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ABBOTT LABORATORIES

Jane K. Amelotte
Environmental Specialist
Global Environment, Health & Safety

Dept. 0539, Bldg. AP52-S
200 Abbott Park Road
Abbott Park, Illinois 60064-6212
Office: (847) 938-4219
Facsimile: (847) 937-9679
Jane.Amelotte@Abbott.com

April 20, 2010

Mr. Thomas Slusser
Underground Injection Control Program Manger
North Carolina Department of Environment and Natural Resources
Division of Water Quality / Groundwater Section
1636 Mail Service Center
Raleigh, North Carolina 27699-1636

RECEIVED / DENR / DWQ
Aquifer Protection Section
APR 27 2010

Re: Application for Underground Injection Control Permit
Former Abbott Facility- Solvent Release Remediation
Laurinburg, Scotland County, North Carolina
NCDENR-DWM #NONCD-000-0040

Dear Mr. Slusser:

Attached are two copies of an Underground Injection Control (UIC) Permit application with attachments for the above-referenced project site. This site previously had a UIC Permit (#WI0600011) issued for organic substrate injections to promote in-situ anaerobic bioremediation of volatile organic compounds in Site groundwater. Permit #WI0600011 expired in September 2008, and a new UIC permit is being requested to continue with the ongoing bioremediation program.

Abbott is requesting the new UIC permit to inject additional organic substrates to promote reductive dechlorination and other bioremediation processes. Specifically, Abbott proposes to inject Anaerobic BioChem, a patented, NCDENR-approved substrate material. Additionally, studies conducted by our consultant demonstrate low populations of indigenous dechlorinating bacteria are present in Site groundwater. To improve this situation, injections of RTB-1 *Dehalococcoides spp.* bacteria culture (also approved by NCDENR) will be performed on a limited pilot test basis during the initial Anaerobic BioChem injections, followed by full-scale injections of RTB-1 bacteria culture within six months if the indigenous populations of DHC bacteria do not flourish without bioaugmentation.

Please note that much of the Site information provided in the Attachments to the enclosed permit application is unchanged from the application submitted for prior permit #WI0600011. Abbott's objective is to maintain and enhance the bioremediation program that has been ongoing since 2002. Updated Site information and groundwater data, including a recent subsurface

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investigation report and groundwater monitoring report, are included as attachments to this permit application to demonstrate the effectiveness of the remediation programs.

Finally, the property ownership has changed since the prior UIC permit application was made by Abbott in 2002. The current property owner is Marketta, LLC, who purchased the property from Scotland Development Corporation. We have attached a copy of the *Release and Right of Entry Agreement* between Abbott and Scotland Development Corporation for your review. This agreement allows Abbott perpetual, full access to the Site property, regardless of future ownership, for the purposes of conducting environmental investigations and remediation. This *Release and Right of Entry Agreement* document meets the intent of (and replaces) the 'Consent of Property Owner' signature requirement in Section VII, Page 7 of the UIC permit application.

If you have any questions and/or need additional information, please contact me at (847) 938-4219 or Curt Michols at (847) 937-0863.

Best regards,

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Aquifer Protection Section
APR 27 2010

Abbott Laboratories

Jane K. Amelotte
Environmental Specialist
Global Environment, Health & Safety

c.c.: S. Boyles, Aquifer Protection Section, NCDENR Fayetteville Regional Office

AECOM Environment

Prepared for:
Abbott Laboratories
Abbott Park, IL

Prepared by:
AECOM
Raleigh, NC
60135880
April 2010

# Underground Injection Control Permit Application and Attachments

**Continuation of Anaerobic Bioremediation in Groundwater**
**Solvent Plume Incident**
**Former Abbott Facility**
**Laurinburg, Scotland County, North Carolina**


Prepared By
Matt Allen, PG
Senior Project Geologist

Reviewed By
S. Grant Watkins, PG, RSM
Senior Program Manager


NORTH CAROLINA LICENSED SEAL 1035 GEOLOGIST S. GRANT WATKINS

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APR 27 2010

**State of North Carolina**
**Department of Environment and Natural Resources**
**Division of Water Quality**

# APPLICATION FOR PERMIT TO CONSTRUCT AND/OR USE A WELL(S) FOR INJECTION
## Type 5I Wells – *In Situ* Groundwater Remediation / Type 5T Wells – Tracer Injection

- Do **not** use this form for remediation systems that extract contaminated groundwater, treat it, and reinject the treated groundwater.
- Submit **TWO** copies of the completed application and all attachments to the address on the last page of this form.
- Any changes made to this form will result in the application package being returned.

**Application Number** (*to be completed by DWQ*): _____

## I. GENERAL INFORMATION:

1. Applicant's Name (generally the responsible party): Abbott Laboratories
2. Signing Official's Name*: Corlis D. Murray Title: Vice President, Global Engineering Services
   * Signing Official must be in accordance with instructions in part VI on page 7.
3. Mailing address of applicant: Bldg. AP52-S, D0539 c/o Curt Michols
   200 Abbott Park Road
   City: Abbott Park State: IL Zip: 60064
   Telephone number: 847-937-0863 Fax number: 847-937-9679
4. Property Owner's Name (if different from Applicant): Marketta, LLC
5. Property Owner's mailing address: One GOJO Plaza, Suite 500
   City: Akron State: OH Zip: 44311
6. Name and address of contact person who can answer questions about the proposed injection project:
   Name: Grant Watkins, P.G., RSM Title: Sr. Program Manager
   Company: AECOM North Carolina, Inc
   Address: 8540 Colonnade Drive, Suite 306
   City: Raleigh State: NC Zip: 27616
   Telephone number: 919-872-6600 Fax number: 919-872-7996
   Email Address: grant.watkins@aecom.com

## II. PERMIT INFORMATION:

1. Project is: ( New ( Modification of existing permit ( Renewal of existing permit **without** modification
   ( Renewal of existing permit **with** modification
2. If this application is being submitted for renewal or modification to an existing permit, provide:
   existing permit number NA and the issuance date NA
   **For renewal <u>without</u> modifications, fill out sections I & II only, sign the certification on the last page of this form, and obtain the property owner's signature to indicate consent (if the applicant is not the owner).**
   **For <u>all</u> renewals, submit a status report including monitoring results of all injection activities to date.**

**APPLICATION FOR PERMIT TO CONSTRUCT AND/OR USE A WELL(S) FOR INJECTION**
**Type 5I Wells – *In Situ* Groundwater Remediation / Type 5T Wells – Tracer Injection**

