plug

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Appendix C

Long-Term Monitoring Optimization
Technical Memorandum

APPENDIX C

Monitoring Network Optimization – Optimum Sampling Frequency

The monitoring network at SABIC used to monitor and manage the PCE concentration at the existing PCE plume on-site was optimized for sample frequency. All monitoring wells in the current network will be retained.

The initial Cleanup Agreement Modification for the PCE monitoring network at SABIC was completed in May 2016 with adjustments to the sample frequency from quarterly to semi-annual. The reduction in sample frequency was justified by the successful response from the remediation system that began operation in June 2015.

This Technical Memorandum documents trend analyses used to update the sample frequency established in the May 2016 modification. The temporal analysis included establishing trend for the primary Constituent of Concern (COC), tetrachloroethylene (PCE) for each well and optimizing the sampling frequency based on the results. Since the PCE and elevated pH plumes are comingled, this optimization is protective of elevated pH in groundwater.

Trend Analysis

Groundwater samples used for trend assessment were collected from 27 monitoring wells and 5 observation wells from July 2013 through the August 2018. The monitoring and observation wells are grouped into three types: effectiveness (EFF) wells, boundary (BDY) wells and background (BKG) wells (**Table C1 and Figure C1**). The EFF wells are used to evaluate groundwater and plume condition, and effectiveness of the remedial measure implemented on site. They represent a larger number of the monitoring well network. The BDY wells are used to evaluate current extent of PCE in groundwater and verify whether the PCE is migrating off-site at concentrations exceeding the ADEM remedial goal for PCE of 5 micrograms per liter (µg/L). The BKG wells are used to evaluate background concentrations outside the estimated plume boundary. Samples were initially collected quarterly for three years then semi-annually thereafter. This results in approximately 17 sampling events at each of the monitoring wells through August 2018. Data from these sampling events provide information for qualitative and quantitative statistical evaluations to determine changes in PCE concentrations at the site. Other VOCs and associated daughter products of PCE have not been detected sufficiently to warrant the quantitative and qualitative statistical evaluations.

The non-parametric Mann-Kendall trend analysis was used to analyze the PCE groundwater monitoring data to quantitatively determine if the measured concentrations show an overall increasing trend, a decreasing trend or no-trend (EPA, 2009). Trend analysis results can be used to determine if the time between sampling events can be increased to effectively monitor changes in the constituent's concentrations through time.

The Mann-Kendall test for trend analysis relies on two statistical metrics:

- The S Statistic – indicates whether a concentration trend versus time is generally increasing (positive S value) or decreasing (negative S value).

- Confidence interval (CI)/probability (p value) – modifies the S statistic calculation to indicate the degree of confidence in the trend result. The confidence interval is the measure of confidence for rejecting the null hypothesis (H_0) of no-trend versus time. While H_0 states that the dataset shows no distinct linear trend over time, the Mann-Kendall tests H_0 against the alternative hypothesis (H_A) that do show a trend over the specified time period.

Table C1: Monitoring Well Network

Well Location ID	Well Type
MW-1	EFF
MW-2	EFF
MW-3	EFF
MW-4	EFF
MW-5	EFF
MW-6	EFF
MW-7	EFF
MW-8	EFF
MW-9	EFF
MW-10	EFF
MW-11	EFF
MW-12	EFF
MW-13	BDY
MW-14	EFF
MW-15	EFF
MW-16	EFF
MW-17	EFF
MW-18	BDY
MW-19	EFF
MW-20	BDY
MW-21	BDY
MW-22	BDY
MW-23	BKG
MW-24	BKG
MW-25	BDY
MW-26	BDY
MW-27	EFF
OW-1	EFF
OW-2	EFF
OW-3	EFF
OW-4	EFF
OW-5	EFF

Notes: EFF = Effectiveness
BDY= Boundary
BKG = background

For the Mann-Kendall test evaluated, H_0 is rejected when the p value < 0.05 for a one-tailed test assuming a normal distribution of the data; which corresponds to a CI greater than 95%. Thus, when the p value < 0.05 a significant trend exists for the sampled data at the monitoring well and depending on the estimated S statistic, the well will either have a significantly increasing trend (for a positive S value) or a significantly decreasing trend (for a negative S value). However, when the p value > 0.05, the H_0 is accepted and no-trend condition is indicated.

The Mann-Kendall trend analysis result is presented on **Table C2** and distributions of the trends are presented on **Figure C2**. The Mann-Kendall trend analysis was completed for monitoring wells with at least four sample events and one PCE concentration above the detection limit. Based on this, the trend analysis was conducted for 26 of the 32 monitoring wells. Time-series plots for PCE at the monitoring wells, presented in **Appendix C-1**, provide for visual interpretation of trends.

Evaluation of the Mann-Kendall trend indicated the following:

- PCE concentrations for most of the monitoring wells (approximately 92 percent) have no trends (50 percent) or significantly decreasing trends (42 percent) through time.
- All the monitoring wells located within or adjacent to the PCE source area in the Brine Unit (**Figure A2**) have no trends (25 percent) or significantly decreasing trends (75 percent).
- Two wells out of the 32 monitoring wells have significantly increasing trends (8 percent of the wells for which trend analysis was conducted). These wells are located in downgradient areas of the plume and likely receive PCE from an upgradient area outside the area of influence of the remediation system. The most recent PCE concentrations at these wells are below the groundwater protection standard for PCE and the ADEM remedial goal of 5 µg/L.

The overall PCE trends confirm movement predicted by the conceptual site model and the site-wide groundwater model. The maximum extent of the plume has been defined and is expected to remain within the SABIC property boundary. The lack of any trend to decreasing trends in PCE concentrations for 92 percent of the monitoring wells is indicative of a regressive plume. Moreover, concentrations in the source area continue to decrease (as indicated by the decreasing to stable trends in PCE concentrations at wells in the source area). Because the source mass has been remediated, no mass is present to feed or expand the plume.

Sampling Frequency Evaluation

The results of the trend analysis indicate that the sample collection frequency can be modified from the current semi-annual sampling schedule to an annual schedule, at least for a subset of the monitoring wells. Two evaluation methods were used to determine if an annual sampling schedule can be an optimum sampling frequency for correlating PCE data through time: i) Comparing the trend analysis of single event data with trend analysis of entire dataset; and, ii) Using the Theil-Sen Trend line slope to estimate the rate of change of PCE concentration

i) Comparing the Trend Analysis of Single event data with the Trend Analysis of Entire Dataset

The Mann-Kendall trend statistic for reduced datasets of only annual sampling events were re-estimated to determine if the results have the same trend as the entire dataset.

a. Based on the current semi-annual sample schedule, sampling is conducted in the winter and fall seasons. Therefore, one annual dataset was reduced to all winter data (January data for 2016 and February data for all other years ranging from 2014 through 2018) and another annual dataset was reduced to all fall data (one July event for 2013, September data for 2014, October data for 2016 and August data for 2015, 2017 and 2018).

b. The Mann-Kendall trend statistic was estimated for both the reduced winter and fall datasets and their trend statistic results were compared to the trend statistic result of the entire dataset (**Table C3** and **Table C4**).
c. Wells that had trend statistic changes between the single event (winter/fall datasets) and all event data analyses were identified (**Table C5, Figure C3**). Based on this evaluation, the following wells do not meet the criteria for an annual sampling frequency:
    i. For the winter data, 8 wells were identified to have trend changes and one well (MW-3) could not be analyzed because all winter data for the well were below detectable levels.
    ii. For the fall data, 11 wells were identified to have trend changes and three wells (MW-5, MW-14 and MW-22) could not be analyzed because all fall data for the wells were below detectable levels.
    iii. Overall, 12 wells were identified to have trend changes when comparing the single event (winter/fall) trend analysis to all event data analysis. Four wells (WM-3, MW-5, MW-14 and MW-22) did not have detectable PCE data during the winter or fall sampling events to analyze trends for these events.
d. Sixteen wells were identified to meet the criteria for an annual sampling frequency:
    i. 10 wells that were identified to have similar trend statistic for the single event trend analysis as the trend analysis for the entire dataset.
    ii. 6 BDY and BKG wells were non-detect.
    iii. Wells where PCE has not been detected from sampling conducted to date (MW-18, MW-21, MW-23, MW-24, MW-25 and MW-26)

ii) Theil-Sen Trend Line Slope to Estimate the Rate of Change of PCE Concentration

In addition to conducting the Mann-Kendall trend analysis for the PCE data collected to date, the Theil-Sen line was used to estimate the slope of the trend (**Table C2**). The Theil-Sen line is a nonparametric method for estimating slope where the line models how the median (50^{th} percentile) concentration changes linearly with time. In order to confirm the findings from evaluation "i", the estimated Theil-Sen trend line slope of the entire dataset for the wells identified not to meet the annual sampling criteria in evaluation were used to estimate the rate of change of PCE concentration. Based on the slope, concentration changes were estimated for the time periods of ½-year and 1-year to determine if annual sampling frequency can be optimal for these monitoring wells. The result from this evaluation was used to confirm the findings from evaluation "i" (**Table C6**).

This evaluation confirmed all but two wells (MW-19 and OW-5) from evaluation "i" did not meet the annual sampling frequency criteria. Based on the estimated Theil-Sen trend line median slopes for wells MW-19 and OW-5, PCE concentration at the wells do not change significantly over time and an annual sampling frequency can be optimal for these wells. This is acceptable for OW-5 because the PCE concentration at this well has been at or below detectable levels for the past two and a-half years (**Appendix C-1 figures**). However, for MW-19, because the PCE data over time at the well is estimated to have an increasing trend, it is recommended that semi-annual sampling continue for two more years and re-evaluate MW-19 for annual sampling.

The outcome for evaluation “i” of the wells not meeting the annual sampling frequency criteria is retained for MW-19 and the outcome for evaluation ii) of the well meeting the annual sampling frequency criteria is retained for OW-5. The four wells that were not re-analyzed for Mann-Kendall trend statistic in evaluation “i” due to the lack of detectable PCE data (MW-3, MW-5, MW-14 and MW-22) were estimated to have a Theil-Sen trend line slope of zero due to the lack of enough detectable PCE data at these wells. MW-3 and MW-5 only have three and two PCE concentrations, respectively, above detectable levels from the PCE data collected to date and both wells have not had detectable PCE concentrations for the past three years sampling has been conducted (**Appendix C-1 Figures**). Likewise, PCE concentrations at MW-14 and MW-22 have largely been below detectable levels for the past two to three years of sampling, respectively. Therefore, annual sampling frequency at these wells is acceptable for correlating PCE data through time at these wells.

Based on trend analysis, sampling frequency evaluations and qualitative analysis conducted for the existing monitoring network at SABIC, 21 out of the 32 monitoring wells have been identified for annual monitoring and 11 of the wells have been identified for continued semi-annual monitoring. **Table C7** lists the recommended monitoring network sampling schedule.

Appendix C
TABLES

TABLE C2
Summary Statistics and Trend Results for all Sampling Data[1,2]
SABIC
Burkville, Alabama

						Detected Results Summary				Mann-Kendall Test				
Location ID	Well Type	Analyte	Date Range	Figure	FOD	Range	Mean	Median	SD	Result	p Value	s Value	Slope (µg/L/Day)	95% CI (µg/L/Day)
MW-1	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-1	17 / 17	0.9 - 160	25.2	6.88	39.5	DWN	0.0456	-42	-0.0112	-0.0458 to 0.000977
MW-2	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-2	18 / 18	11 - 650	236	210	208	DWN	0.00224	-76	-0.256	-0.437 to -0.0756
MW-3	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-3	3 / 17	1.1 - 1.3	1.17	1.3	0.115	NST	0.0941	-22	0	0 to 0
MW-4	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-4	18 / 18	11.9 - 1500	381	187	466	DWN	<0.001	-105	-0.538	-0.850 to -0.256
MW-5	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-5	2 / 17	0.7 - 0.77	0.735	0.735	0.0495	NST	0.117	-17	0	0 to 0
MW-6	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-6	17 / 18	1.12 - 250	70.1	27	85.5	DWN	<0.001	-119	-0.126	-0.200 to -0.0643
MW-7	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-7	18 / 18	4.26 - 5700	1240	875	1570	DWN	0.00439	-70	-0.648	-1.59 to -0.134
MW-8	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-8	17 / 17	18.6 - 350	126	100	97	NST	0.100	-32	-0.0435	-0.153 to 0.0874
MW-9	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-9	17 / 18	9.4 - 120	68.5	67	24.3	NST	0.202	23	0.00978	-0.0117 to 0.0457
MW-10	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-1	17 / 17	44.8 - 86	61	58	12.6	DWN	0.00599	-62	-0.0165	-0.0269 to -0.00574
MW-11	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-11	14 / 17	1.22 - 30.5	11.9	6.62	9.91	NST	0.161	25	0.00314	-0.00309 to 0.0148
MW-12	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-12	17 / 17	13.4 - 270	101	87.7	87.9	NST	0.418	6	0.0178	-0.0522 to 0.216
MW-13	BDY	Tetrachloroethene	07/13 - 08/18	Fig A-13	7 / 17	0.65 - 2.6	1.35	1.2	0.694	NST	0.202	19	0	0 to 0.000233
MW-14	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-14	7 / 17	0.59 - 2.88	1.26	1.3	0.756	NST	0.243	-16	0	-0.000267 to 0
MW-15	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-15	5 / 17	0.51 - 0.9	0.692	0.65	0.157	NST	0.0821	-28	0	-0.0000213 to 0
MW-16	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-16	17 / 18	0.77 - 16	4.58	3.7	4.1	NST	0.381	-9	-0.000590	-0.00357 to 0.00270
MW-17	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-17	13 / 18	0.35 - 12.1	3.45	2.1	3.2	NST	0.245	19	0.000182	-0.00126 to 0.00399
MW-18	BDY	Tetrachloroethene	07/13 - 08/18	--	0 / 17	0 - 0	0	0	0	FALSE	0.000	0	0	0 to 0
MW-19	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-18	12 / 18	0.95 - 10.1	4.12	3.615	3.02	UP	0.0409	46	0.000933	0 to 0.00407
MW-20	BDY	Tetrachloroethene	07/13 - 08/18	Fig A-19	12 / 17	1.1 - 4.74	2.72	2.705	1.22	UP	<0.001	105	0.00209	0.00132 to 0.00266
MW-21	BDY	Tetrachloroethene	07/13 - 08/18	--	0 / 17	0 - 0	0	0	0	FALSE	0.000	0	0	0 to 0
MW-22	BDY	Tetrachloroethene	07/13 - 08/18	Fig A-2	9 / 17	0.87 - 1.54	1.17	1.1	0.196	NST	0.363	9	0	-0.0000954 to 0.000203
MW-23	BKG	Tetrachloroethene	07/13 - 08/18	--	0 / 17	0 - 0	0	0	0	FALSE	0.000	0	0	0 to 0
MW-24	BKG	Tetrachloroethene	07/13 - 08/18	--	0 / 17	0 - 0	0	0	0	FALSE	0.000	0	0	0 to 0
MW-25	BDY	Tetrachloroethene	07/13 - 08/18	--	0 / 17	0 - 0	0	0	0	FALSE	0.000	0	0	0 to 0
MW-26	BDY	Tetrachloroethene	07/13 - 08/18	--	0 / 17	0 - 0	0	0	0	FALSE	0.000	0	0	0 to 0
MW-27	EFF	Tetrachloroethene	09/14 - 08/18	Fig A-21	10 / 13	1.94 - 240	68.4	32	85.9	DWN	0.00494	-43	-0.0515	-0.151 to -0.00380
OW-1	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-22	17 / 17	1.9 - 3000	604	40	1000	DWN	0.00132	-74	-0.457	-1.23 to -0.0308
OW-2	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-23	17 / 17	4.3 - 550	79.7	42.8	128	NST	0.484	0	-0.000243	-0.0606 to 0.0369
OW-3	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-24	17 / 17	1.55 - 1900	195	12	468	DWN	0.00224	-70	-0.0799	-0.352 to -0.00834
OW-4	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-25	15 / 17	1.15 - 1400	123	16	355	DWN	0.0160	-53	-0.0208	-0.0863 to -0.00113
OW-5	EFF	Tetrachloroethene	07/13 - 08/18	Fig A-26	11 / 17	0.446 - 150	16.9	3.4	44.2	DWN	<0.001	-84	-0.00421	-0.00829 to -0.00141

Abbreviations:

-- = insufficient data for calculating statistics (n < 4)
FOD = frequency of detection (# detects / # samples)
mean = arithmetic mean
SD = standard deviation
NST = no significant trend
DWN = significanlty decreasing trend
UP = significantly increasing trend
FALSE = trend analysis not analyzed, no detected result
H_0 = null hypothesis: no significant trend (slope = 0)
H_A = alternative hypothesis: significant trend (slope ≠ 0)
95% CI = 95% confidence interval (p-value < 0.05)

Notes:

1. All analytical results are in µg/L. Result values less than 10 are reported to 2 significant figures; values greater than 10 are reported to 3 significant figures. P-values are reported to 3 decimal places.
2. Trend results are presented when at least four samples and one detected value are available. Non-detects were assigned a common value less than the minimum detected value (95% of the minimum detected value) (EPA, 2009).

Reference:

USEPA. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance.