## III. INCIDENT & FACILITY DATA

A. FACILITY INFORMATION

1. Facility name: Former Abbott Facility (QualPak, Inc.)
2. Complete physical address of the facility: 16000 Joy Street

City: Laurinburg County: Scotland State: NC Zip: 28352

B. INCIDENT DESCRIPTION

1. Describe the source of the contamination: The contaminant source is a former solvent evaporation waste pit previously operated by Abbott from 1970 to 1976. The waste pit was located on the north side of the facility building and was used for disposal of chlorinated and non-chlorinated solvents.
2. List all contaminants present in soils or groundwater at the site (contaminants may be listed in groups, e.g., gasoline, diesel, jet fuel, fuel oil, chlorinated ethenes, chlorinated ethanes, metals, pesticides/herbicides, etc): Chlorinated ethenes (TCE, cis DCE); chlorinated ethanes (1,1,1-TCA); acetone; toluene; methyl ethyl ketone (MEK); methylene chloride; trichlorotrifluoroethane (Freon 113);
3. Has LNAPL or DNAPL ever been observed at the site (even if outside the injection zone)?
   ( Yes If yes, list maximum measured separate phase thickness 0.16 **feet**
   ( No If no, list maximum concentration of total VOCs observed at site: _____ **ppb**
4. Agency managing the contamination incident:
   ( UST Section
   ( DWQ Aquifer Protection Section
   ( Hazardous Waste Section
   ( Superfund Section (including REC Program and DSCA sites)
   ( Solid Waste Section
   ( Other: IHSB
5. Incident managers name Sean Boyles and phone number 910-433-3345
6. Incident number or other site number assigned by the agency managing the contamination incident:
   NO NCD 000 0040

C. PERMITS

List all permits or construction approvals that have been issued for the **facility or incident**, including those not directly related to the proposed injection operation:

1. Hazardous Waste Management program permits under RCRA: NA
2. DWQ Non-Discharge or NPDES permits: NA
3. County or DEH subsurface wastewater disposal permits: NA
4. Other environmental permits required by state or federal law: No current active environmental permits are held by Abbott for this facility. WI0600010, WI0600011 UIC permits.

## IV. INJECTION DATA

. INJECTION FLUID DATA

1. List all proposed injectants.
*NOTE: Any substance to be injected as a tracer or to promote* in situ *remediation must be reviewed by the Occupational and Environmental Epidemiology Section (OEES) of the Division of Public Health, Department of Health and Human Services. Review the list of approved injectants or contact the UIC Program to determine if the injectants you are proposing have been reviewed by OEES.*

Injectant: Anaerobic BioChem (ABC®)

Concentration at point of injection: 10-30% by weight (varies) after dilution with water

Percent if in a mixture with other injectants: _____

Injectant: RTB-1 (Solution of *Dehalococcoides spp.* bacteria)

Concentration at point of injection: 0.75% by weight (1 X $10^{11}$ DHC cells per milliliter)

Percent if in a mixture with other injectants: 0.75% by weight

Injectant: NA

Concentration at point of injection: NA

Percent if in a mixture with other injectants: NA

Injectant: NA

Concentration at point of injection: NA

Percent if in a mixture with other injectants: NA

2. Source of fluids used to dilute or chase the injectants listed above:
( None
( Municipal water supply
( Groundwater from private well or any well within ¼ mile of injection site
( Air
( Other: De-oxygenated municipal water for RTB-1 bacteria injection solution

3. If any well within ¼ mile of injection site, a private well, or surface water is to be used as the fluid source, supply the following information: NA

   a. Location/ID number of source: _____

   b. Depth of source: _____

   c. Formation: _____

   d. Rock/Sediment type: _____

   e. In Attachment C, provide a current, complete chemical analysis of the water from the source well, including analyses for all contaminants suspected or historically recognized in soil or groundwater on the site.
   *NOTE: If contaminated groundwater is to be used as the dilution or chase fluid, this is* ***not*** *the proper permit application form. You must apply for a closed-loop groundwater remediation permit using application form GWRS.*

**APPLICATION FOR PERMIT TO CONSTRUCT AND/OR USE A WELL(S) FOR INJECTION**
**Type 5I Wells – *In Situ* Groundwater Remediation / Type 5T Wells – Tracer Injection**

B. PROPOSED OPERATING PARAMETERS

1. Duration of Injection: 36 days (all events)
   a. Maximum number of separate injection events: 3
   b. Expected duration of each injection event: 12 days (inclusive of all injection borings)
   c. Expected duration between events (if more than one event): 3 to 9 months
2. Injection rate per well: 5-15 gallons per minute (gpm)
3. Total Injection volume: NA gallons per day (gpd); 59,900 gallons per event (if separate events)
4. Injection pressure: 30-100 pounds/square inch (psi)
5. Temperature at point of injection: 65 °F
6. Briefly describe how the above parameters will be measured and controlled: The ABC® aqueous solution will be injected via Geoprobe rods from bottom up using a high pressure pump. The pump and tank system will have pressure gauges and flow meters to measure and control pressure and flow. Also, the graduated mixing tanks will hold a known volume of ABC® solution that will be prepared for each injection boring or group of borings.
7. Estimated hydraulic capacity of the well: NA gpm

C. INJECTION WELL CONSTRUCTION DATA

1. Injection will be via: Direct Push Technology (Geoprobe) borings

   ( Existing well(s) proposed for use as an injection well. Provide the data in (2) through (6) below to the best of your knowledge.

   ( Proposed well(s) to be constructed for use as an injection well. Provide the data in (2) through (6) below as proposed construction specifications.

2. Well Drilling Contractor's Name: Gary Meyers (employee of Redox Tech, Inc.)

   NC Well Contractor Certification number: 3380

3. Date to be constructed: June & September 2010 Number of borings: 72 max

   Approximate depth of each boring (feet): 25-62 feet (varies by location)

4. Screened interval/Injection interval of injection wells:

   Depth: 15 to 62 feet below ground surface (if multiple intervals, indicate shallowest and deepest depth).

5. Well casing (N/A if injection is through direct push rods): N/A

   Type: ( PVC ( Stainless steel ( Other: _____

   Casing depth: _____ to _____ ft.

6. Grout (N/A if injection is through direct push rods): N/A

   Type: ( Cement ( Bentonite ( Other: _____

   Grout depth: _____ to _____ ft.

## V. ATTACHMENTS

Provide the following items as separate attachments with the given headings:

### A. SITE HISTORY

Provide a brief description of the site history including:

(1) site usage historically and present,
(2) origin of the contamination,
(3) previous remedial action(s).

*NOTE: G.S. 89E-18 requires that any geologic plans, reports, or documents in which the performance is related to the public welfare or safeguarding of the environment be prepared by a licensed geologist or subordinate under their direction. G.S. 89E-13 requires that all drawings, reports, or documents involving geologic work prepared or approved by a licensed geologist, or a subordinate under their direction, be signed and sealed by the licensed geologist.*

### B. HYDROGEOLOGIC DESCRIPTION

Provide a hydrogeologic description, soils description, and cross section of the subsurface to a depth that includes the known or projected depth of contamination. The hydrogeologic description shall include:

(1) the regional geologic setting;
(2) significant changes in lithology;
(3) the hydraulic conductivity, transmissivity, and specific yield of the aquifer to be used for injection, including a description of the test(s) used to determine these parameters; and
(4) the depth to the mean seasonal high water table.