TABLE C3
Summary Statistics and Trend Results for Winter Sampling Data[1,2]
SABIC
Burkville, Alabama

Location ID	Well Type	Analyte	Date Range	FOD	Detected Results Summary				Mann-Kendall Test				
					Range	Mean	Median	SD	Result	p Value	s Value	Slope (µg/L/Day)	95% CI (µg/L/Day)
MW-1	EFF	Tetrachloroethene	02/14 - 02/18	5 / 5	1.6 - 42.9	20	11	19.9	NST	0.592	0	NA	NA
MW-2	EFF	Tetrachloroethene	02/14 - 02/18	5 / 5	11 - 520	195	47.1	231	NST	0.117	-6	NA	NA
MW-3	EFF	Tetrachloroethene	02/14 - 02/18	0 / 5	0 - 0	0	0	0	FALSE	0.592	0	0	0 to 0
MW-4	EFF	Tetrachloroethene	02/14 - 02/18	5 / 5	18.8 - 530	184	141	206	NST	0.117	-6	NA	NA
MW-5	EFF	Tetrachloroethene	02/14 - 02/18	1 / 5	0.7 - 0.7	0.7	0.7	0	NST	0.242	-4	0	-0.0000459 to 0
MW-6	EFF	Tetrachloroethene	02/14 - 02/18	4 / 5	1.7 - 210	62.4	19.03	99.7	NST	0.117	-6	NA	NA
MW-7	EFF	Tetrachloroethene	02/14 - 02/18	5 / 5	4.26 - 2400	703	140	1010	DWN	0.0420	-8	NA	NA
MW-8	EFF	Tetrachloroethene	02/14 - 02/18	5 / 5	18.6 - 350	139	100	131	NST	0.117	-6	NA	NA
MW-9	EFF	Tetrachloroethene	02/14 - 02/18	5 / 5	55.7 - 88	73.5	82.8	16.2	NST	0.592	0	NA	NA
MW-10	EFF	Tetrachloroethene	02/14 - 02/18	5 / 5	48.7 - 86	67.5	67	14.4	DWN	0.0420	-8	NA	NA
MW-11	EFF	Tetrachloroethene	02/14 - 02/18	5 / 5	15 - 30.5	23.6	25	5.78	NST	0.242	4	NA	NA
MW-12	EFF	Tetrachloroethene	02/14 - 02/18	5 / 5	13.4 - 270	96.6	31	112	NST	0.242	-4	NA	NA
MW-13	BDY	Tetrachloroethene	02/14 - 02/18	3 / 5	0.953 - 2	1.38	2	0.547	NST	0.500	1	0.0000165	-0.00271 to 0.00148
MW-14	EFF	Tetrachloroethene	02/14 - 02/18	3 / 5	0.59 - 2.88	1.46	2.88	1.24	NST	0.325	-3	-0.000264	-0.00646 to 0.0000745
MW-15	EFF	Tetrachloroethene	02/14 - 02/18	1 / 5	0.6 - 0.6	0.6	0.6	0	NST	0.242	-4	0	-0.0000394 to 0
MW-16	EFF	Tetrachloroethene	02/14 - 02/18	4 / 5	0.779 - 11	4.95	4.015	4.64	NST	0.408	-2	NA	NA
MW-17	EFF	Tetrachloroethene	02/14 - 02/18	4 / 5	2.8 - 12.1	6.54	5.62	4.37	NST	0.117	6	NA	NA
MW-18	BDY	Tetrachloroethene	02/14 - 02/18	0 / 5	0 - 0	0	0	0	FALSE	0.592	0	0	0 to 0
MW-19	EFF	Tetrachloroethene	02/14 - 02/18	3 / 5	0.95 - 4	1.98	4	1.75	NST	0.180	5	0.0000608	-0.00756 to 0.00391
MW-20	BDY	Tetrachloroethene	02/14 - 02/18	4 / 5	2.15 - 4.28	3.25	3.28	0.871	UP	0.0420	8	NA	NA
MW-21	BDY	Tetrachloroethene	02/14 - 02/18	0 / 5	0 - 0	0	0	0	FALSE	0.592	0	0	0 to 0
MW-22	BDY	Tetrachloroethene	02/14 - 02/18	5 / 5	1 - 1.54	1.25	1.3	0.209	NST	0.592	0	NA	NA
MW-23	BKG	Tetrachloroethene	02/14 - 02/18	0 / 5	0 - 0	0	0	0	FALSE	0.592	0	0	0 to 0
MW-24	BKG	Tetrachloroethene	02/14 - 02/18	0 / 5	0 - 0	0	0	0	FALSE	0.592	0	0	0 to 0
MW-25	BDY	Tetrachloroethene	02/14 - 02/18	0 / 5	0 - 0	0	0	0	FALSE	0.592	0	0	0 to 0
MW-26	BDY	Tetrachloroethene	02/14 - 02/18	0 / 5	0 - 0	0	0	0	FALSE	0.592	0	0	0 to 0
MW-27	EFF	Tetrachloroethene	02/15 - 02/18	3 / 4	1.94 - 45	20.6	45	22.1	NST	0.167	-4	NA	NA
OW-1	EFF	Tetrachloroethene	02/14 - 02/18	5 / 5	5.71 - 2900	830	33	1270	DWN	0.0420	-8	NA	NA
OW-2	EFF	Tetrachloroethene	02/14 - 02/18	5 / 5	16.7 - 59	40.1	42.8	17	NST	0.592	0	NA	NA
OW-3	EFF	Tetrachloroethene	02/14 - 02/18	5 / 5	1.55 - 120	32.6	12	49.7	NST	0.408	-2	NA	NA
OW-4	EFF	Tetrachloroethene	02/14 - 02/18	4 / 5	4.96 - 76	39.9	39.25	40	NST	0.117	-6	NA	NA
OW-5	EFF	Tetrachloroethene	02/14 - 02/18	4 / 5	0.446 - 6.6	3.21	2.9	2.57	DWN	0.0420	-8	NA	NA

Abbreviations:

-- = insufficient data for calculating statistics (n < 4)
FOD = frequency of detection (# detects / # samples)
mean = arithmetic mean
SD = standard deviation
NST = no significant trend
DWN = significantly decreasing trend
UP = significantly increasing trend
FALSE = trend analysis not analyzed, no detected result
NA = not analyzed
H_0 = null hypothesis: no significant trend (slope = 0)
H_A = alternative hypothesis: significant trend (slope ≠ 0)
95% CI = 95% confidence interval (p-value < 0.05)

Notes:

1. All analytical results are in µg/L. Result values less than 10 are reported to 2 significant figures; values greater than 10 are reported to 3 significant figures. P-values are reported to 3 decimal places.
2. Trend results are presented when at least four samples and one detected value are available. Non-detects were assigned a common value less than the minimum detected value (95% of the minimum detected value) (EPA, 2009).

Reference:

USEPA. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance.

TABLE C4
Summary Statistics and Trend Results for Fall Sampling Data[1,2]
SABIC
Burkville, Alabama

Location ID	Well Type	Analyte	Date Range	FOD	Detected Results Summary				Mann-Kendall Test				
					Range	Mean	Median	SD	Result	p Value	s Value	Slope (µg/L/Day)	95% CI (µg/L/Day)
MW-01	EFF	Tetrachloroethene	07/13 - 08/18	6 / 6	2.15 - 160	31	4.84	63.3	NST	0.136	-7	-0.00466	-0.178 to 0.00569
MW-02	EFF	Tetrachloroethene	07/13 - 08/18	6 / 6	12 - 270	140	135.5	108	NST	0.0680	-9	-0.114	-0.293 to 0.0651
MW-03	EFF	Tetrachloroethene	07/13 - 08/18	2 / 6	1.1 - 1.1	1.1	1.1	0	NST	0.186	-6	0	-0.0000682 to 0
MW-04	EFF	Tetrachloroethene	07/13 - 08/18	6 / 6	11.9 - 1500	402	152	577	NST	0.0680	-9	-0.530	-1.68 to 0.0368
MW-05	EFF	Tetrachloroethene	07/13 - 08/18	0 / 6	0 - 0	0	0	0	FALSE	0.577	0	0	0 to 0
MW-06	EFF	Tetrachloroethene	07/13 - 08/18	6 / 6	1.12 - 250	60	8.37	99.2	DWN	0.0280	-11	-0.0830	-0.286 to -0.00475
MW-07	EFF	Tetrachloroethene	07/13 - 08/18	6 / 6	5.55 - 5700	1390	455.8	2220	NST	0.0680	-9	-0.565	-7.01 to 1.40
MW-08	EFF	Tetrachloroethene	07/13 - 08/18	6 / 6	19.7 - 190	68.5	42.75	62.7	NST	0.186	-6	-0.0392	-0.188 to 0.0652
MW-09	EFF	Tetrachloroethene	07/13 - 08/18	5 / 6	44.2 - 92	65	64	18	NST	0.500	1	0.00119	-0.0633 to 0.0500
MW-10	EFF	Tetrachloroethene	07/13 - 08/18	6 / 6	44.8 - 61	51.3	49.05	6.46	NST	0.136	-7	-0.00559	-0.0185 to 0.00471
MW-11	EFF	Tetrachloroethene	07/13 - 08/18	4 / 6	1.8 - 7.04	5.18	5.945	2.32	NST	0.430	-2	-0.0000817	-0.00948 to 0.00470
MW-12	EFF	Tetrachloroethene	07/13 - 08/18	6 / 6	16.8 - 130	63.4	57.85	46.8	NST	0.360	-3	-0.00841	-0.139 to 0.0921
MW-13	BDY	Tetrachloroethene	07/13 - 08/18	2 / 6	0.9 - 1.18	1.04	1.04	0.198	NST	0.500	-1	0	-0.000120 to 0.0000889
MW-14	EFF	Tetrachloroethene	07/13 - 08/18	0 / 6	0 - 0	0	0	0	FALSE	0.577	0	0	0 to 0
MW-15	EFF	Tetrachloroethene	07/13 - 08/18	1 / 6	0.8 - 0.8	0.8	0.8	0	NST	0.360	-3	0	-0.0000236 to 0
MW-16	EFF	Tetrachloroethene	07/13 - 08/18	6 / 6	1.6 - 8.8	4.27	3.96	2.47	NST	0.136	-7	-0.00149	-0.00604 to 0.00111
MW-17	EFF	Tetrachloroethene	07/13 - 08/18	5 / 6	1.6 - 3.79	2.21	1.94	0.912	NST	0.577	0	0	-0.00224 to 0.00160
MW-18	BDY	Tetrachloroethene	07/13 - 08/18	0 / 6	0 - 0	0	0	0	FALSE	0.577	0	0	0 to 0
MW-19	EFF	Tetrachloroethene	07/13 - 08/18	4 / 6	1.3 - 4.9	3.29	3.47	1.5	NST	0.186	6	0.00134	-0.00183 to 0.00436
MW-20	BDY	Tetrachloroethene	07/13 - 08/18	5 / 6	1.3 - 4.74	2.96	3.54	1.46	UP	0.00830	13	0.00203	0.000245 to 0.00302
MW-21	BDY	Tetrachloroethene	07/13 - 08/18	0 / 6	0 - 0	0	0	0	FALSE	0.577	0	0	0 to 0
MW-22	BDY	Tetrachloroethene	07/13 - 08/18	0 / 6	0 - 0	0	0	0	FALSE	0.577	0	0	0 to 0
MW-23	BKG	Tetrachloroethene	07/13 - 08/18	0 / 6	0 - 0	0	0	0	FALSE	0.577	0	0	0 to 0
MW-24	BKG	Tetrachloroethene	07/13 - 08/18	0 / 6	0 - 0	0	0	0	FALSE	0.577	0	0	0 to 0
MW-25	BDY	Tetrachloroethene	07/13 - 08/18	0 / 6	0 - 0	0	0	0	FALSE	0.577	0	0	0 to 0
MW-26	BDY	Tetrachloroethene	07/13 - 08/18	0 / 6	0 - 0	0	0	0	FALSE	0.577	0	0	0 to 0
MW-27	EFF	Tetrachloroethene	09/14 - 08/18	3 / 5	6.6 - 82	36.1	82	40.3	NST	0.180	-5	-0.00988	-0.145 to 0.0152
OW-01	EFF	Tetrachloroethene	07/13 - 08/18	6 / 6	6.04 - 3000	797	74.95	1250	NST	0.0680	-9	-0.844	-3.64 to -0.00984
OW-02	EFF	Tetrachloroethene	07/13 - 08/18	6 / 6	36.9 - 550	162	89.5	197	NST	0.136	-7	-0.124	-0.576 to 0.0270
OW-03	EFF	Tetrachloroethene	07/13 - 08/18	6 / 6	2.41 - 1900	364	20.74	758	NST	0.0680	-9	-0.221	-2.21 to -0.00601
OW-04	EFF	Tetrachloroethene	07/13 - 08/18	5 / 6	1.15 - 1400	308	16	613	NST	0.500	-1	-0.0122	-1.65 to 0.0964
OW-05	EFF	Tetrachloroethene	07/13 - 08/18	2 / 6	2.1 - 150	76.1	76.05	105	NST	0.0680	-9	-0.0000979	-0.122 to 0

Abbreviations:

-- = insufficient data for calculating statistics (n < 4)
FOD = frequency of detection (# detects / # samples)
mean = arithmetic mean
SD = standard deviation
NST = no significant trend
DWN = significantly decreasing trend
UP = significantly increasing trend
FALSE = trend analysis not analyzed, no detected result
H_0 = null hypothesis: no significant trend (slope = 0)
H_A = alternative hypothesis: significant trend (slope ≠ 0)
95% CI = 95% confidence interval (p-value < 0.05)

Notes:

1. All analytical results are in µg/L. Result values less than 10 are reported to 2 significant figures; values greater than 10 are reported to 3 significant figures. P-values are reported to 3 decimal places.
2. Trend results are presented when at least four samples and one detected value are available. Non-detects were assigned a common value less than the minimum detected value (95% of the minimum detected value) (EPA, 2009).

Reference:

USEPA. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance.

Table C5: Wells Showing Trend Statistic Change between Single Event and All Event Analysis

Location Well ID	Well Type	All Data Trend Result	Single Event Trend Change	Single Event Trend Result
MW-1	EFF	Sig. Decrease	Both	No Sig. Trend
MW-2	EFF	Sig. Decrease	Both	No Sig. Trend
MW-3	EFF	No Sig. Trend	Winter	NA
MW-4	EFF	Sig. Decrease	Both	No Sig. Trend
MW-5	EFF	No Sig. Trend	Fall	NA
MW-6	EFF	Sig. Decrease	Winter	No Sig. Trend
MW-7	EFF	Sig. Decrease	Fall	No Sig. Trend
MW-10	EFF	Sig. Decrease	Fall	No Sig. Trend
MW-14	EFF	No Sig. Trend	Fall	NA
MW-19	EFF	Sig. Increase	Both	No Sig. Trend
MW-22	BDY	No Sig. Trend	Fall	NA
MW-27	EFF	Sig. Decrease	Both	No Sig. Trend
OW-1	EFF	Sig. Decrease	Fall	No Sig. Trend
OW-3	EFF	Sig. Decrease	Both	No Sig. Trend
OW-4	EFF	Sig. Decrease	Both	No Sig. Trend
OW-5	EFF	Sig. Decrease	Fall	No Sig. Trend

Notes:
Both = fall and winter
NA = not analyzed due to lack of data

Table C6: Estimated PCE Concentration Rate of Change for Wells not Meeting Annual Sampling Criteria

Location Well ID	Well Type	Estimated Sen's Trend Line Median Slope	Estimated Change in Concentration[1] (µg/L)	Annual Sampling Freq. Recommended[2]?	Annual Sampling Freq. Recommended in Evaluation I)[3]?
MW-01	EFF	-0.0112	2	No	No
MW-02	EFF	-0.256	47	No	No
MW-03	EFF	0	0	Yes	NA
MW-04	EFF	-0.538	98	No	No
MW-05	EFF	0	0	Yes	NA
MW-06	EFF	-0.126	23	No	No
MW-07	EFF	-0.648	118	No	No
MW-10	EFF	-0.0165	3	No	No
MW-14	EFF	0	0	Yes	NA
MW-19	EFF	0.000933	0.2	Yes	No
MW-22	BDY	0	0	Yes	NA
MW-27	EFF	-0.0515	9	No	No
OW-01	EFF	-0.457	83	No	No
OW-03	EFF	-0.0799	15	No	No
OW-04	EFF	-0.0208	4	No	No
OW-05	EFF	-0.00421	0.8	Yes	No

Notes:

[1] Estimated change in concentration is for a 1/2 year (between the time period of 1/2-year and 1-year)

[2] The recommended sampling freq. is just based on this analysis

[3] Sampling frequency evaluation I) is comparison of trend statistic changes between single event and all event analysis

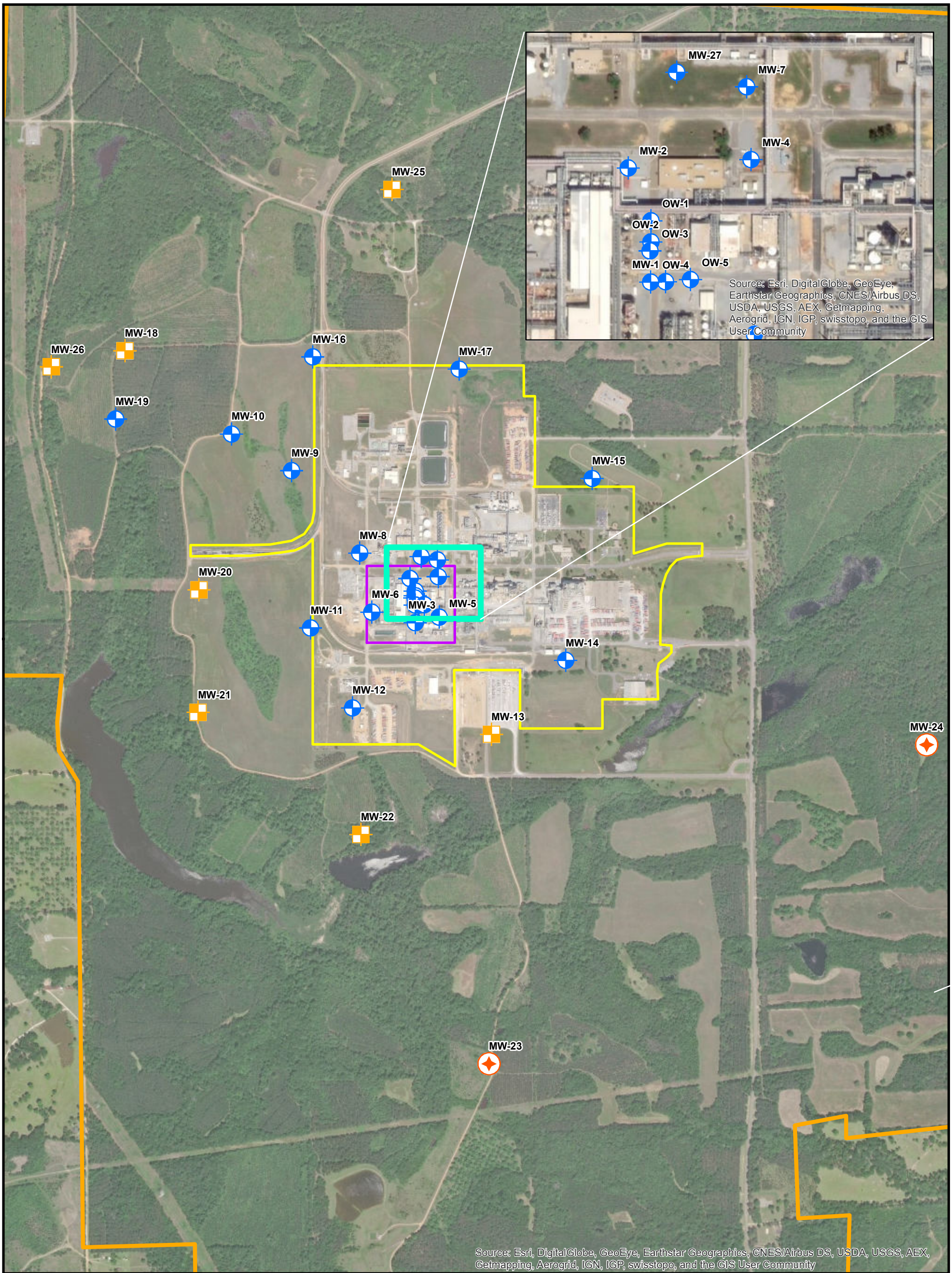
NA = not analyzed due to lack of data

µg/L - micrograms per liter

Table C7: Recommended Monoritoring Network Sampling Schedule

Well Location ID	Well Type	Sampling Frequency
MW-1	EFF	Semi-annual
MW-2	EFF	Semi-annual
MW-3R	EFF	Annual
MW-4	EFF	Semi-annual
MW-5	EFF	Annual
MW-6	EFF	Semi-annual
MW-7	EFF	Semi-annual
MW-8	EFF	Annual
MW-9	EFF	Annual
MW-10	EFF	Semi-annual
MW-11	EFF	Annual
MW-12	EFF	Annual
MW-13	BDY	Annual
MW-14	EFF	Annual
MW-15	EFF	Annual
MW-16	EFF	Annual
MW-17	EFF	Annual
MW-18	BDY	Annual
MW-19	EFF	Semi-annual
MW-20	BDY	Annual
MW-21	BDY	Annual
MW-22	BDY	Annual
MW-23	BKG	Annual
MW-24	BKG	Annual
MW-25	BDY	Annual
MW-26	BDY	Annual
MW-27	EFF	Semi-annual
OW-1	EFF	Semi-annual
OW-2	EFF	Annual
OW-3	EFF	Semi-annual
OW-4R	EFF	Semi-annual
OW-5	EFF	Annual