### C. INJECTION FLUID COMPOSITION

Describe the chemical, physical, biological and radiological characteristics of each injectant. Attach the Material Safety Data Sheet (MSDS) for each injectant. If a private well or a well within ¼ mile of the injection site is used as the source well, include chemical analysis of source fluid here.

### D. INJECTION RATIONALE

Attach a brief description of the rationale for selecting the injectants and concentrations proposed for injection, including:

(1) goals of the injection project;
(2) explanation and/or calculations of how the proposed injectant volume and concentration were determined;
(3) a description of the reactions between the injectants and the contaminants present including specific breakdown products or intermediate compounds that may be formed by the injection; and
(4) summary results of modeling or testing performed to investigate the injectant's potential or susceptibility to change (biological, chemical or physical) in the subsurface.

### E. INJECTION PROCEDURE AND EQUIPMENT

Provide a detailed description of all planned activities related to the proposed injection including but not limited to:

(1) construction plans and materials;
(2) operation procedures;
(3) a detailed diagram of the surface and subsurface portions of the system; and
(4) a planned injection schedule.

F. MONITORING PLAN

Provide a plan for monitoring the results of the injection, including:

(1) a list of existing and proposed monitoring wells to be used;
(2) a list of monitoring parameters and analytical methods to be used; and
(3) a schedule for sampling to monitor the proposed injection.

*NOTE: The selected monitoring wells must be located so as to detect any movement of injection fluids, process by-products, or formation fluids outside the injection area or zone. The monitoring parameters should include the target contaminants as well as secondary or intermediate contaminants which may result from the injection and other parameters which may serve to indicate the progress of the intended reactions, such as pH, ORP, dissolved oxygen, and other electron acceptors and donors. The monitoring schedule should be consistent with the pace of the anticipated reactions and rate of transport of the injectants and contaminants.*

G. WELL DATA

Provide a tabulation of data on **all** existing or abandoned wells within ¼ mile of the injection well(s) which penetrate the proposed injection zone, including, but not limited to, monitoring wells and wells proposed for use as injection wells. Such data shall include a description of each well's use (water supply, monitoring, etc), total depth, screened or open borehole depth interval, and well construction or abandonment record, if available.

H. MAPS

Attach the following scaled, site-specific maps:

(1) Area map based on the most recent USGS 7.5' topographic map of the area, at a scale of 1:24,000 and showing the location of the proposed injection site.
(2) Site map including:
   a. all property boundaries;
   b. all buildings within the property boundary;
   c. existing and proposed injection wells or well field(s)
   d. any existing sources of potential or known groundwater contamination, including waste storage, treatment or disposal systems within ¼ mile of the injection well or well system;
   e. all surface water bodies within ¼ mile of the injection well or well system; and
   f. **all** existing or abandoned wells within ¼ mile of the injection well(s) which penetrate the proposed injection zone, including, but not limited to, monitoring wells and wells proposed for use as injection wells.
(3) Potentiometric surface map(s) including:
   a. direction of groundwater movement
   b. existing and proposed monitoring wells
   c. existing and proposed injection wells
(4) Contaminant plume map(s) including:
   a. the horizontal extent of the contaminant plume, including isoconcentration lines
   b. existing and proposed monitoring wells
   c. existing and proposed injection wells
(5) Cross-section(s) to the known or projected depth of contamination, including:
   a. horizontal and vertical extent of the contaminant plume, including isoconcentration lines
   b. major changes in lithology
   c. existing and proposed monitoring wells
   d. existing and proposed injection wells

**APPLICATION FOR PERMIT TO CONSTRUCT AND/OR USE A WELL(S) FOR INJECTION**
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**VI. CERTIFICATION** (to be signed as required below or by that person's authorized agent)

NCAC 15A 2C .0211(b) requires that all permit applications shall be signed as follows:

1. for a corporation: by a responsible corporate officer
2. for a partnership or sole proprietorship: by a general partner or the proprietor, respectively
3. for a municipality or a state, federal, or other public agency: by either a principal executive officer or ranking publicly elected official
4. for all others: by the well owner.

**If an authorized agent is signing on behalf of the applicant, then supply a letter signed by the applicant that names and authorizes their agent.**

I hereby certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments therein, and that, based on my inquiry of those individuals immediately responsible for obtaining said information, I believe that the information is true, accurate, and complete. I am aware that there are penalties, including the possibility of fines and imprisonment, for submitting false information. I agree to construct, operate, maintain, repair, and if applicable, abandon the injection well(s) and all related appurtenances in accordance with the approved specifications and conditions of the Permit.

Printed Name and Title: Corlis D. Murray, Vice President – Global Engineering Services

Signature: Corlis D. Murray Date: 30 MAR 2010

**VII. CONSENT OF PROPERTY OWNER** (if the property is not owned by the applicant) - SEE RELEASE AND RIGHT OF ENTRY AGREEMENT

*("Owner" means any person who holds the fee or other property rights in the well being constructed. A well is real property and its construction on land shall be deemed to vest ownership in the land owner, in the absence of contrary agreement in writing.)*

As owner of the property on which the injection well(s) are to be constructed and operated, I hereby consent to allow the applicant to construct each injection well as outlined in this application and agree that it shall be the responsibility of the applicant to ensure that the injection well(s) conform to the Well Construction Standards (Title 15A NCAC 2C .0200).

Printed Name and Title: _____

Signature: _____ Date: _____

Submit **TWO** copies of the completed application package, including all attachments, to:

**UIC Program**
**Aquifer Protection Section**
**North Carolina DENR-DWQ**
**1636 Mail Service Center**
**Raleigh, NC 27699-1636**
**Telephone (919) 733-3221**

*Prepared by and Return to After Recording:*
Abbott Laboratories
100 Abbott Park Road
Bldg. AP6D, Loc. 32-L
Abbott Park, Illinois 60064-6049
Attn: Michael J. Klein

## RELEASE AND RIGHT OF ENTRY AGREEMENT

THIS RELEASE AND RIGHT OF ENTRY AGREEMENT is made as of the 30th day of September, 2003 (the "*Effective Date*"), by and between ABBOTT LABORATORIES, an Illinois corporation ("*Donor*"), with offices at 100 Abbott Park Road, Dept. 364, Bldg. AP6D, Abbott Park, Illinois 60064-6032, and SCOTLAND DEVELOPMENT CORPORATION, a North Carolina not for profit corporation ("*Donee*"), whose address is 606 South Atkinson Street, P.O. Box 1025, Laurinburg, NC 28353-1025, (collectively, the "*Entry Agreement*").

## WITNESSETH:

**WHEREAS,** Donor and Donee entered into an Agreement to Donate Real Property dated September 30th, , 2003 (as the same may have been amended, the "*Agreement*"), pursuant to which Donor agreed to donate to Donee, and Donee agreed to accept the donation from Donor of all of Donor's right, title and interest in and to the real estate legally described on Attachment A attached hereto and made a part hereof, together with Donor's right, title and interest in and to certain improvements and personal property located thereon, as more specifically set forth in the Agreement (collectively, the "*Property*"); and

**WHEREAS,** Donor has further provided to Donee access to and the opportunity to inspect the Property and to perform such soil, groundwater or other tests upon the Property as Donee deemed necessary or appropriate; and

**WHEREAS,** Donor intends to perform and be responsible for certain Remediation and Compliance Obligations, as those terms are defined herein below, and

**WHEREAS,** Donor intends to indemnify and hold Donee (and its successors and assigns) harmless for certain Known Environmental Conditions and Unknown Environmental Conditions, as those terms are defined herein below, and

**WHEREAS,** Donee and Donor desire to provide a continuing right of access to the Property to allow Donor to perform Remediation and Compliance Obligations after conveyance of the Property; and

**WHEREAS,** Donee acknowledges and agrees that Donor donated the Property to Donee and desires the IRS to recognize the donation for certain tax purposes; and

**WHEREAS,** Donee and Donor desire to provide a continuing right of access to the Property to allow Donor and the IRS and their employees and agents to perform a review and appraisal of the Property related to Donor's donation of the Property to Donee after conveyance of the Property.

**NOW, THEREFORE,** in consideration of the mutual covenants of the parties herein and the parties' respective duties and obligations set forth in the Agreement, Donor and Donee do hereby agree as follows:

## I. DEFINITIONS

1. Terms not defined herein shall have the meaning ascribed to them in the Agreement, except that the definition of "Donor's Knowledge" as defined in the Agreement shall not apply to this Entry Agreement.

2. "Compliance Obligations" – any and all actions, responses, filings, improvements, changes, reports or other similar activities as required of the owner of the Property by applicable laws to bring the Property or operations at the Property into full compliance with all applicable Environmental Laws, excluding only those obligations that are classified as Remediation.

3. "Donee Parties" -- shall have the same meaning ascribed to it in the Agreement except that for the purposes of this Entry Agreement "Donee Parties" shall include any entity deemed to be an owner or operator of the Property under Environmental Laws.

4. "Ending Date" – shall mean, as to Remediation being performed by Donor, either (a) the date when Donor receives a No Further Action Letter from the Department or (b) a date three (3) years after the date when Donor receives a written determination by the Department that only groundwater testing or monitoring is required under the Groundwater Rules, provided that, if after the Ending Date the Department requires Donor to undertake subsequent Remediation, a new Ending Date shall be set pursuant to (a) or (b) of this paragraph.

5. "Environmental Contamination" – the presence, emission, discharge, release or Imminent Threat (as that term is defined herein) of any Hazardous

Materials at or into the environment (including, without limitation, land, subsoil, surface waters, groundwaters, and ambient air) and the effects of such emission, discharge, release, or Imminent Threat.

6. "Environmental Claims" – any claim, action, suit, proceeding, or investigation by any person alleging Loss (including, without limitation, potential Loss for investigation costs, cleanup costs, governmental response costs, natural resource damages, property damages, personal injuries, or penalties) arising out of, based on, or resulting from the alleged violation of or incurrence of Loss under any applicable Environmental Laws; and shall also include any claim or action at common law (including, without limitation, nuisance, trespass, negligence, or strict liability), equity, or any other action of whatever form or denomination that alleges harm to natural resources, property damages, personal injuries, costs incurred in satisfying Remediation or Compliance Obligations, or other similar harms from the presence of Hazardous Materials, an Environmental Contamination; "Environmental Claims" shall also include, without limitation, a claim based on or arising out of the presence, release, spillage, transportation, treatment, storage, disposal or other handling or management of any Hazardous Materials generated at or by the operation of the Property; "Environmental Claims" shall not include any claims with respect to the buildings, structures, or other improvements, but shall include any claims with respect to air quality within the buildings, structures or improvements if such air quality claim is based on or arises from any Environmental Contamination.

7. "Environmental Laws" – all federal, state, regional, local or other applicable laws, rules, regulations, or other legally enforceable requirements, or relevant portions thereof, relating to public health, or to pollution or protection of the environment (including, without limitation, ambient air, surface water, groundwater, land surface or subsurface strata) including, without limitation, the Federal Water Pollution Control Act, the Federal Clean Air Act, the Comprehensive Environmental Response, Cleanup and Liability Act, the Resource Conservation and Recovery Act of 1976, the Toxic Substances Control Act, the Occupational Safety and Health Act of 1970, the Safe Drinking Water Act, the Hazardous Materials Transportation Act, and the Oil Pollution Act of 1990, and also including any relevant portions of the North Carolina laws in Chapters 113, 113A, 130A, and 143 of the General Statutes and other North Carolina laws implementing or similar to the foregoing federal laws; and any rules, regulations, or other standards enforceable pursuant to those federal and state laws, including, without limitation, the Groundwater Rules; and any amendments to any of the foregoing.

8. "Governmental Entity" – any Federal, state, local or foreign government, legislature, governmental or administrative agency or commission, or any court or other tribunal of competent jurisdiction.

9. "Groundwater Rules" – The rules for the regulation and protection of groundwater as promulgated by the Department and codified as Subchapter 2L of Title 15A in the North Carolina Administrative Code.

10. "Hazardous Materials" – whether a substance which is found in nature and whether alone or in combination and whether solid, liquid or gaseous (1) any and all chemicals, pollutants, contaminants, wastes, polychlorinated biphenyls, asbestos, lead-based paint, crude oil and its derivatives, natural or synthetic gas, oil and gas exploration and production wastes, and pesticides, identified as a hazardous substance or hazardous waste under any Environmental Law, and (2) any and all of the foregoing and any other materials or sources of pollution or contamination or terms of similar import (i) which are regulated, licensed, prohibited or controlled under any Environmental Law or (ii) the presence, existence or Imminent Threat, of which may form the basis for or give rise to Loss under any Environmental Law, including any obligation to take remedial action.

11. "Imminent Threat" shall mean a determination by a Governmental Entity that an imminent threat of an emission, discharge or release of a Hazardous Material exists, and for which a Government Entity has provided a written statement reflecting such determination.

12. "Known Environmental Condition" – any Environmental Contamination which is the subject of a current Remediation being performed by Donor as required by the State of North Carolina and listed on **Attachment B**, and any Newly Identified Environmental Condition.