Appendix C
FIGURES



Legend

GROUNDWATER MONITORING WELLS

- EFFECTIVENESS WELL (EFF)
- BOUNDARY WELL (BDY)
- BACKGROUND WELL (BKG)
- SABIC FENCE LINE
- APPROXIMATE SABIC PROPERTY BOUNDARY
- BRINE UNIT

0 1,000 2,000 Feet

SABIC
BURKVILLE, ALABAMA

GROUNDWATER MONITORING WELL NETWORK

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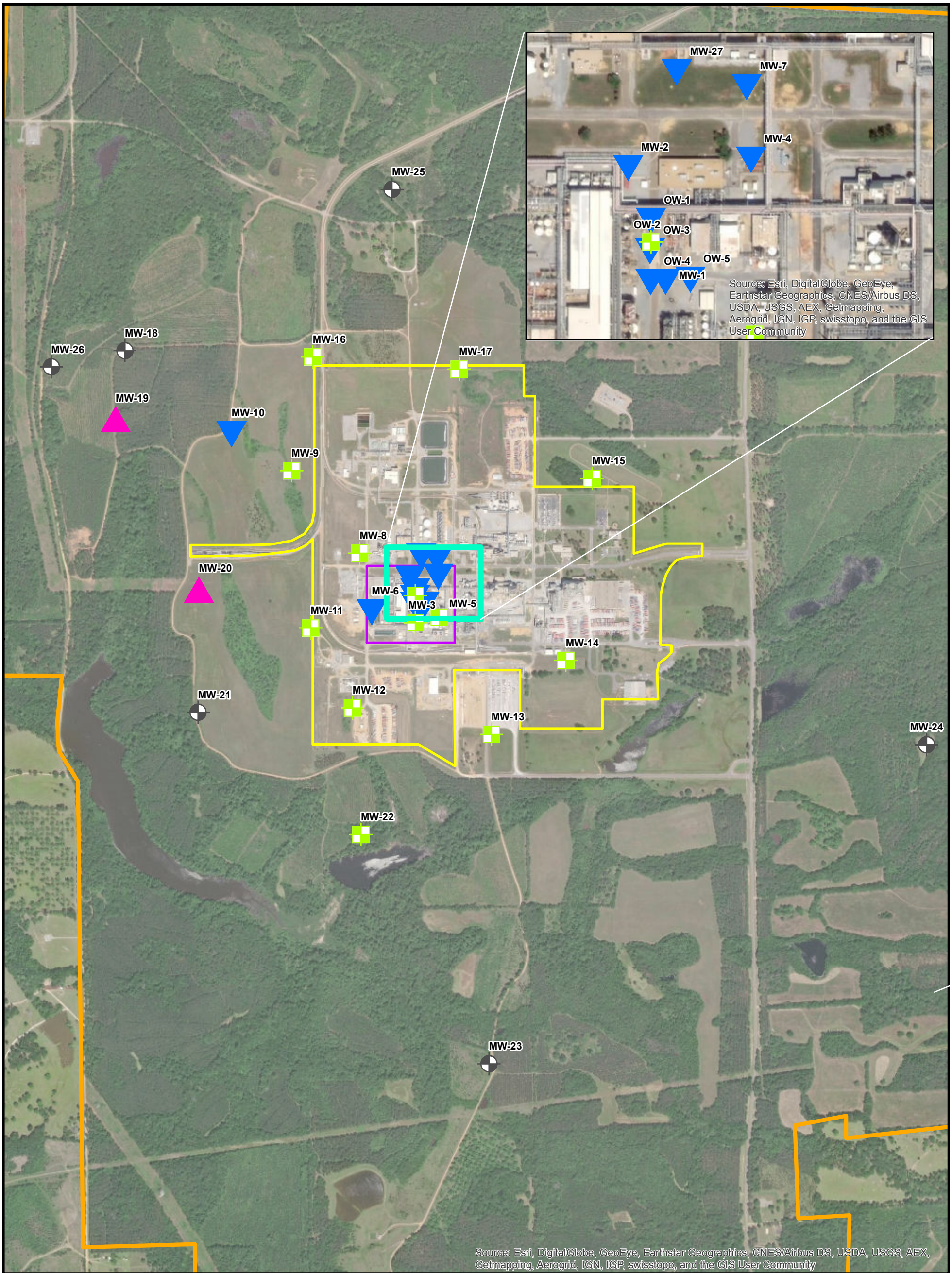
FIGURE
C1



Legend

MANN-KENDALL STATISTIC

- SIGNIFICANT DECREASE ($p < 0.05$; $S < 0$)
- NO SIGNIFICANT TREND ($p > 0.05$)
- SIGNIFICANT INCREASE ($p < 0.05$; $S > 0$)
- WELLS NOT ANALYZED (ND RESULTS)

- SABIC FENCE LINE
- APPROXIMATE SABIC PROPERTY BOUNDARY
- BRINE UNIT

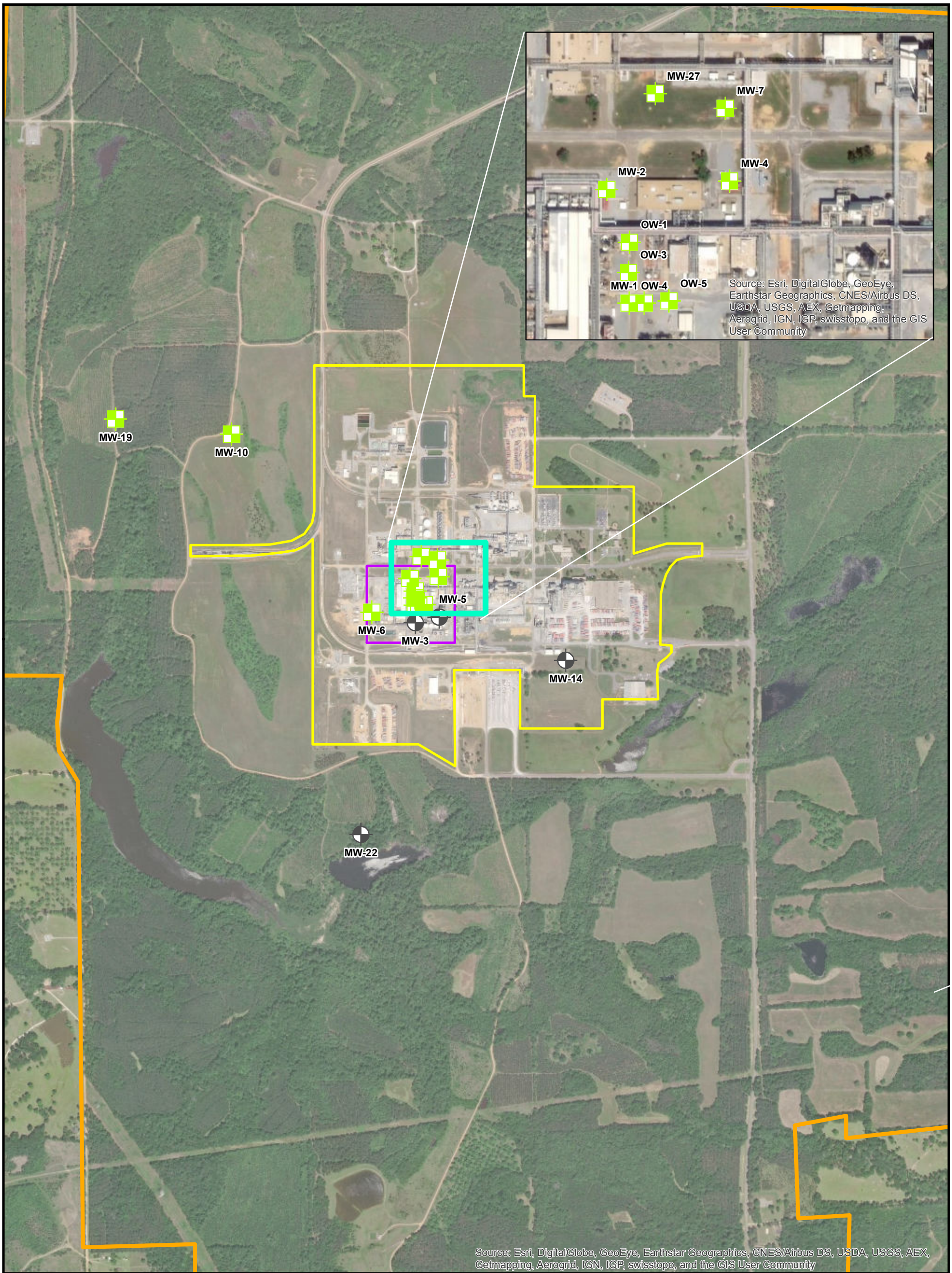
0 1,000 2,000 Feet

SABIC
BURKVILLE, ALABAMA

MANN-KENDALL PCE TRENDS THROUGH 2018; ALL DATA

ARCADIS

FIGURE
C2



Legend

MANN-KENDALL STATISTIC

- SIGNIFICANT DECREASE ($p < 0.05$; $S < 0$)
- NO SIGNIFICANT TREND ($p > 0.05$)
- SIGNIFICANT INCREASE ($p < 0.05$; $S > 0$)
- WELLS NOT ANALYZED (ND RESULTS)

- SABIC FENCE LINE
- APPROXIMATE SABIC PROPERTY BOUNDARY
- BRINE UNIT

0 1,000 2,000 Feet

SABIC
BURKVILLE, ALABAMA

WELLS SHOWING THE MANN-KENDALL PCE TREND STATISTIC CHANGE FROM A SINGLE EVENT ANALYSIS

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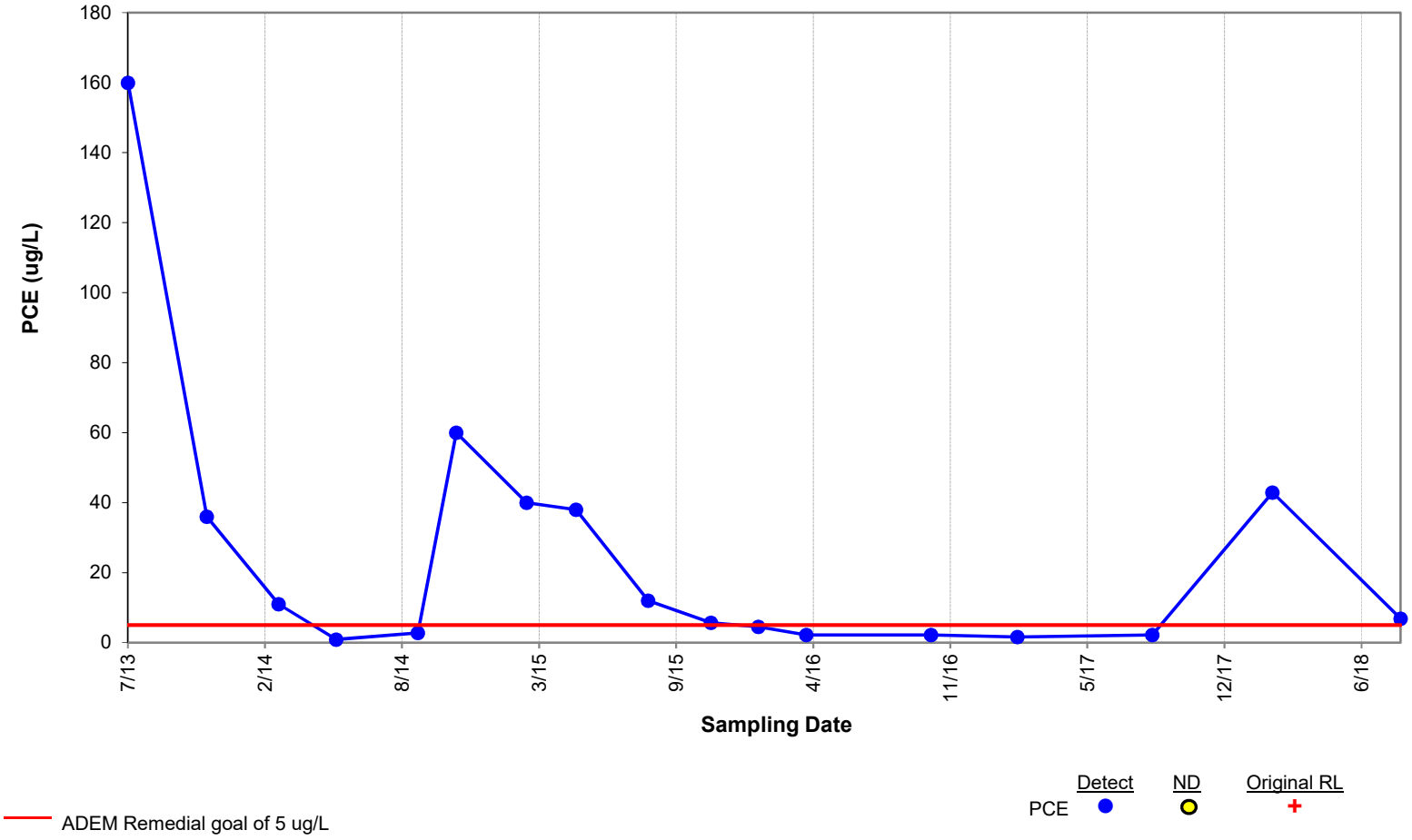
FIGURE
C3

APPENDIX C

TETRACHLOROETHYLENE TREND PLOTS



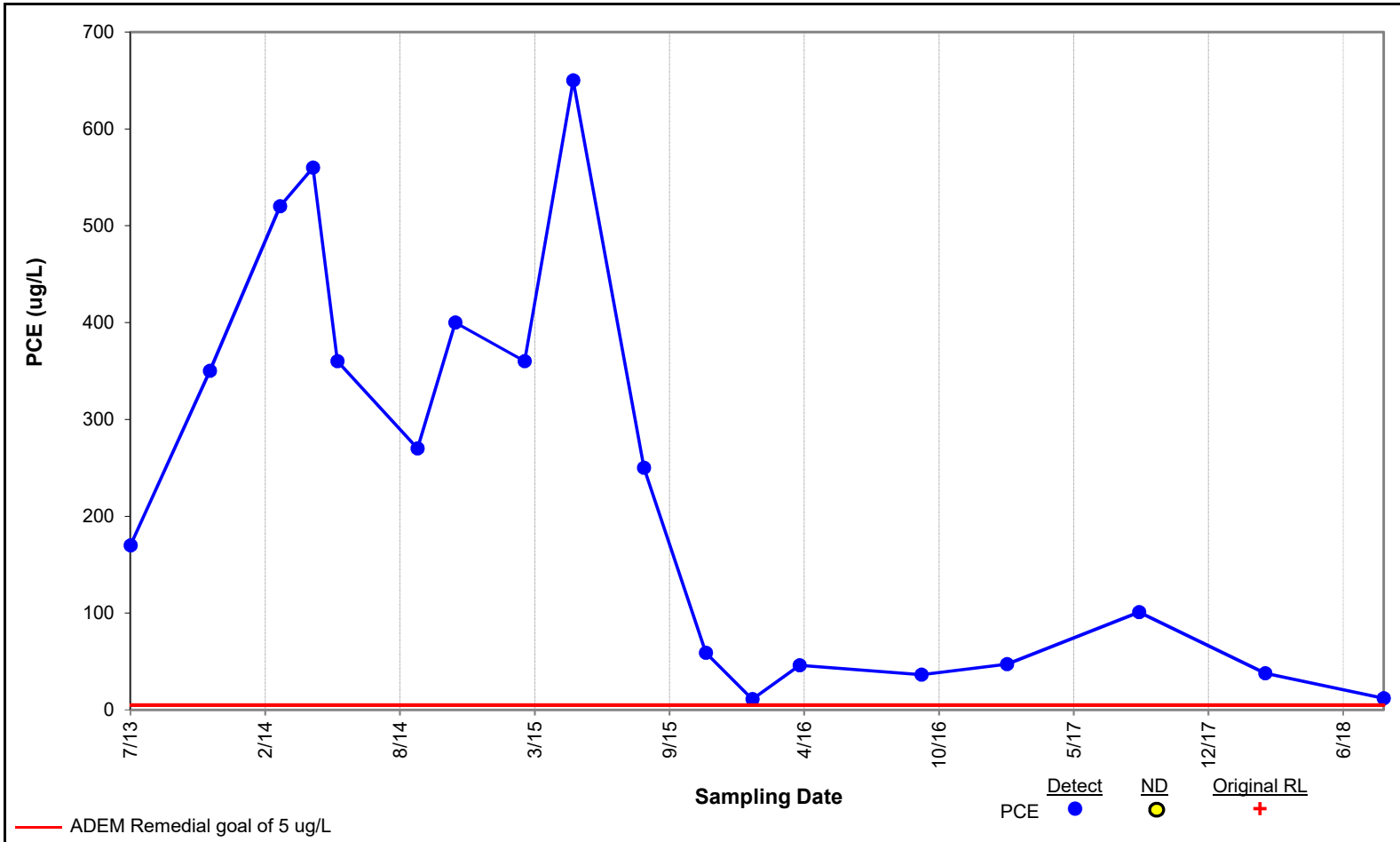
Mann-Kendall Test Result: **DECREASING TREND**
p-value = 0.046
H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = -1.1E-02 ug/L per day
95% Confidence Interval = -4.6E-02 to 9.8E-04 ug/L per day

ARCADIS

Concentration vs. Time Plot – PCE in Well MW-1

Figure A-1



Mann-Kendall Test Result: **DECREASING TREND**
p-value = 0.002

H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result:
Median Slope Estimate = -2.6E-01 ug/L per day
95% Confidence Interval = -4.4E-01 to -7.6E-02 ug/L per day