13. "Loss" – any Claims, liabilities, obligations, losses, costs, expenses, fees (including but not limited to attorney's fees), litigation, proceedings, fines, taxes, levies, imposts, duties, deficiencies, assessments, charges, penalties, allegations, demands, damages, settlements and judgments of any kind or nature whatsoever. "Loss" does not include special or consequential damages or lost profits, except that "Loss" shall include special or consequential damages or lost profits of third parties.

14. "Newly Identified Environmental Condition" – any Environmental Contamination which is not listed on **Attachment B**, and which is specifically identified and brought to Donor's attention by the Closing Date, provided that prior to the Closing Donor notifies Donee or its assigns in writing that Donor agrees to perform Remediation of this contamination.

15. "No Further Action Letter" – written verification from the Department that Donor has completed Remediation with respect to all Known Environmental Conditions in accordance with Environmental Laws, including, without limitation, a written notification from the Division of Waste Management that no further Remediation will be required at the site pursuant to Section 130A-310.7(c) of the North Carolina General Statutes.

16. "Remediation" – all activities that are necessary to remove, correct, clean-up, treat, or otherwise remediate the presence or effects of Hazardous Materials at, on or under the Real Property as required under the Environmental Laws.

17. "Unknown Environmental Condition" – any Environmental Contamination which is not a Known Environmental Condition or a Newly Identified Environmental Condition, which results in a Loss to Donee or its assigns from claims made by third parties, including remediation or monitoring requirements imposed by a Governmental Entity. "Unknown Environmental Condition" includes any Environmental Contamination specifically identified and brought to Donor's attention by the Closing Date and for which Donor did not by the Closing Date agree to perform any and all Remediation.

## II. DONOR'S COVENANTS, REPRESENTATIONS AND WARRANTIES REGARDING THE ENVIRONMENTAL CONDITION OF THE PROPERTY

A. General Representations and Warranties. Donor represents and warrants that, as of the Closing Date:

1. Donor has submitted a notice of inactive hazardous substance or waste disposal sites to the State, pursuant to Section 130A-310.8 of the North Carolina General Statutes, and has provided a copy of such notice to Donee. Donor is undergoing voluntary remedial action pursuant to Section 130A-310.8 and has not been required by the Department to record a notice of inactive hazardous substance or waste disposal sites.

2. Donor has not received within the last three years any written notice or other communication from any Governmental Entity alleging that the Property is in violation of any Environmental Laws or alleging that there are unsatisfied Compliance Obligations. With respect to the time period prior to the last three years, Donor has not received any written notice or other communication from any Governmental Entity alleging that the Property is in violation of any Environmental Laws or alleging that there are unsatisfied Compliance Obligations, for which such violation or Compliance Obligation is still pending, outstanding, or otherwise unresolved to the satisfaction of the Governmental Entity from which the notice was received. Further, to the best of Donor's knowledge there are no pending or threatened demands, Environmental Claims, toxic tort suits, or similar complaints or allegations against Donor related to the Property by or involving any Governmental Entity or other third party.

3. Donor shall notify Donee (or as applicable its successors or assigns as then current owner of the Property) promptly in writing about, and provide such then current owner with a copy of, any written notice or other communication, from any Governmental Entity or third party at any time, including, without limitation, any communication received after the Closing Date, with respect to any alleged violation of any Environmental Laws; the handling, packaging, manufacture, transportation, release, use, discharge, treatment, removal, storage, or disposal of Hazardous Materials or storage tanks; or any pending or threatened toxic tort lawsuit. Except for the Known Environmental Conditions listed in **Attachment B**, to the best of Donor's knowledge, Donor operated at the Property in substantial compliance with all Environmental Laws

and the condition of the Property at the time of Closing will be in compliance with all Environmental Laws.

4. Donee shall promptly notify Donor of all leaks, spills or releases of any Hazardous Materials which occur from and after the Closing Date of which Donee becomes aware, it being the intent of the Parties that Donee shall be responsible and liable for any and all spills, leaks or releases of Hazardous Materials occurring on or at the Property subsequent to the Closing Date and/or any migration thereof, except for any Environmental Contamination existing on or before the Closing Date or resulting from or connected or related to the migration of such Environmental Contamination.

B. Environmental Documentation. To the best of Donor's knowledge Donor has disclosed or delivered to Donee, or its agents or consultants, all documentation that is material or relevant to any known risk of or the existence of any Environmental Contamination at, on, under, or migrating from the Real Property, except that Donor has not disclosed or delivered any documents which are protected as Attorney-Client privileged or under the Work Product doctrine. Except to the extent contained in the documents produced or delivered to Donee, or its agents or consultants, Donor is not aware of any documentation that is relevant or material to any known risk of or the existence of any Environmental Contamination at, on, under, or migrating from the Real Property. Information contained in any documents withheld as Attorney-Client privileged or under the Work Product doctrine have been reviewed by Donee and do not contain any information that materially changes the information disclosed or delivered by Donor to Donee pursuant to this part. After the Closing Date, Donee (or its successors and assigns) shall disclose to Donor the use by Donee or, to the extent known by Donee but unknown to Donor, the existence of any Hazardous Material on the Property or any Environmental Contamination at, on, under, or migrating from the Real Property.

C. Remediation.

1. Donor agrees to perform all Remediation required by Environmental Laws regarding all Known Environmental Conditions to the extent (and only to the extent) that Donor is required to perform such Remediation by any Governmental Entity having jurisdiction over the Property.

2. Donor agrees to perform all Remediation in a good and workmanlike manner, in compliance with all applicable Laws, and to obtain all required permits and licenses necessary for such work. In performing this Remediation, Donor agrees to comply with all Environmental Laws applicable to the Property. Donor shall retain sole authority before and after the Closing Date in all negotiations with any Governmental Entity regarding any reporting, assessment, monitoring, remediation and/or other corrective action activities required by any Governmental Entity in connection with Remediation, provided, however, that Donor shall provide Donee (or its successors and assigns) with copies of all reports, studies, analyses, documentation, recommendations, submittals and other related reports to Donor or its consultants or agents prior to their submittal to any Governmental Entity.

3. Donor shall not be responsible for any assessment, monitoring or remediation of, or any Loss in connection with, spills, leaks or releases by Donee of Hazardous Materials at, on or under the Property after the Closing Date, provided, however, the term "release" as used in this sentence shall not include the migration from, on, or under the Property of a previously occurring spill, leak or release of Hazardous Materials.

D. Cooperation.

1. Donor agrees to conduct and complete Remediation at the Property in a manner that is practicable, reasonable and minimizes to the maximum extent feasible disruption to the use of the Property by Donee (and its successors and assigns). Donor and Donee agree to cooperate in good faith to minimize any disruption of Donee's (or its successors' and assigns') business operations at the Property.

2. Donee agrees to reasonably cooperate and reasonably maintain the Property in a manner which does not unreasonably interfere with Donor's performance of its Remediation and in a manner which shall not impair Donor's eligibility and/or ability to recover funds from any environmental reimbursement program and/or the Donor's ability to comply with any applicable laws. Donee agrees to reasonably cooperate and assist Donor in obtaining any approvals, consents or permits required for Donor's performance of Remediation or Donor's reimbursement requests under any applicable governmental programs, including but not limited to Donor's receipt of an NFA letter or other approval which would satisfy the criteria of Ending Date, provided that nothing in this Entry Agreement will preclude Donee from opposing such approval if Donee has a good faith reason to believe that the issuance of such approval would be unreasonable. Donee agrees to cooperate fully with Donor in the performance of the activities authorized herein so as to minimize the time and expense to Donor including, without limitation, the granting of access to on-site utilities (e.g., electricity, sewer, and water) if required for such activities (provided, however, that the cost of any such access will be borne exclusively by Donor as provided in this Entry Agreement), and further agrees, during the period of any Remediation, to the extent reasonably feasible, that no construction or improvements shall be made upon the Property which would unreasonably impede or restrict access to Donor's monitoring wells, remediation or monitoring equipment, without the prior written consent of Donor, which consent shall not be unreasonably withheld.

3. Donee shall be solely responsible for any damage to, or destruction of, any monitoring wells (or related facilities) and/or any remediation or monitoring equipment caused by Donee Parties. In the event that Donee (or any of its successors or assigns) desires to perform any work or activity at the Property which may in any way adversely affect Donor's monitoring wells (or related facilities, if applicable), remediation or monitoring equipment, Donee (or its successors or assigns, as applicable) shall provide Donor with such notice thereof as is reasonable under the circumstances.

4. Except as set forth in Section II.C.3., no acts or omissions of Donee Parties shall relieve Donor of any liability or responsibility for or resulting from the Remediation or Compliance Obligations, or any other obligation of Donor set forth in this Entry Agreement.

5. Except as set forth in Section II.C.3., no acts or omissions of Donor shall relieve Donee of any responsibility for Donee's compliance with applicable law, or any other obligation of Donee set forth in this Entry Agreement.

6. Notwithstanding anything to the contrary in this Entry Agreement, the Agreement or its exhibits, nothing in the Entry Agreement or the Agreement or its exhibits is intended to limit or in any way restrict or control Donee's (or its successors' or assigns') rights to enforce any Environmental Law or to file any action under any Environmental Law against Donor (or its successors and assigns).

E. Environmental Permits. Donor agrees to reasonably cooperate in the transfer and/or reissuance to Donee or Donee's successors and assigns or their agents, employees, consultants, contractors and subcontractors of any environmental permits issued to Donor or Donor's agents, employees, consultants, contractors, or subcontractors by any Governmental Entity for the Property.

F. Continuation of Environmental Representations and Warranties. Notwithstanding anything to the contrary contained in this Agreement, the representations and warranties contained in this Part II. shall survive the execution and delivery of this Entry Agreement for a period of three (3) years after the Closing Date.

## III. INDEMNIFICATION

A. Donor agrees to defend and indemnify and hold the Donee Parties harmless from any Loss arising out of or related or connected to any (i) Known Environmental Condition, or (ii) Unknown Environmental Condition, as follows:

1. For any Loss arising out of or related or connected to any Known Environmental Condition which arises during the period of time ending three (3) years after the Ending Date.

2. For any Loss arising out of or related or connected to any Unknown Environmental Condition which arises during the period of time ending five (5) years after the Closing Date.

B. Without limitation of the foregoing, Donor shall defend and indemnify and hold the Donee Parties harmless from any Loss arising out of or related or connected to Donor Parties' failure to perform, or negligence in performing, Remediation or Compliance Obligations. Except to the extent that such Loss is caused by the Donor Parties, the foregoing indemnity does not protect Donee from any Loss caused by the acts, omissions, negligence or willful misconduct of the Donee Parties. Donor shall also be responsible for and shall defend and indemnify and hold the Donee Parties harmless

from Loss arising out of or related or connected to any spills, leaks or releases of Hazardous Materials and in connection with any Environmental Contamination at the Property caused by the Donor Parties after the Closing Date, and/or any spills, leaks, or releases of Hazardous Materials and any Environmental Contamination resulting from the Donor Parties' performance of Remediation at the Property after the Closing Date.

C. Donor shall retain, and shall remain exclusively responsible for paying, performing and discharging when due, any Remediation with respect to the Known Environmental Conditions, and any obligation, commitment or liability of Donor or otherwise relating to the Property with respect to all Known Environmental Conditions, and Donee (and its successors and assigns) shall not assume or have any liability, obligation, or other responsibility with respect to Known Environmental Conditions.

## IV. ACCESS AND RIGHT OF ENTRY

A. Subject to the terms and conditions of this Entry Agreement, Donee hereby grants to the Donor Parties the irrevocable right, at Donor's sole cost, risk and expense, to have reasonable access to the Property, from time to time and at any reasonable time during normal business hours from and after the Effective Date, for the purpose of: (i) engaging in and completing Remediation and Compliance Activities, and (ii) removing from the Property any property and equipment not sold pursuant to the Agreement (including, without limitation, any remediation equipment, monitoring equipment and observation equipment), and (iii) engaging in and completing any investigation, mitigation, or remediation activities Donor deems necessary and appropriate, after consultation with Donee Parties, to resolve Known Environmental Conditions or third party claims, or potential claims related to Unknown Environmental Conditions. This provision is intended to allow Donor access to the Property and control over Donor's investigations of environmental conditions brought to Donor's attention, after consultation with Donee Parties, including those which have not yet resulted in third party claims. It is further intended to give Donor the opportunity, but not impose on Donor any obligation, to mitigate conditions and potential claims through precautionary remediation, even if not required by law, and to resolve its indemnification obligations through proactive measures. Donee hereby grants Donor the right to mitigate or otherwise remediate any environmental condition for which Donor has accepted in writing responsibility for investigating, prior to Donee's taking any such actions, provided that Donee (or its successors and assigns) is in no way prevented or restricted from independently investigating any environmental condition, including conducting testing or sampling, or from providing notification to the Department of any environmental condition. Donor may waive this right by written notice to Donee Parties or failure to respond within ten (10) days of Donor's receipt of a reasonable written warning from Donee (or its successors and assigns). Disputes over control of environmental mitigation or remediation activities shall be resolved through binding alternative dispute resolution.