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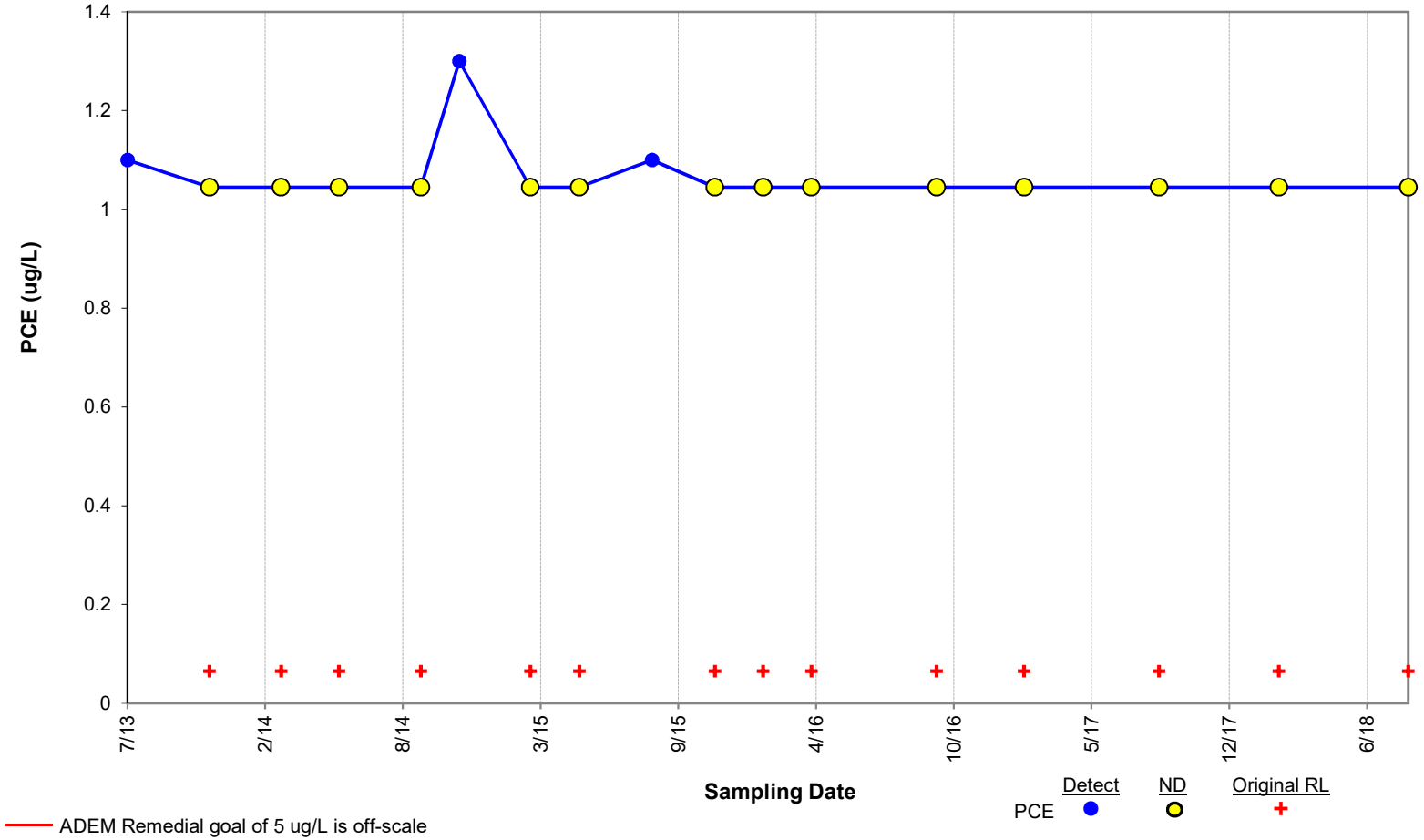
Concentration vs. Time Plot – PCE in Well MW-2

Figure A-2



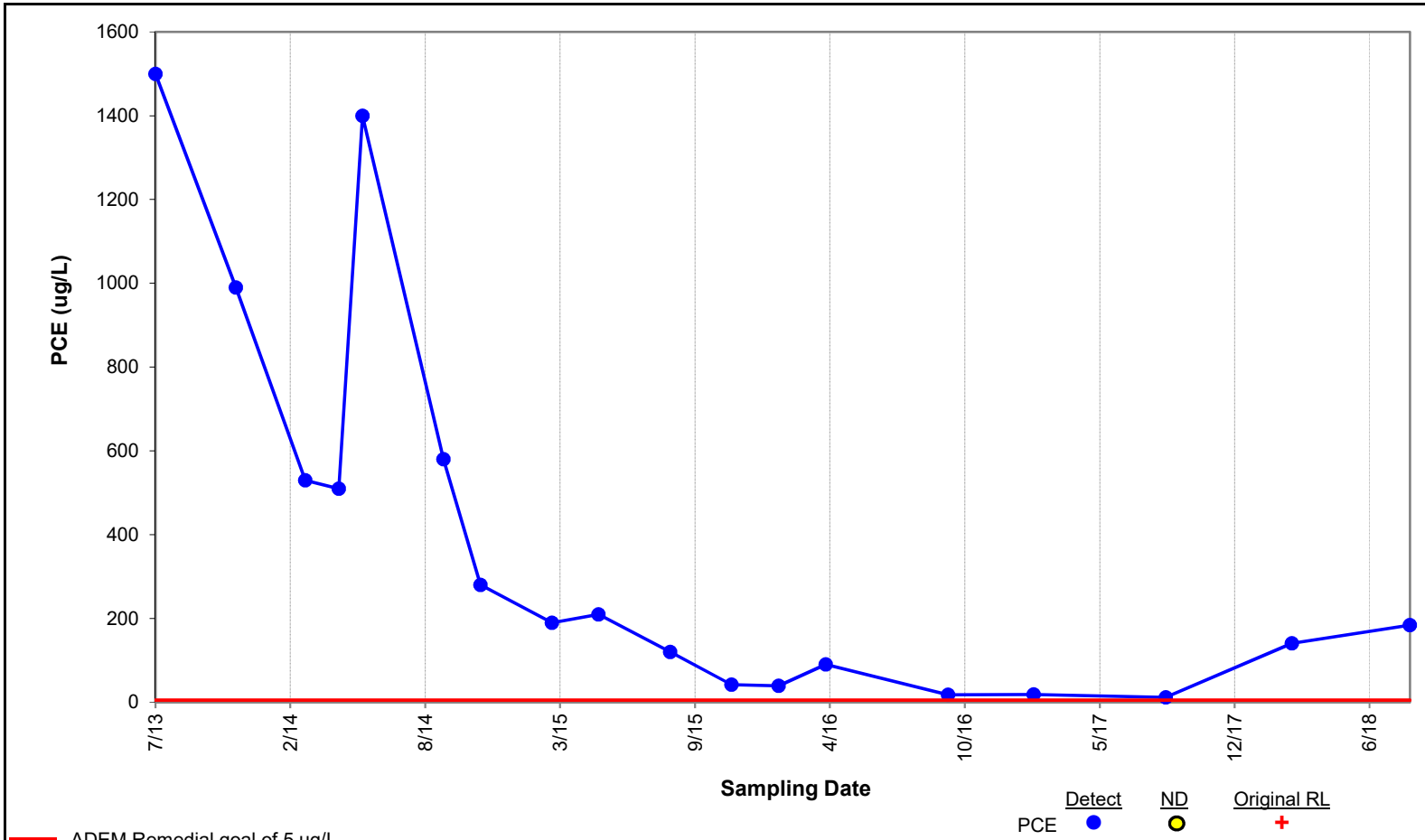
Mann-Kendall Test Result: **No Significant Trend**
p-value = 0.094
H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = 0.0E+00 ug/L per day
95% Confidence Interval = 0.0E+00 to 0.0E+00 ug/L per day

ARCADIS

Concentration vs. Time Plot – PCE in Well MW-3

Figure A-3



Mann-Kendall Test Result: **DECREASING TREND**
p-value = <0.001

H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result:
Median Slope Estimate = -5.4E-01 ug/L per day
95% Confidence Interval = -8.5E-01 to -2.6E-01 ug/L per day

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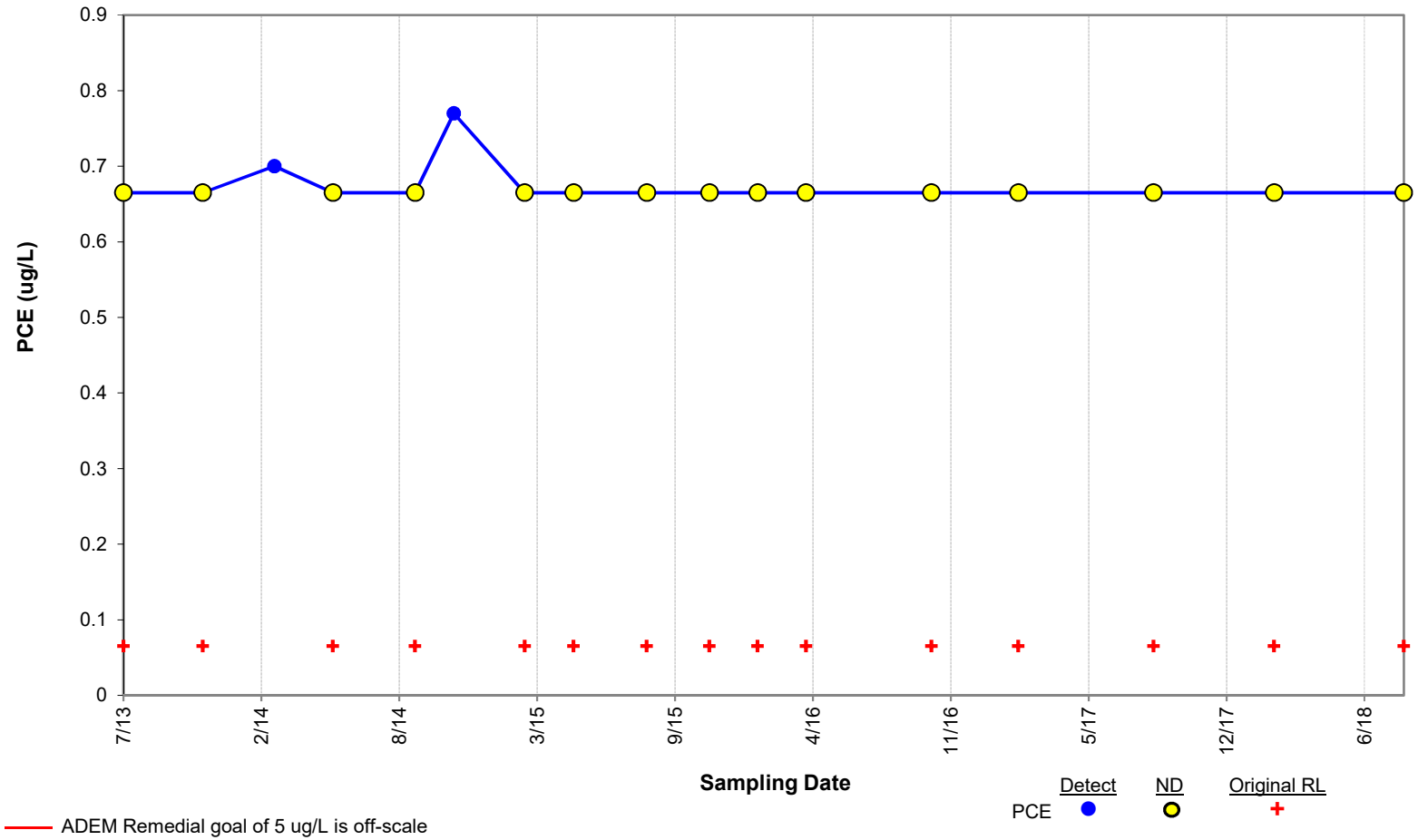
Concentration vs. Time Plot – PCE in Well MW-4

Figure A-4



Mann-Kendall Test Result: **No Significant Trend**
p-value = 0.117
H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = 0.0E+00 ug/L per day
95% Confidence Interval = 0.0E+00 to 0.0E+00 ug/L per day

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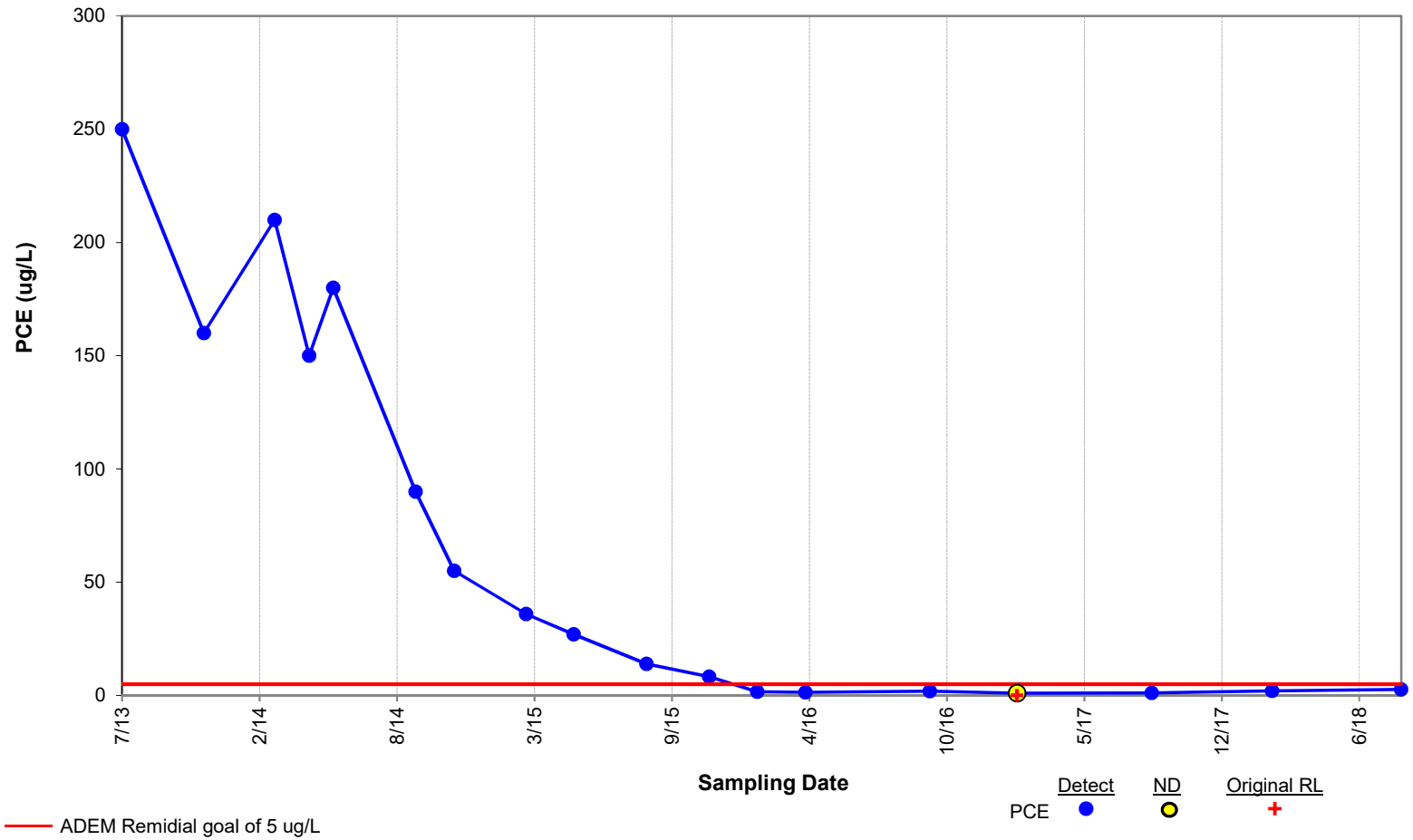
Concentration vs. Time Plot – PCE in Well MW-5

Figure A-5



Mann-Kendall Test Result: **DECREASING TREND**
p-value = <0.001
H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = -1.3E-01 ug/L per day
95% Confidence Interval = -2.0E-01 to -6.4E-02 ug/L per day

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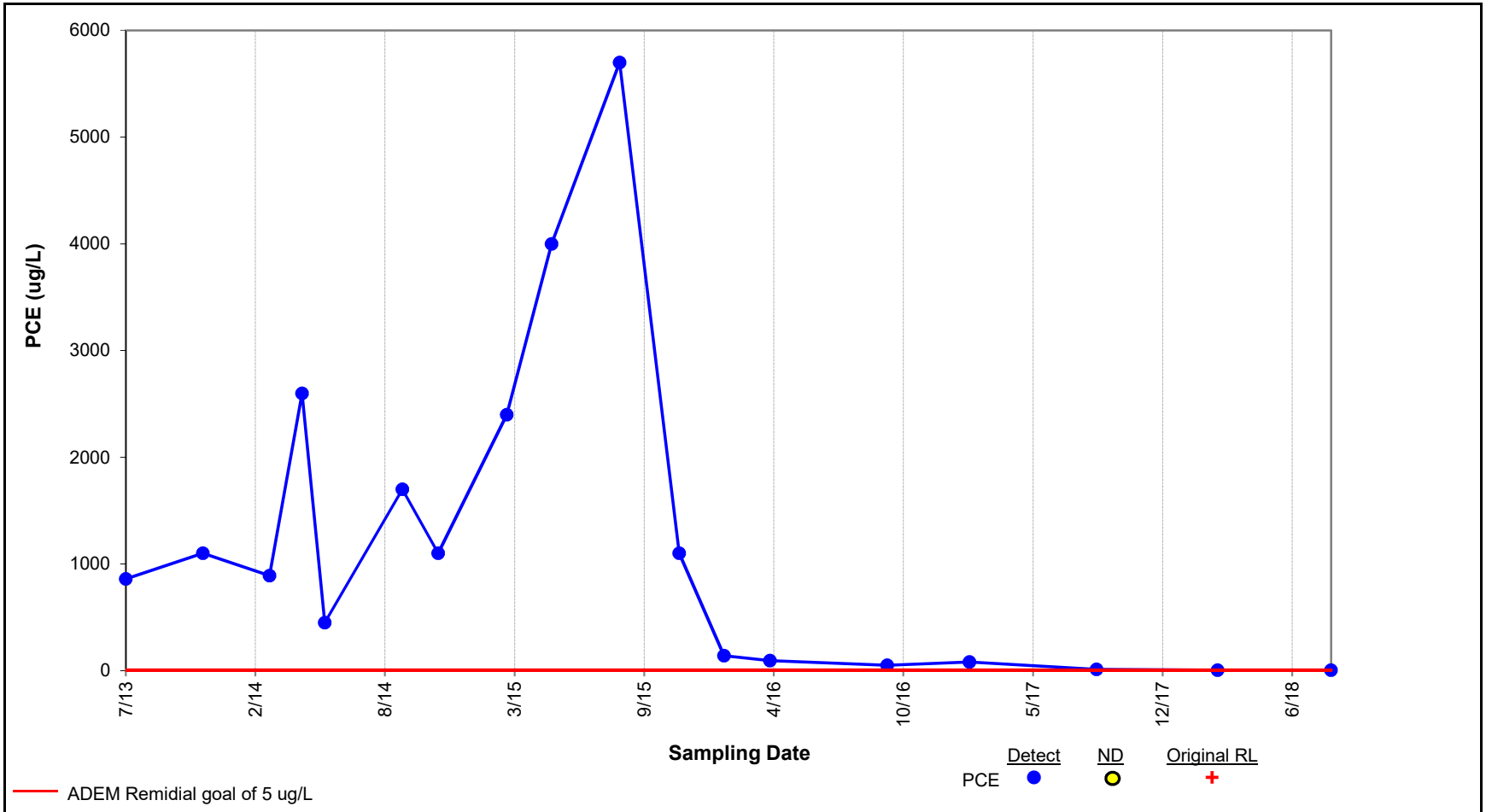
Concentration vs. Time Plot – PCE in Well MW-6