B. Subject to the terms and conditions of this Entry Agreement, Donee hereby grants permission to the Donor Parties the irrevocable right to tap electrical, gas

and water connections upon and to the Property for the purpose of Donor's work in accordance with Part II.C. above, provided, however, that such tapping may not interfere with the conduct of the Donee's (or its successors' and assigns') business on the Property. Donor shall reimburse Donee (or its successors and assigns) promptly for any costs paid by Donee (or its successors and assigns) for such utility use, provided, however, that, if, at any time in the future, a significant change in utility costs should occur or to the extent that additional utility systems must be constructed to accommodate Donor's utility requirements for Donor's work to be performed by Donor pursuant to Part II.C., Donor (or its successors and assigns) and Donee (or its successors and assigns) shall negotiate in commercially reasonable good faith to agree upon a mutually satisfactory resolution. Without limitation of the foregoing sentence, if Donor uses Donee's (or its successors' and assigns') pretreatment system, Donor shall reimburse Donee (or its successors and assigns) for (i) Donor's (or its successors' and assigns') proportionate share, allocated on a volumetric basis, of the total discharge cost incurred by Donee (or its successors and assigns); (ii) Donor's (or its successors' and assigns') proportionate share, allocated on a volumetric basis, of Donee's (or its successors' and assigns') total annual cost for operation, maintenance and repair of the pretreatment system; and (iii) all of Donee's (or its successors' and assigns') costs, losses, and liabilities arising out of or related or connected to Donor's introduction of any water containing Environmental Contamination into Donee's (or its successors' and assigns') pretreatment system.

C. In addition to all other preconditions and instructions contained in this Entry Agreement, Donor agrees to the following:

1. At least five (5) days prior to each Period of Use (hereinafter defined) of the Property, Donor shall coordinate with Donee (or its successors and assigns) regarding the time Donor Parties desire to access the Property and the intended use thereof, so as to provide Donee (or its successors and assigns) the opportunity to accompany the Donor Parties in such access. The Donor Parties shall obtain Donee's (or its successors' and assigns') prior written consent to such Period of Use, which shall not be unreasonably withheld or delayed. A "***Period of Use***" upon the Property is defined as a period of time when there is continuous daily use and/or occupancy of the Property or any part thereof by any Donor Party for any Donor Party's use of the Property as set forth in this Entry Agreement. All access shall be in a manner consistent with, and subject to, the reasonable requirements of the Donee (or its successors and assigns).

2. No use shall be made of the Property under this Entry Agreement other than as set forth in Paragraphs IV.A., IV.E., and IV.F. hereof.

3. Donor shall assume full responsibility for proper characterization, manifesting, storage and disposal of any environmental spoils (soil, water or otherwise) resulting from or arising out of the activities any Donor Party on the Property. The Donor Parties shall provide whatever signs and/or barricades may be appropriate to identify and protect the container storage site(s). In the instance of bioremedial or thermal destruction of any environmental spoils, the Donor Parties shall obtain a

certificate of treatment or of destruction, and a copy thereof shall be provided to Donee (or its successors and assigns). In the instance of disposal at a landfill, a copy of the manifest indicating receipt of such material by the landfill shall be provided to Donee (or its successors and assigns). The Donor Parties shall provide Donee (or its successors or assigns) with all documents required by this paragraph within thirty (30) days of disposal or treatment of the spoils.

4. At Donor's sole cost and expense, Donor shall remove all improvements, equipment and materials associated with any work pursuant to this Entry Agreement once the same are no longer necessary for environmental assessments, inspection and remediation performed in, at or under the Property by the Donor Parties.

5. At Donor's sole cost and expense, Donor shall restore, or cause to be restored promptly, the Property to the condition that it was in prior to the Donor Parties engaging in the environmental assessments, investigation and remediation. Such restoration shall be completed to the reasonable satisfaction of Donee (or its successors and assigns). The requirements of this section may be waived by Donee (or its successors and assigns) to the extent and only to the extent that Donee (or its successors and assigns) notifies Donor in writing that certain specified restoration not be undertaken; waiver under this section is limited to restoration specified in the writing and in no way waives Donor's obligation to otherwise restore the Property.

6. At Donor's sole cost, Donor shall repair or replace, at Donee's (or its successors' and assigns') option, all property of Donee (or its successors and assigns) on, about, or under the Property that is damaged due to the acts or omissions of the Donor Parties in accessing the Property pursuant to this Entry Agreement. Such repair or replacement shall be completed to the reasonable satisfaction of Donee (or its successors and assigns).

D. Donee hereby grants to the Donor Parties and the IRS and its employees and agents, the irrevocable right to access the Property, from time to time and at any reasonable time during normal business hours from and after the Effective Date until three (3) months thereafter, for the purpose of engaging in assessments, inspection and appraisal of the Property and its facilities and the conduct of such activities as deemed necessary or advisable by the IRS, in its sole discretion, to comply with any applicable tax law or regulation affecting the donation of or recognition of the donation of Property.

E. Subject to the terms and conditions of this Entry Agreement, Donee hereby grants to the Donor Parties the irrevocable right to access the Property, from time to time and at any reasonable time during normal business hours from and after the Effective Date until sixty (60) days thereafter, for the purpose of removing any Donor Intellectual Property existing on the Property, provided, however, that such removal may not interfere with the conduct of the Donee's (or its successors' and assigns') business on the Property.

F. Within ten (10) business days of a request therefore, Donor shall provide any prospective purchaser or the then owner of the Property with an estoppel certificate in the form attached hereto as **Attachment C.**

G. Donor shall, at its sole cost and expense, maintain commercial general liability insurance, including contractual liability (specifically covering Donor's obligations under this Entry Agreement but subject to the policy limits and such policies' other exclusions and exceptions), with a minimum combined single limit in the amount of Five Million Dollars ($5,000,000.00) per occurrence for bodily or personal injury to, illness of, or death of persons and damage to property occurring in, on or about the Property. Notwithstanding the foregoing, provided that Donor has a net worth as measured by its retained earnings ("***Net Worth***") in the amount of $500,000,000.00 (the "***Minimum Net Worth***") or more as of the date of said statement, Donor may self-insure for the insurance coverage specified in this Paragraph. Donor shall provide evidence of the foregoing.