Figure A-6



Mann-Kendall Test Result: **DECREASING TREND**
p-value = 0.004

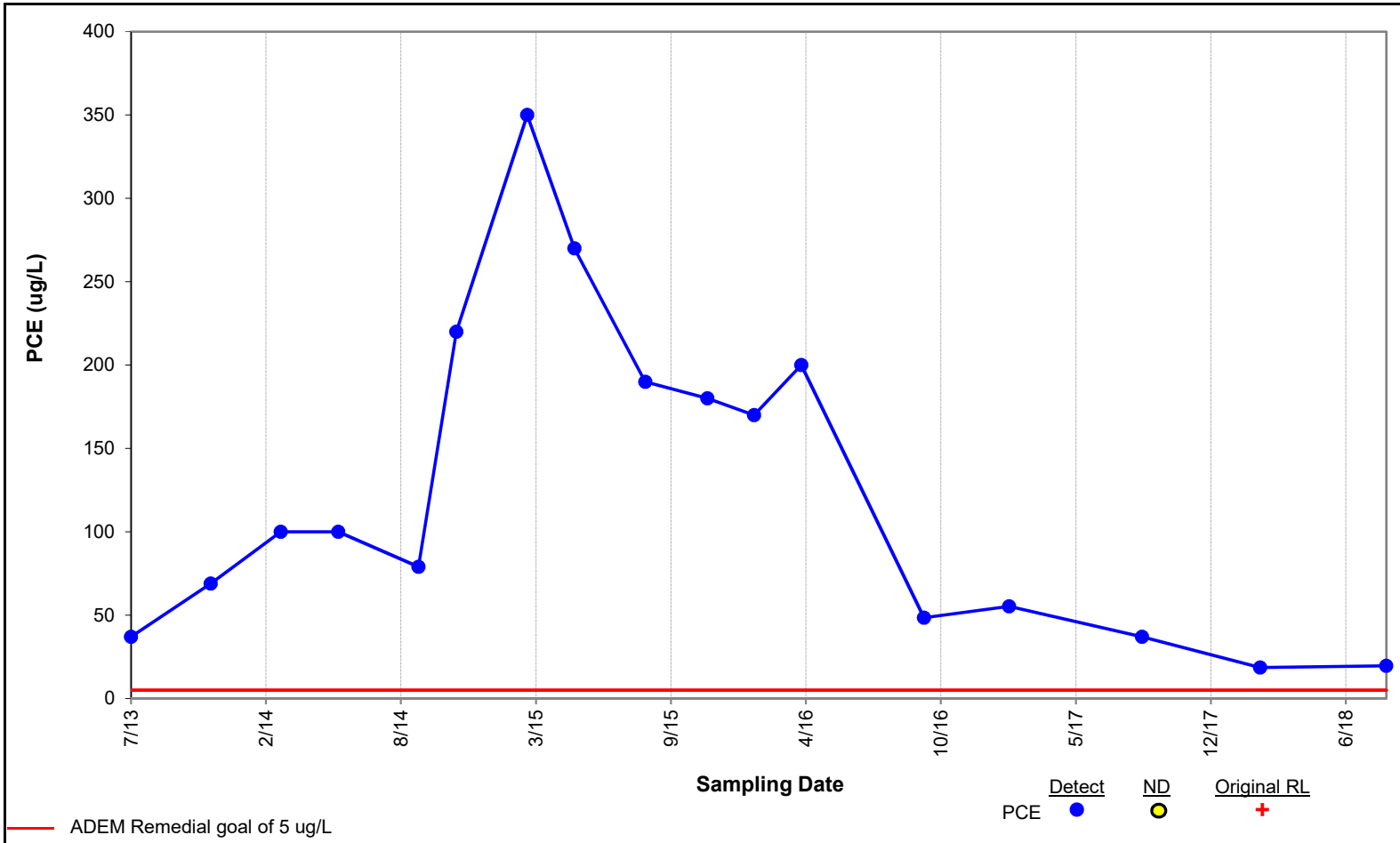
H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = -6.5E-01 ug/L per day
95% Confidence Interval = -1.6E+00 to -1.3E-01 ug/L per day

ARCADIS

Concentration vs. Time Plot – PCE in Well MW-7

Figure A-7



Mann-Kendall Test Result: **No Significant Trend**
p-value = 0.100
H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = -4.4E-02 ug/L per day
95% Confidence Interval = -1.5E-01 to 8.7E-02 ug/L per day

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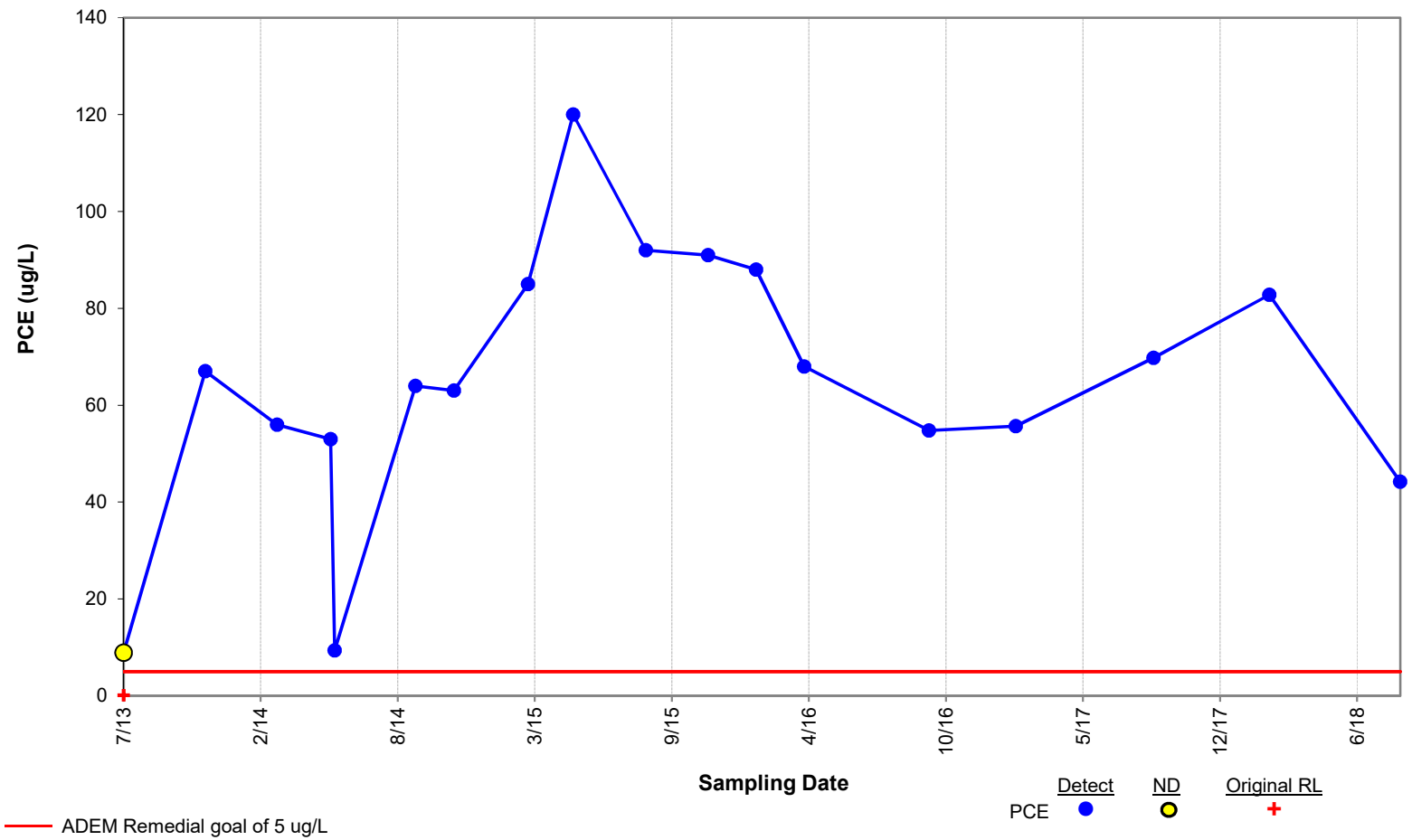
Concentration vs. Time Plot – PCE in Well MW-8

Figure A-8



Mann-Kendall Test Result: **No Significant Trend**
p-value = 0.202

H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result:
Median Slope Estimate = 9.8E-03 ug/L per day
95% Confidence Interval = -1.2E-02 to 4.6E-02 ug/L per day

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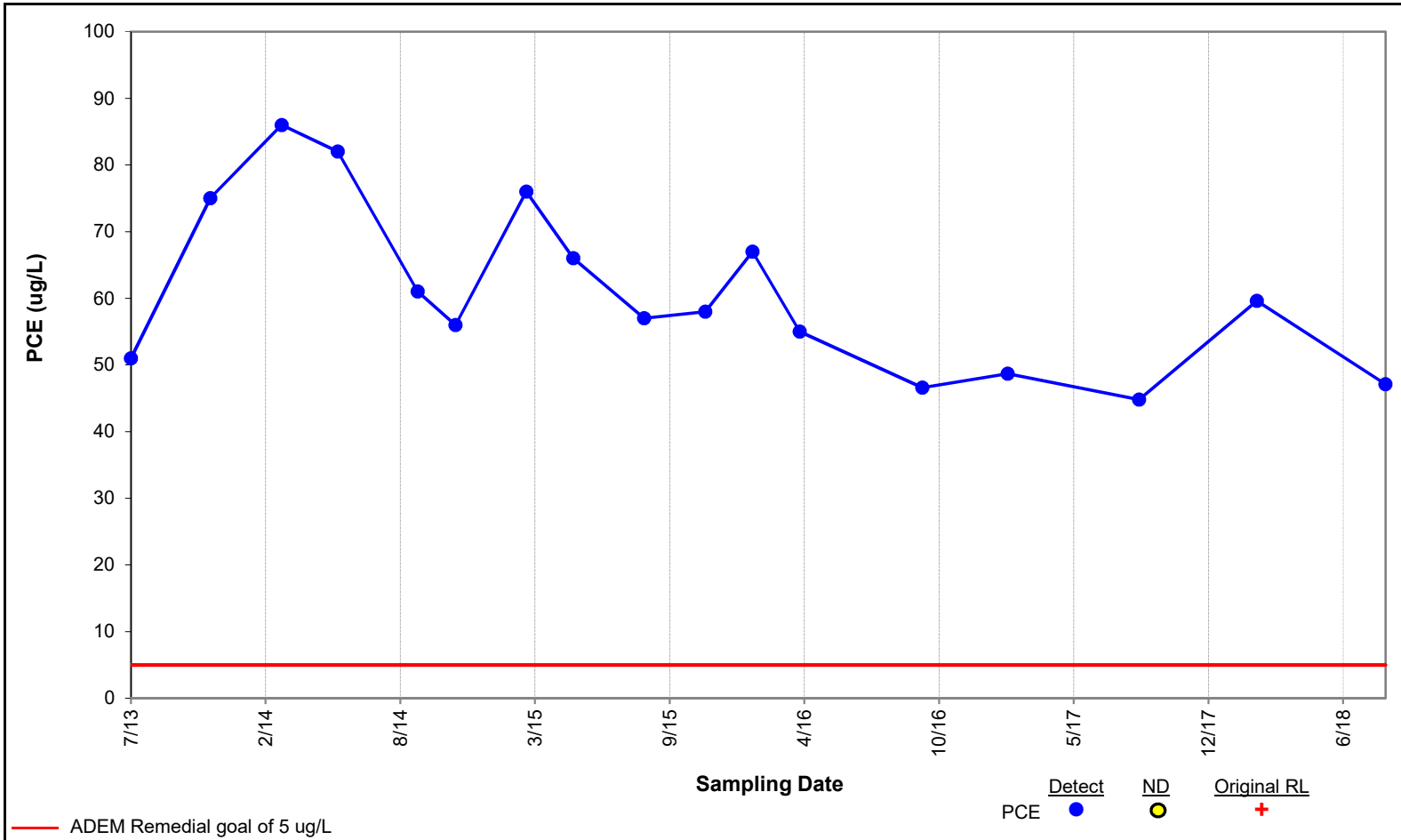
Concentration vs. Time Plot – PCE in Well MW-9

Figure A-9



Mann-Kendall Test Result: **DECREASING TREND**
p-value = 0.006
H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = -1.7E-02 ug/L per day
95% Confidence Interval = -2.7E-02 to -5.7E-03 ug/L per day

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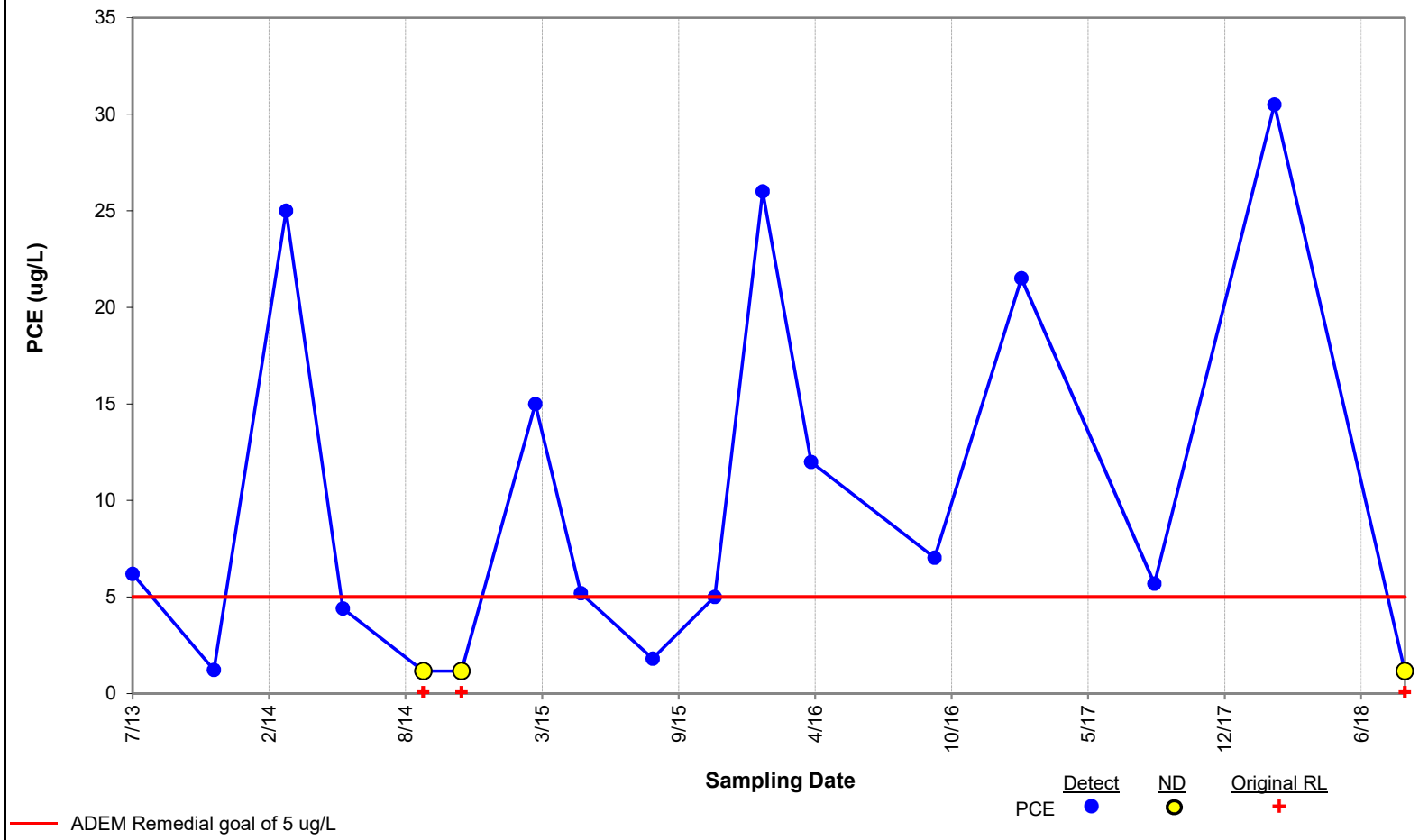
Concentration vs. Time Plot – PCE in Well MW-10

Figure A-10



Mann-Kendall Test Result: **No Significant Trend**
p-value = 0.161

H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result:
Median Slope Estimate = 3.1E-03 ug/L per day
95% Confidence Interval = -3.1E-03 to 1.5E-02 ug/L per day

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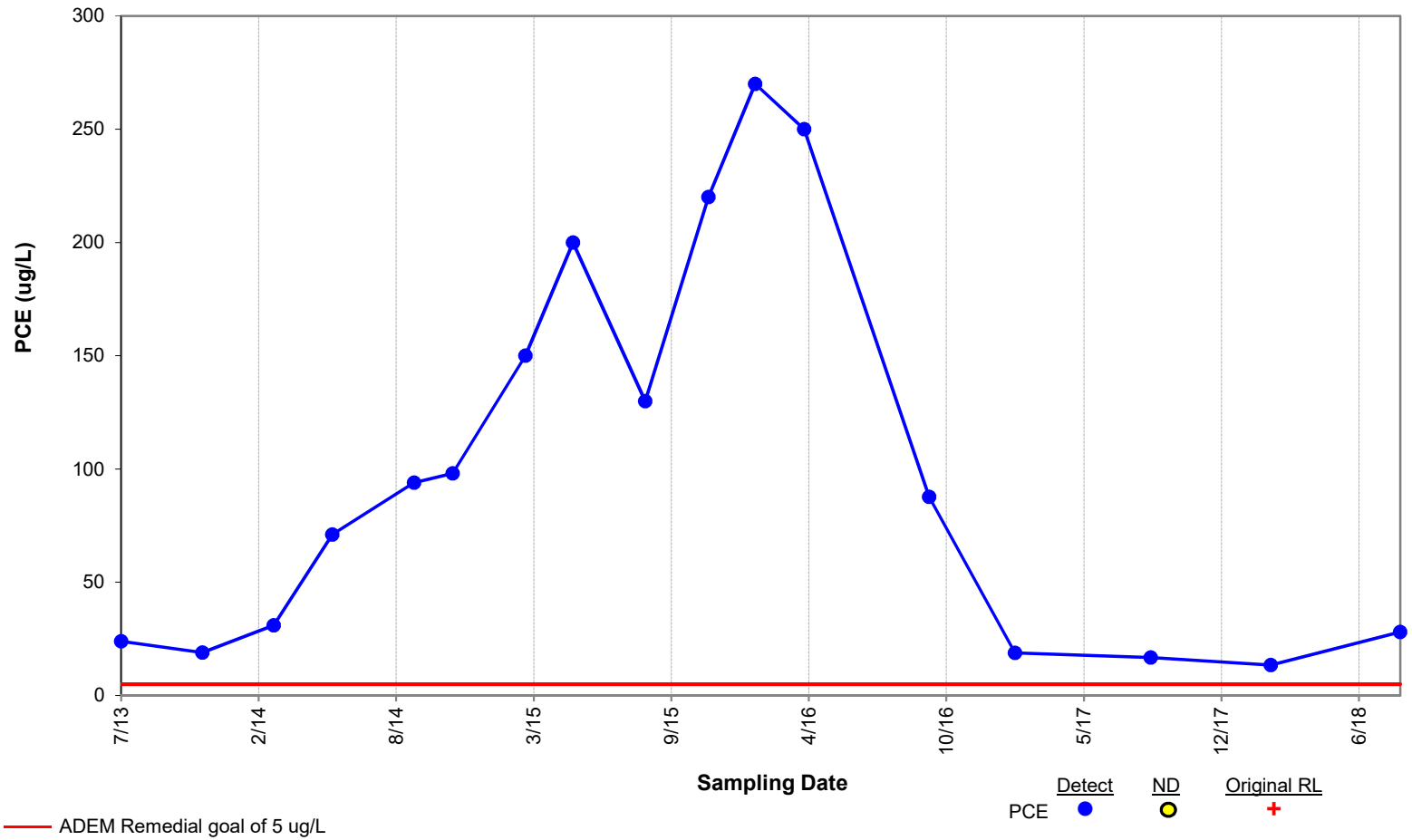
Concentration vs. Time Plot – PCE in Well MW-11

Figure A-11



Mann-Kendall Test Result: **No Significant Trend**
p-value = 0.418

H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result:
Median Slope Estimate = 1.8E-02 ug/L per day
95% Confidence Interval = -5.2E-02 to 2.2E-01 ug/L per day

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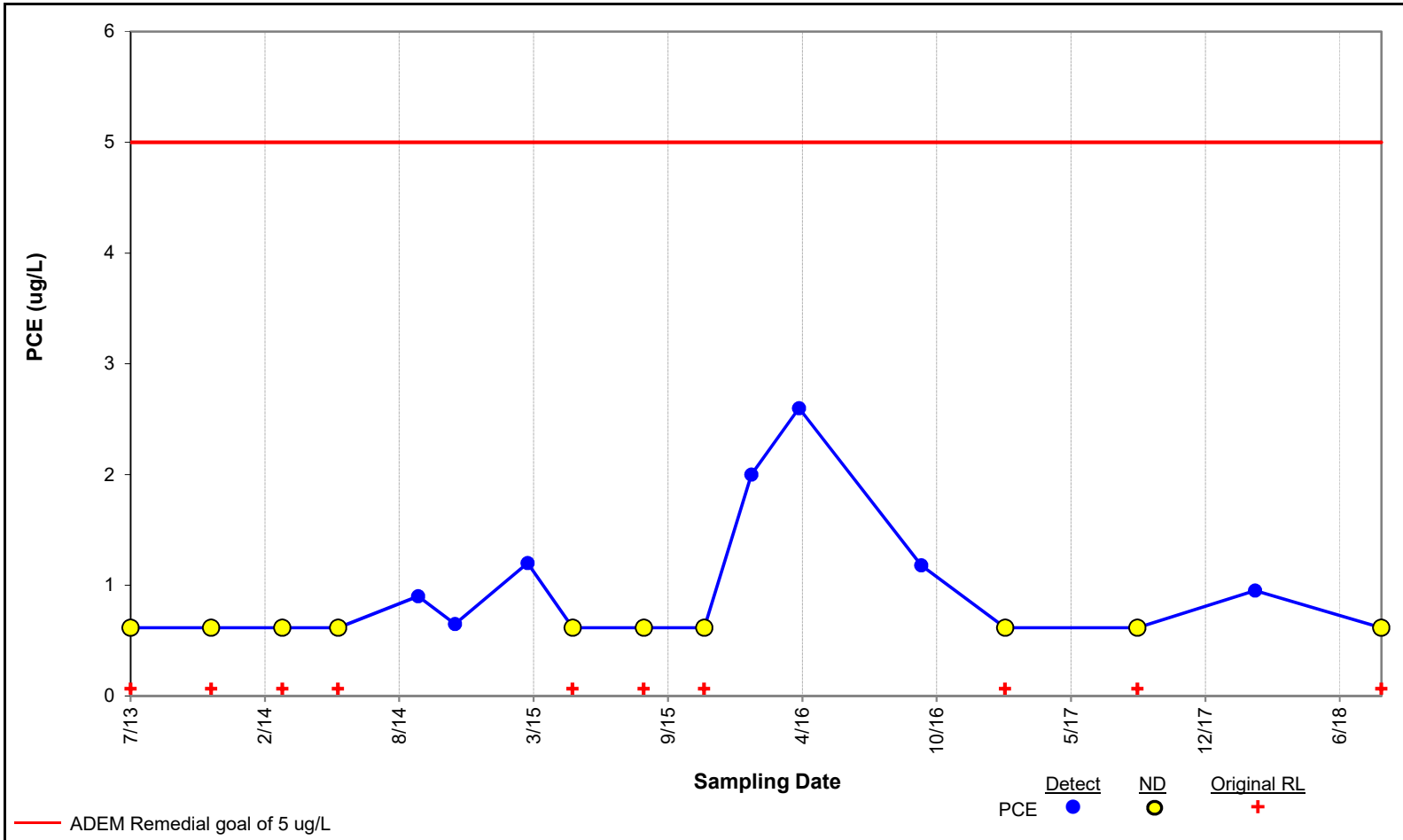
Concentration vs. Time Plot – PCE in Well MW-12

Figure A-12



Mann-Kendall Test Result: **No Significant Trend**
p-value = 0.202

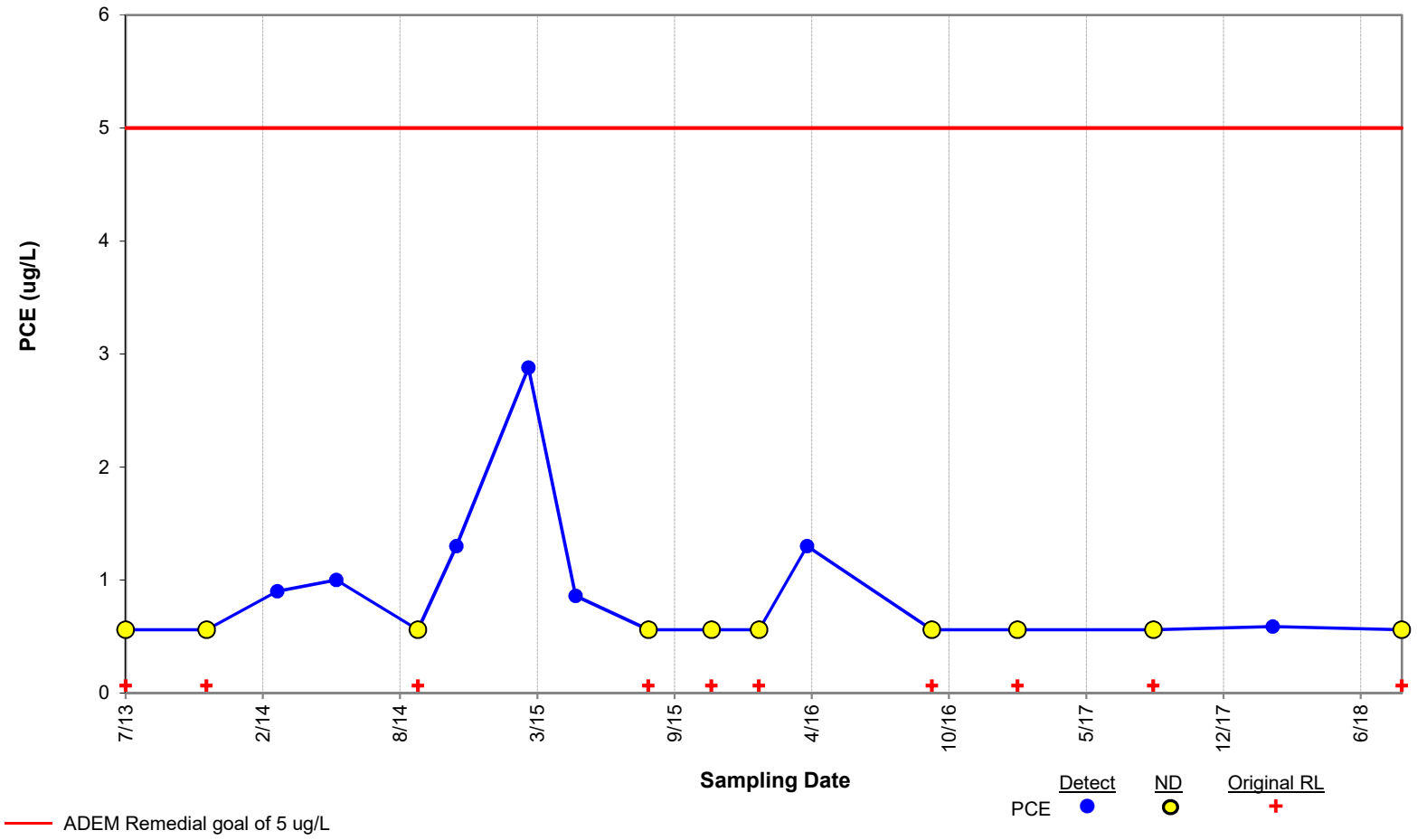
H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = 0.0E+00 ug/L per day
95% Confidence Interval = 0.0E+00 to 2.3E-04 ug/L per day

ARCADIS

Concentration vs. Time Plot – PCE in Well MW-13

Figure A-13



Mann-Kendall Test Result: **No Significant Trend**
p-value = 0.243
H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = 0.0E+00 ug/L per day
95% Confidence Interval = -2.7E-04 to 0.0E+00 ug/L per day

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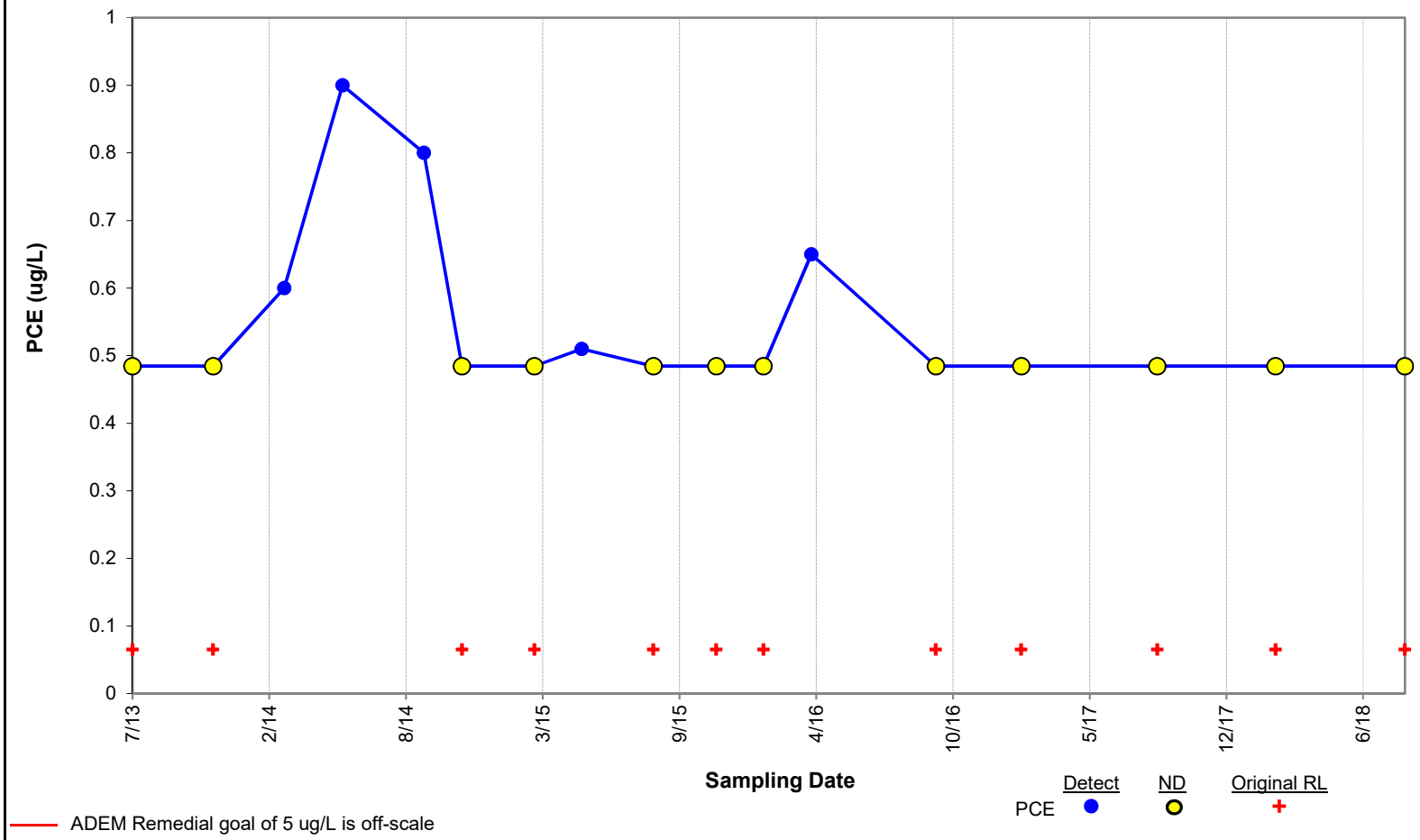
Concentration vs. Time Plot – PCE in Well MW-14

Figure A-14



Mann-Kendall Test Result: **No Significant Trend**
p-value = 0.082
H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = 0.0E+00 ug/L per day
95% Confidence Interval = -2.1E-05 to 0.0E+00 ug/L per day

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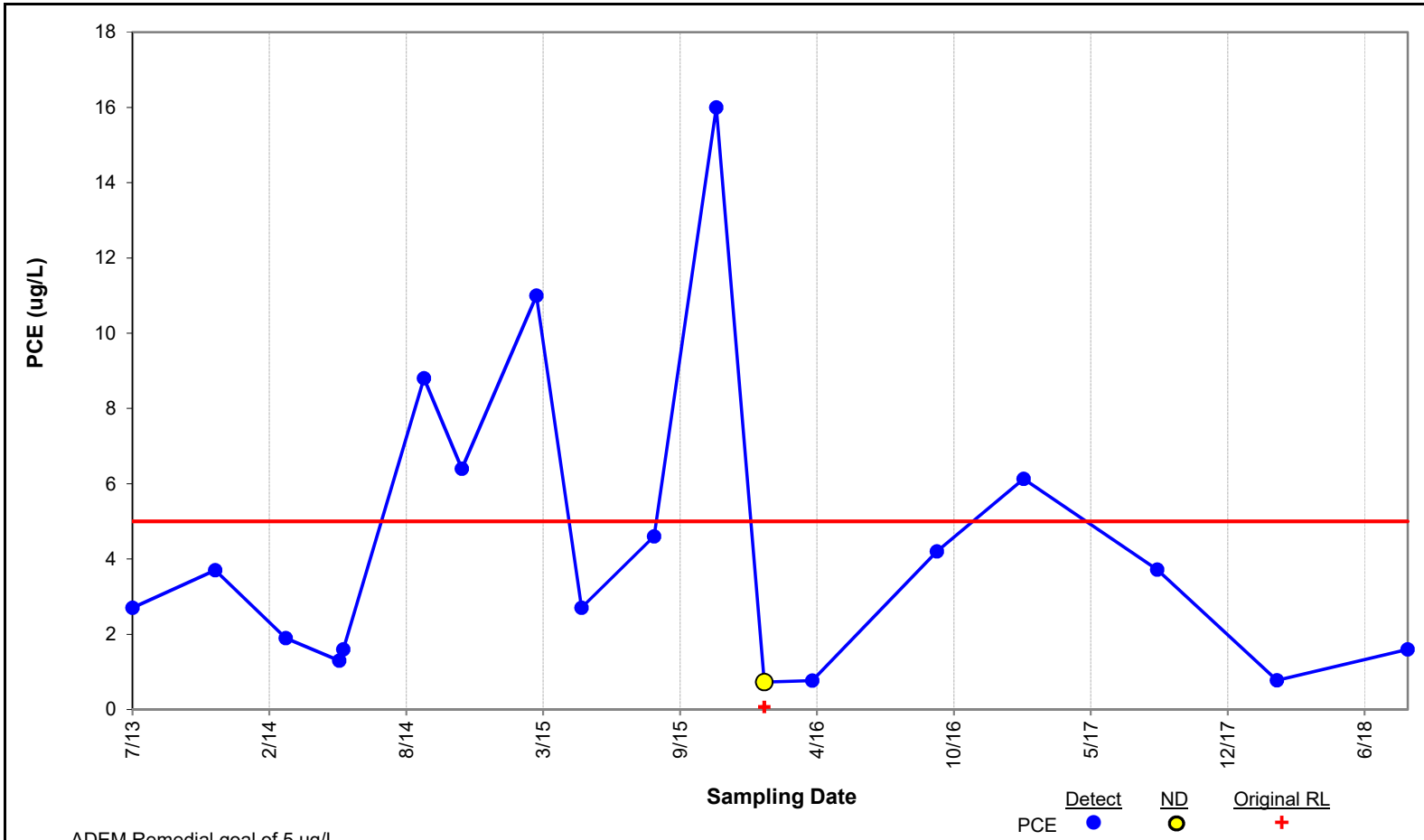
Concentration vs. Time Plot – PCE in Well MW-15

Figure A-15



Mann-Kendall Test Result: **No Significant Trend**
p-value = 0.381

H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = -5.9E-04 ug/L per day
95% Confidence Interval = -3.6E-03 to 2.7E-03 ug/L per day

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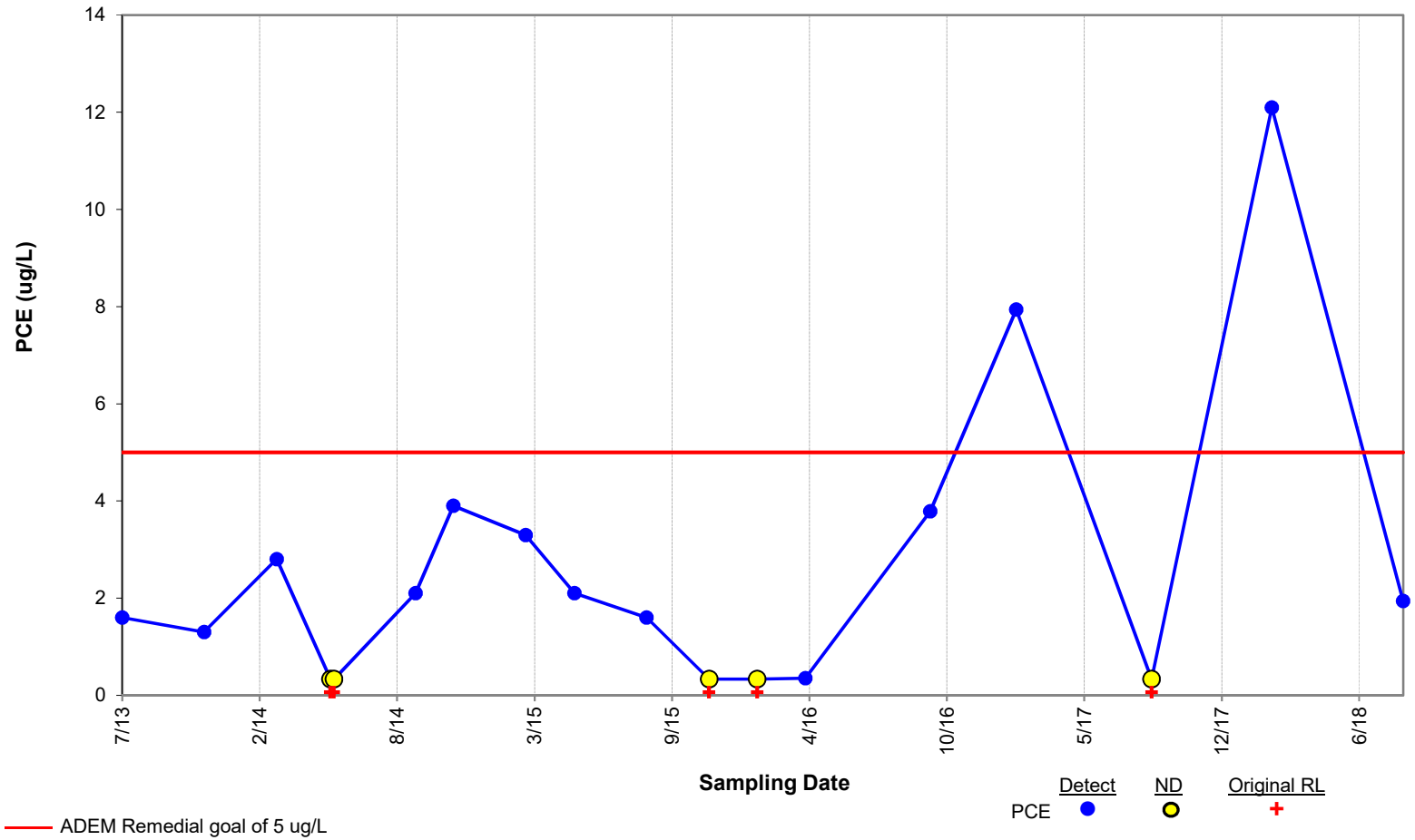
Concentration vs. Time Plot – PCE in Well MW-16

Figure A-16



Mann-Kendall Test Result: **No Significant Trend**
p-value = 0.245

H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = 1.8E-04 ug/L per day
95% Confidence Interval = -1.3E-03 to 4.0E-03 ug/L per day

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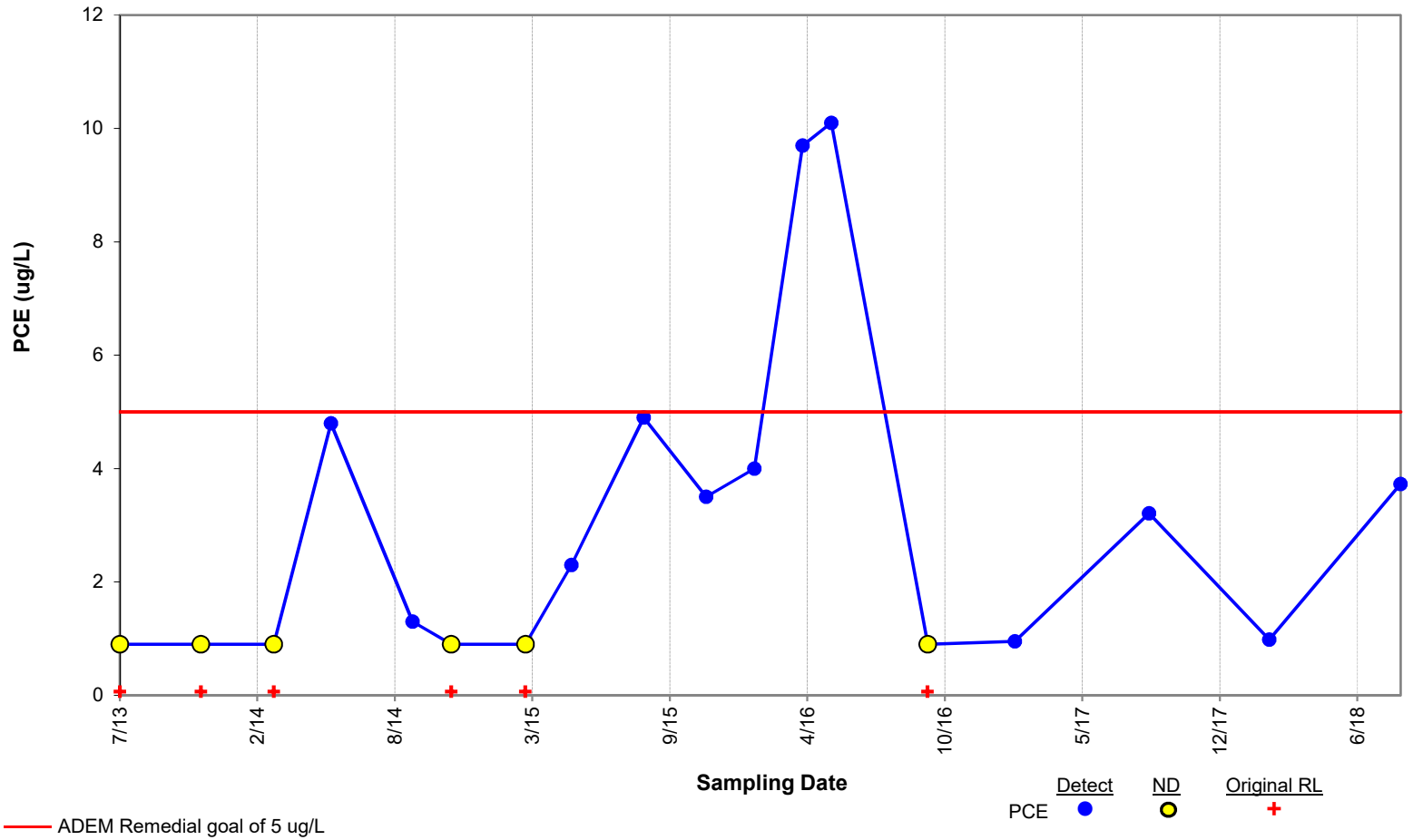
Concentration vs. Time Plot – PCE in Well MW-17

Figure A-17



Mann-Kendall Test Result: INCREASING TREND

p-value = 0.041

H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = 9.3E-04 ug/L per day

95% Confidence Interval = 0.0E+00 to 4.1E-03 ug/L per day

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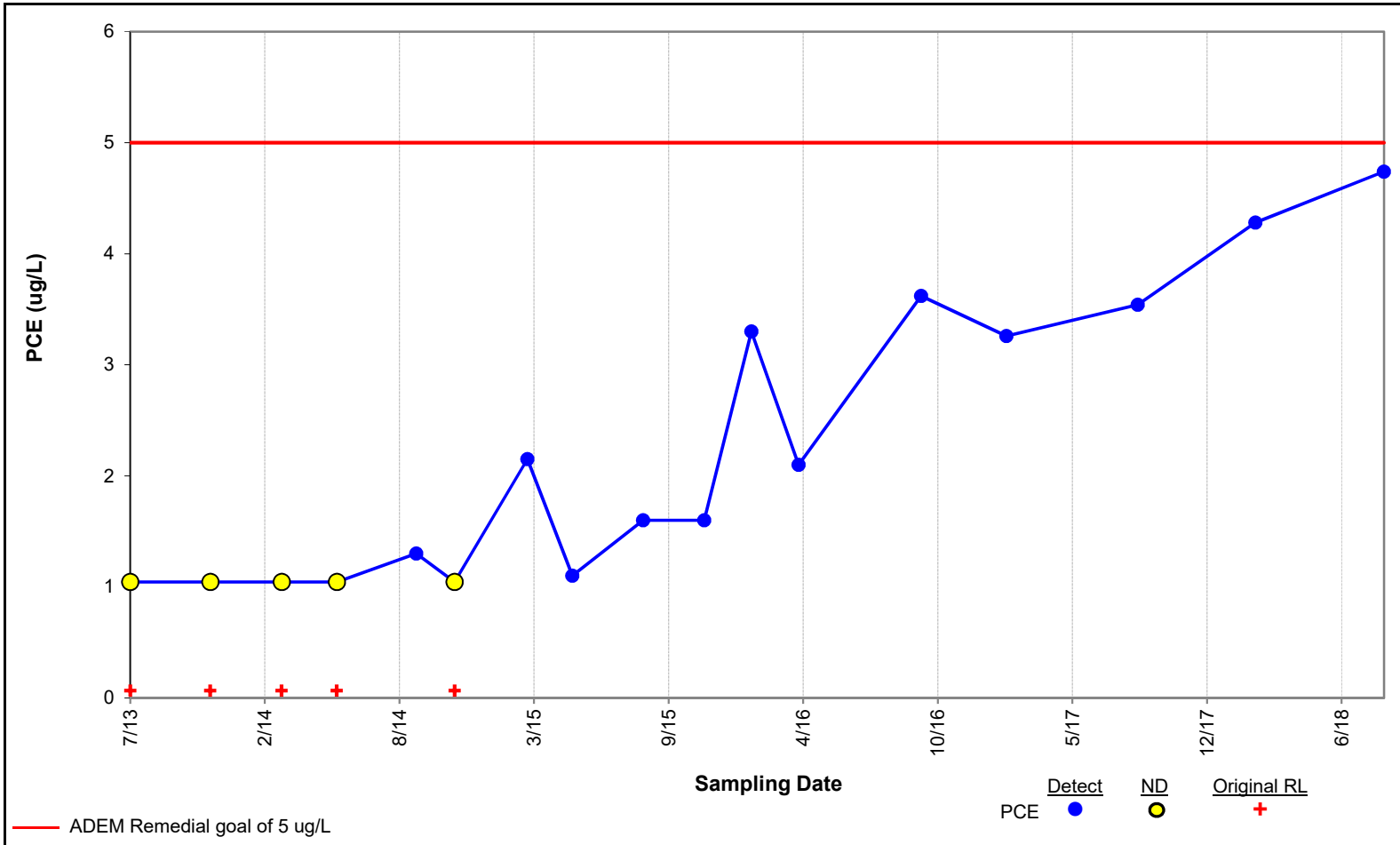
Concentration vs. Time Plot – PCE in Well MW-19

Figure A-18



Mann-Kendall Test Result: **INCREASING TREND**
p-value = <0.001

H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = 2.1E-03 ug/L per day
95% Confidence Interval = 1.3E-03 to 2.7E-03 ug/L per day

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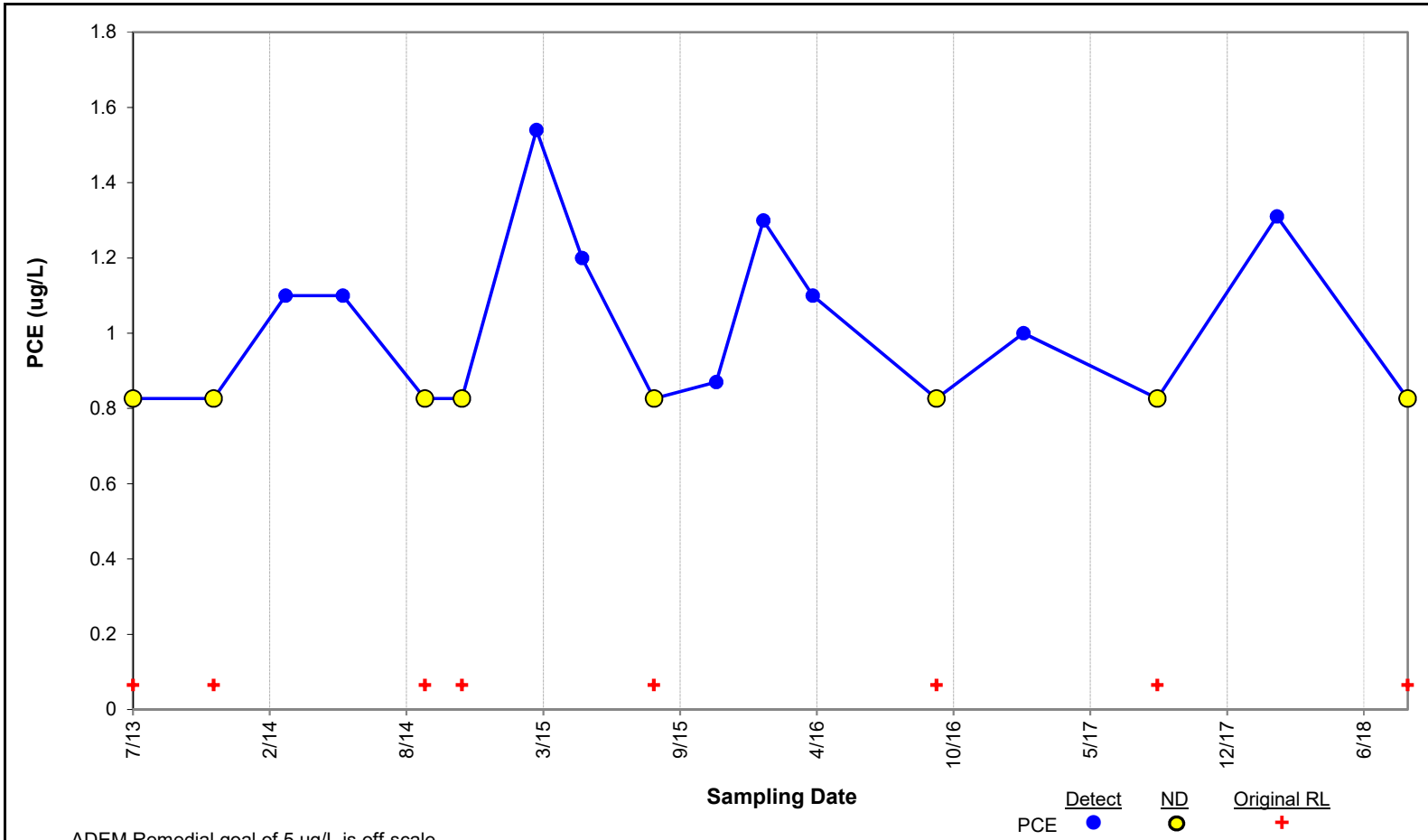
Concentration vs. Time Plot – PCE in Well MW-20

Figure A-19



Mann-Kendall Test Result: **No Significant Trend**
p-value = 0.363
H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = 0.0E+00 ug/L per day
95% Confidence Interval = -9.5E-05 to 2.0E-04 ug/L per day

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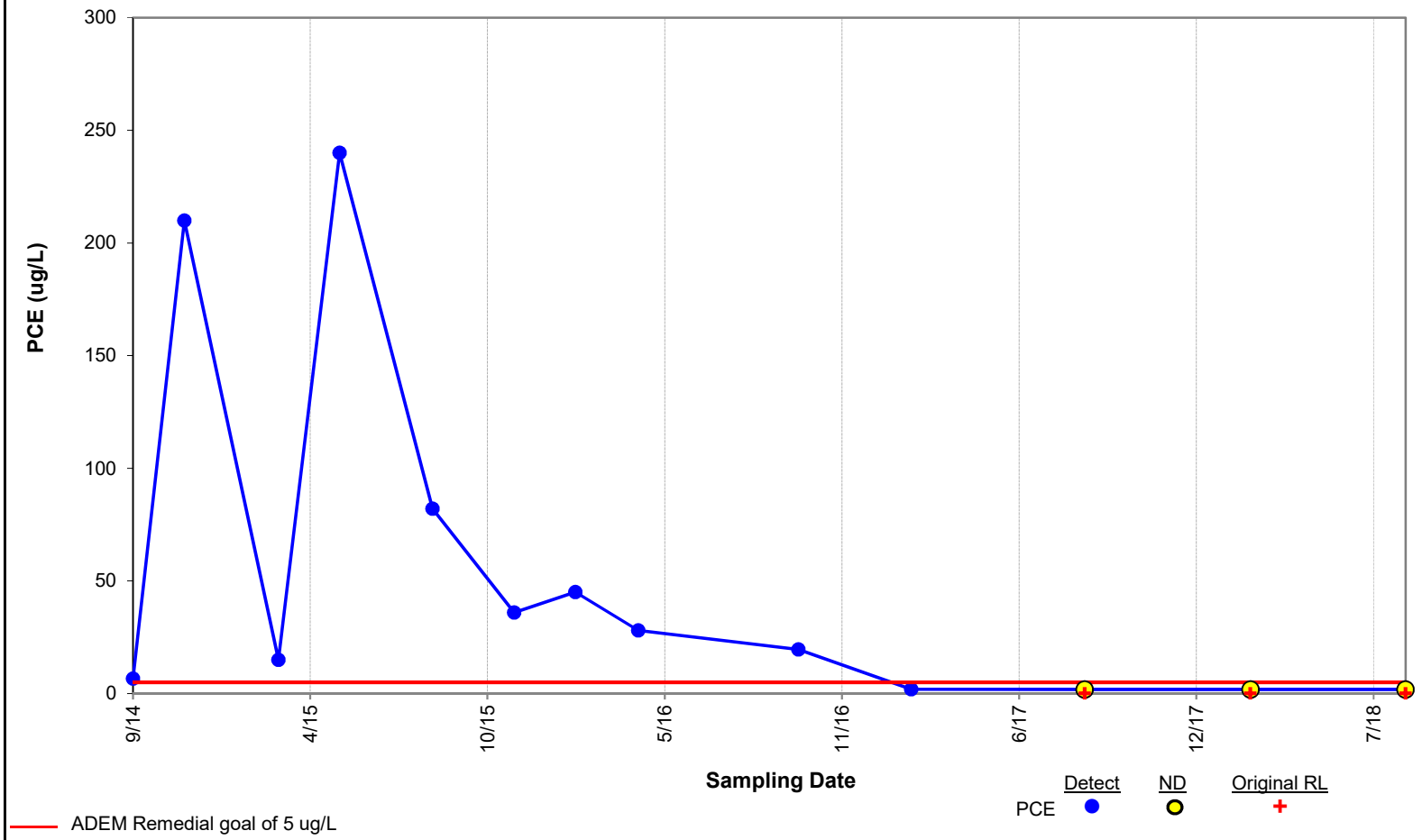
Concentration vs. Time Plot – PCE in Well MW-22

Figure A-20



Mann-Kendall Test Result: **DECREASING TREND**
p-value = 0.005
H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = -5.1E-02 ug/L per day
95% Confidence Interval = -1.5E-01 to -3.8E-03 ug/L per day

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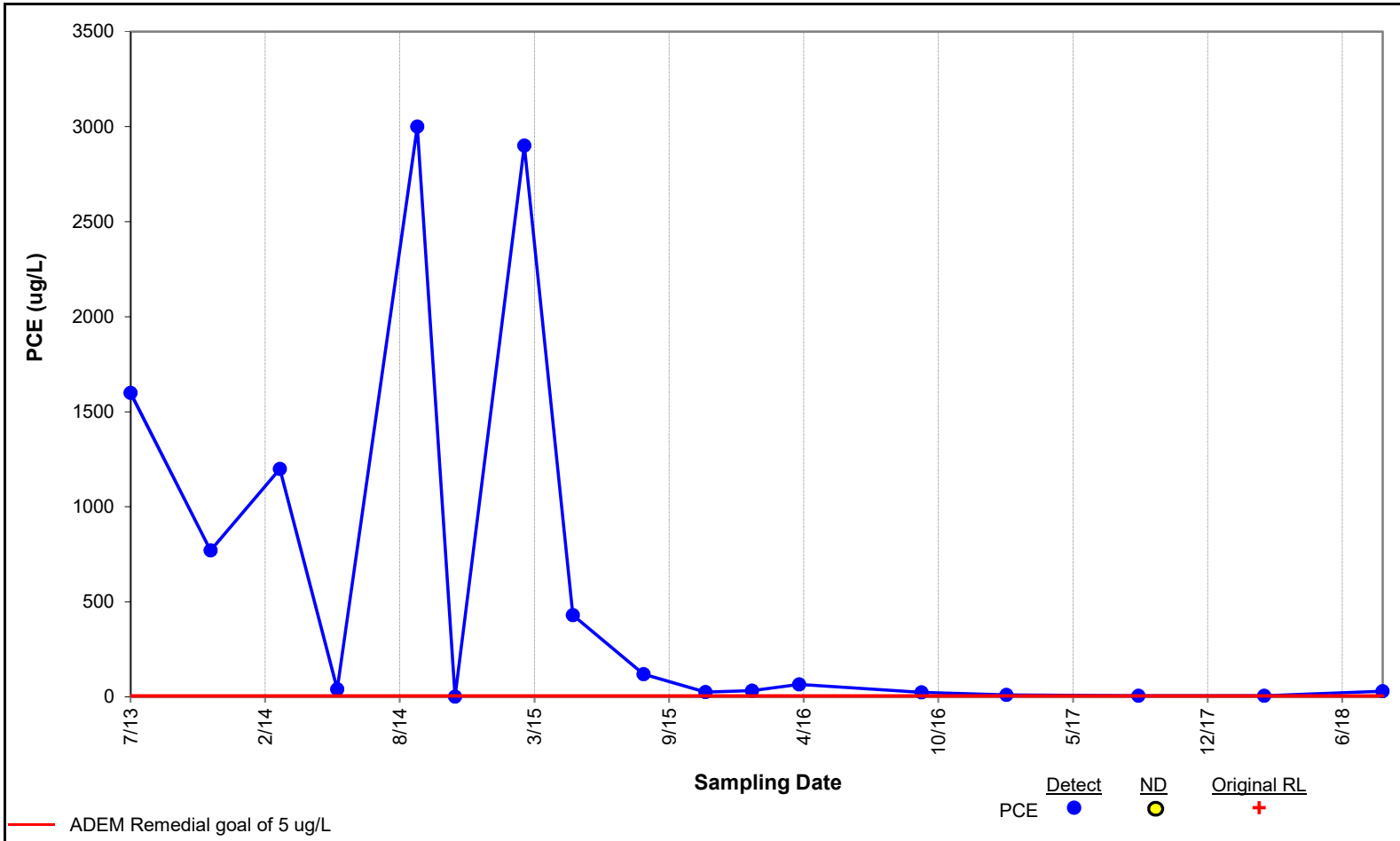
Concentration vs. Time Plot – PCE in Well MW-27

Figure A-21



Mann-Kendall Test Result: **DECREASING TREND**
p-value = 0.001
H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = -4.6E-01 ug/L per day
95% Confidence Interval = -1.2E+00 to -3.1E-02 ug/L per day

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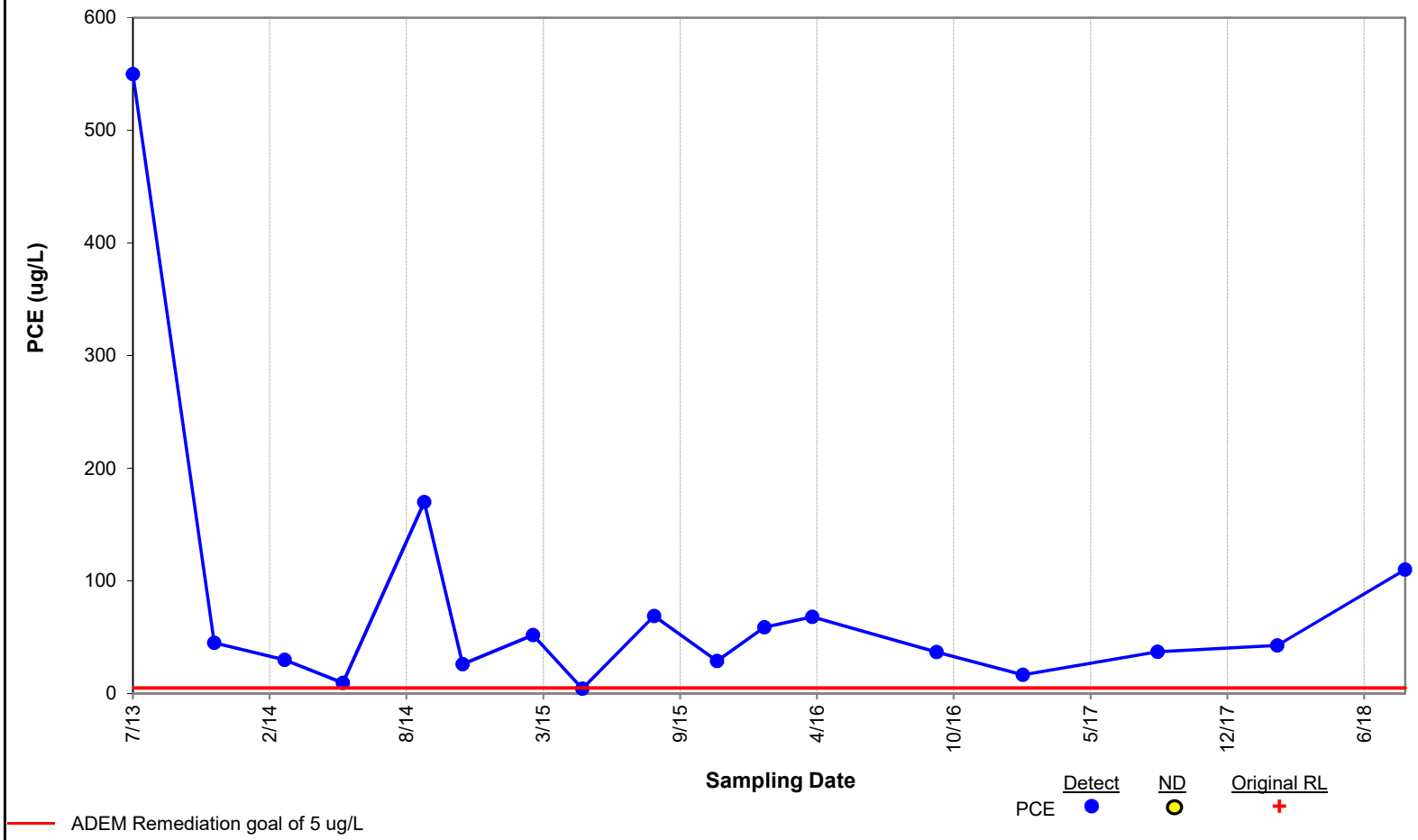
Concentration vs. Time Plot – PCE in Well OW-1

Figure A-22



Mann-Kendall Test Result: **No Significant Trend**
p-value = 0.484
H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = -2.4E-04 ug/L per day
95% Confidence Interval = -6.1E-02 to 3.7E-02 ug/L per day

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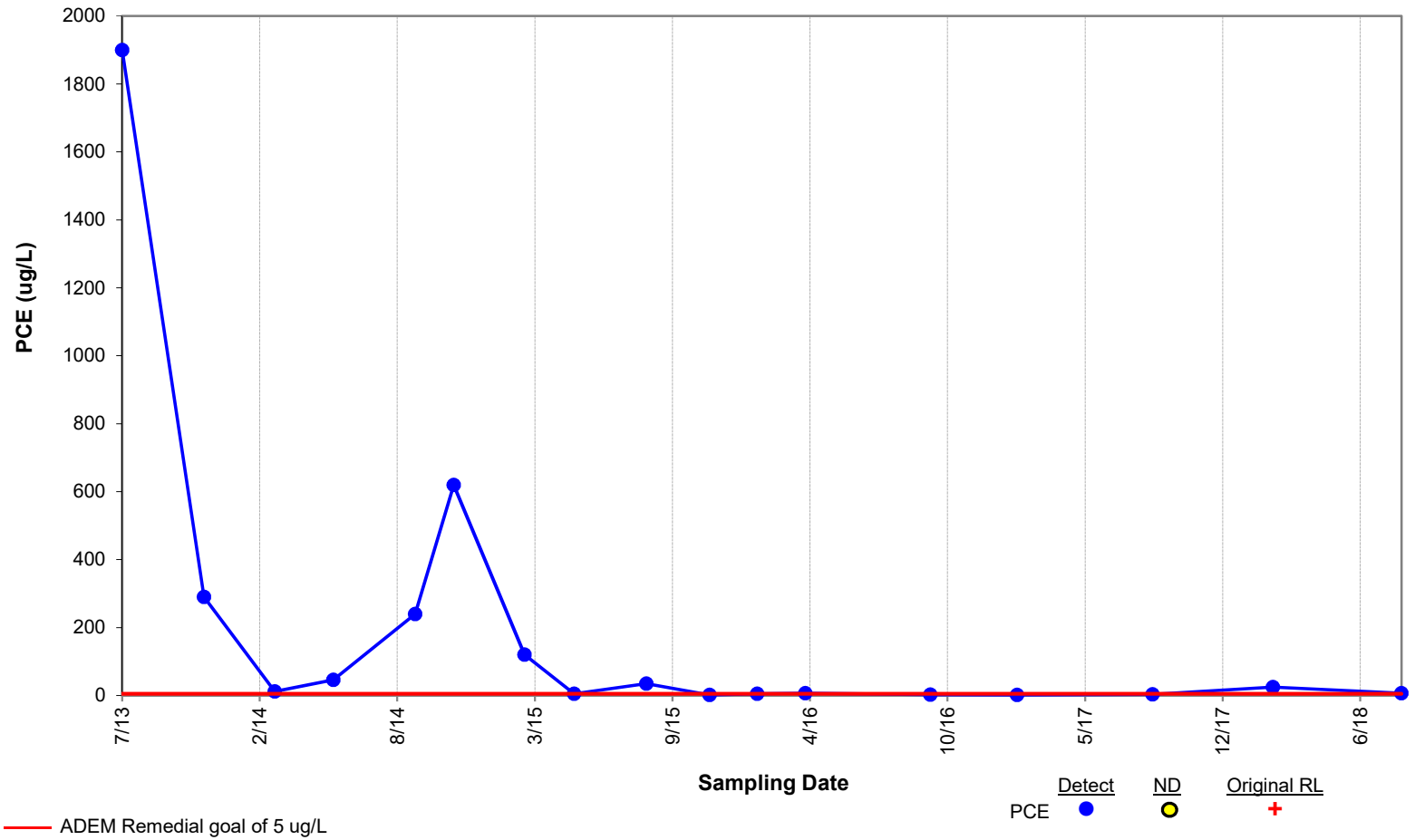
Concentration vs. Time Plot – PCE in Well OW-2

Figure A-23



Mann-Kendall Test Result: **DECREASING TREND**
p-value = 0.002

H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = -8.0E-02 ug/L per day
95% Confidence Interval = -3.5E-01 to -8.3E-03 ug/L per day

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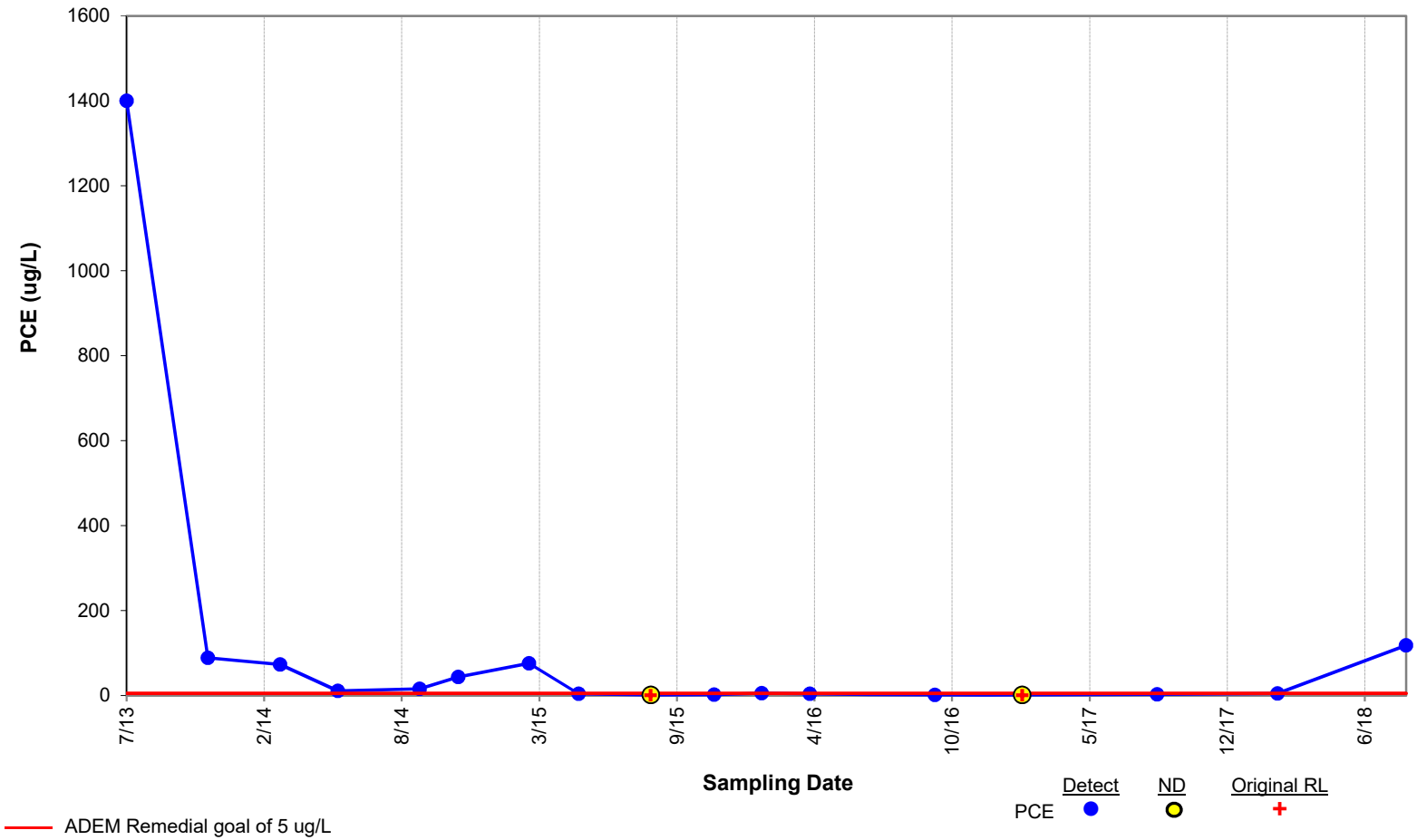
Concentration vs. Time Plot – PCE in Well OW-3

Figure A-24



Mann-Kendall Test Result: **DECREASING TREND**
p-value = 0.016
H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = -2.1E-02 ug/L per day
95% Confidence Interval = -8.6E-02 to -1.1E-03 ug/L per day

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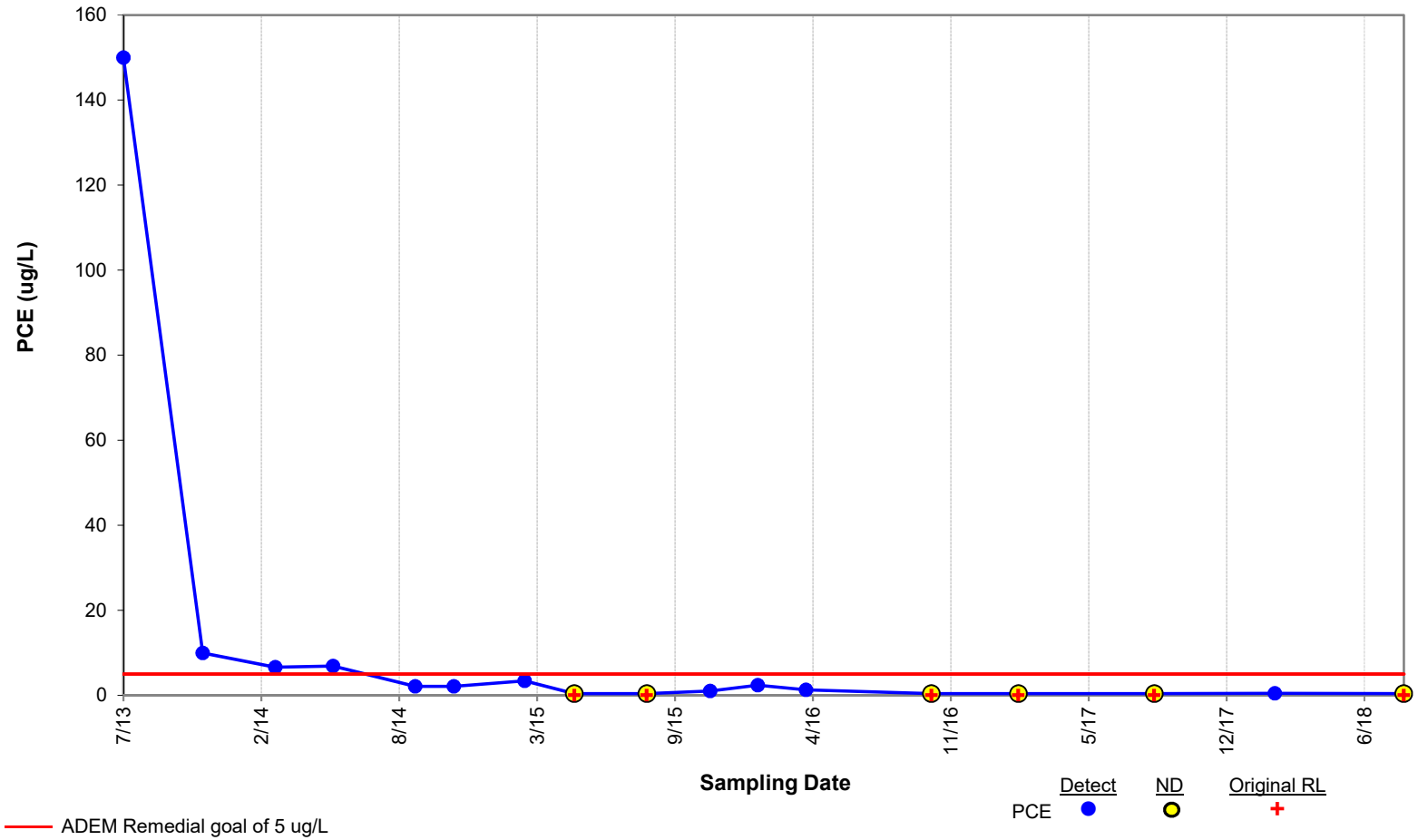
Concentration vs. Time Plot – PCE in Well OW-4

Figure A-25



Mann-Kendall Test Result: **DECREASING TREND**
p-value = <0.001
H_0: No Trend vs. H_A: Increasing Or Decreasing Trend. (Note: A p-value < 0.05 indicates a statistically significant trend for a one-tailed test).

Theil-Sen Trend Line Result: Median Slope Estimate = -4.2E-03 ug/L per day
95% Confidence Interval = -8.3E-03 to -1.4E-03 ug/L per day

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Concentration vs. Time Plot – PCE in Well OW-5

Figure A-26

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