## V. MISCELLANEOUS

A. Donee acknowledges that no promise or inducement with respect to the Property has been offered by Donor or any other Donor Party except as set forth herein and in the Agreement (and the other documents and instruments executed and delivered by Donor and Donee pursuant to the Agreement); that this Entry Agreement, the Agreement and the other documents and instruments executed and delivered by Donor and Donee pursuant to the Agreement contain the entire agreement between Donee and Donor with respect to this matter; and that the terms of this Entry Agreement are contractual and not merely recital. By taking title to the Property (or otherwise succeeding, directly or indirectly, to any of Donee's right, title or interest in or to the Property), each Donee Party shall be conclusively deemed to have agreed to and accepted each and all of the terms, provisions and conditions of this Entry Agreement, and to have agreed to be bound thereby. If any of the terms or provisions contained herein shall be unlawful, void or voidable for violation of any other statutory or common law rule(s) or regulation(s) imposing time limits, then any such terms and provisions shall continue only for the longest period permitted under such statutory or common law rule(s) or regulation(s). If any term or provision in this Entry Agreement shall, to any extent, be invalid or unenforceable, the remainder of this Entry Agreement (or the application of such term or provision to persons or circumstances other than in respect of which it is invalid or unenforceable) shall not be affected thereby, and each term and provision set forth in this Entry Agreement shall be valid and enforceable to the fullest extent permitted by law. Any notices or other communications required in accordance with this Entry Agreement shall be deemed given if hand delivered, sent by certified mail, return receipt requested, postage prepaid, or by overnight courier, addressed as follows: for Donor, to the Attention of General Counsel (attention real estate matters) at the Donor's address written above; and for Donee at the Donee's address written above. All notices hand delivered shall be deemed received on the date of delivery. All notices, unless otherwise specified to the contrary in this Entry Agreement, shall be deemed to have been

given upon receipt (or refusal of receipt) thereto. The parties to the Entry Agreement may change their notice addresses by notice to the other party.

B. The Agreement shall govern in the event of any inconsistency between the terms of, or ambiguity in, the Agreement and this Entry Agreement.

C. No failure by either Party to insist upon strict performance of any term or condition of this Entry Agreement shall constitute a waiver of such term or condition or of a breach thereof. Any such waiver must be in writing and signed by the waiving Party.

D. This Entry Agreement shall be construed in accordance with the laws of the State of North Carolina.

E. This Entry Agreement may be executed in any number of counterparts and all of such counterparts taken together shall be deemed to constitute one and the same instrument.

THIS RIGHT OF ACCESS AGREEMENT, and each of the terms, provisions and covenants herein contained, shall run with the land and be binding upon the Parties hereto and their respective successors and assigns whenever the context so requires or permits.

IN WITNESS WHEREOF, Donor and Donee have caused this Release and Right of Entry Agreement to be executed and delivered as of the date and year first above written.

[signatures on next page]

IN WITNESS WHEREOF, Donor and Donee have caused this Right of Entry Agreement to be executed and delivered as of the date and year first above written.

**DONOR:**

ABBOTT LABORATORIES,
an Illinois corporation

By: _____
Name: Lance B. Wyatt
Title: Senior Vice President

**DONEE:**

SCOTLAND DEVELOPMENT CORPORATION,
a North Carolina not for profit corporation

By: _____
Name: DAVID L. BURNS
Title: PRESIDENT

STATE OF NORTH CAROLINA
COUNTY OF SCOTLAND

I, CAROL LONG, a Notary Public of the State and County aforesaid, do hereby certify that DAVID L. BURNS personally appeared before me this day and acknowledged that he is the President of SCOTLAND DEVELOPMENT CORPORATION, and that by authority duly given and as the act of the corporation, the foregoing instrument was signed in its name by David L. Burns, its President, and sealed with its corporate seal.

WITNESS my hand and Notarial Seal this 30th day of September, 2003.

Carol Long
Notary Public

My Commission Expires: 11/14/2006

CAROL LONG
NOTARY
PUBLIC
SCOTLAND COUNTY, N.C.

State of Illinois

County of Lake

I, Michael J. Klein, Notary Public, certify that Lance B. Wyatt personally came before me this day and acknowledged that he is a Senior Vice President of Abbott Laboratories, an Illinois corporation, and that he as Senior Vice President, being authorized to do so, executed the foregoing on behalf of the corporation.

Witness my hand and official seal, this the 29th day of September, 2003.

Notary Public

My Commission Expires:

OFFICIAL SEAL
MICHAEL J KLEIN
NOTARY PUBLIC - STATE OF ILLINOIS
MY COMMISSION EXPIRES:07/24/07

STATE OF NORTH CAROLINA
COUNTY OF SCOTLAND

THE FOREGOING CERTIFICATE OF MICHAEL J. KLEIN, NOTARY PUBLIC IN AND FOR THE AFORESAID STATE AND COUNTY, IS CERTIFIED TO BE CORRECT. THIS INSTRUMENT WAS PRESENTED IN THIS OFFICE FOR REGISTRATION AND RECORDED IN BOOK _____, AT PAGE _____.

THIS THE _____ DAY OF _____, 2003, AT _____ O'CLOCK, ___.M.

JANE P. CALLAHAN, REGISTER OF DEEDS
SCOTLAND COUNTY, NORTH CAROLINA

**ATTACHMENT A**
**(Legal Description of Property)**

BEGINNING at a concrete monument found at the intersection of the eastern right of way line of U.S. Highway 15-501 with the southern right of way line of the L & S Railroad; thence along the southern right of way line of the L & S Railroad, North 50 degrees 15 minutes 00 seconds East 1682.25 feet to an iron stake, said stake being the northwest corner of Scotland Container, Inc. (Deed Book 11-Q, Pages 327 and 331, Scotland County Registry); thence along the western line of Scotland Container, Inc. South 25 degrees 53 minutes 06 seconds East 1586.19 feet to a concrete monument found in the northern right of way line of U.S. Highway 401 By-Pass; thence along the northern right of way line of U.S. Highway 401 By-Pass, South 73 degrees 16 minutes 00 seconds West 907.60 feet to an iron stake and South 73 degrees 06 minutes 00 seconds West 204.45 feet to a concrete monument; thence continuing along the northern right of way line of U.S. Highway 401 By-Pass, along a curve to the left having a radius of 3713 feet, South 69 degrees 39 minutes 00 seconds West a chord distance of 446.90 feet to a concrete monument; thence continuing along the northern right of way line of U.S. Highway 401 By-Pass, South 77 degrees 26 minutes 00 seconds West 202.40 feet to a concrete monument, and North 78 degrees 57 minutes 00 seconds West 223.90 feet to an iron stake in the eastern right of way line of U.S. Highway 15-501; thence along the eastern right of way line of U.S. Highway 15-501 North 15 degrees 53 minutes 00 seconds West 244.75 feet to an iron stake and North 1 degree 43 minutes 00 seconds West 593.50 feet to a concrete monument, the point and place of BEGINNING, containing 50.752 acres, as shown on map entitled "Survey for Marketta, LLC" dated August 13, 2003, prepared by J.F. Wampler Engineering, Inc., and being a part of the real estate conveyed to Abbott Laboratories by deed recorded in Book 5-O, Page 60, Scotland County Registry.

## ATTACHMENT B

## KNOWN ENVIRONMENTAL CONDITIONS

### 1. Solvent Release Remediation

Abbott is voluntarily remediating solvents in the groundwater that apparently originated from an onsite evaporation pit used from approximately 1970 through 1976. The primary contaminant of concern is trichloroethene. A groundwater extraction and treatment program is being carried out to control potential downgradient migration of the contaminants. In addition, some impacted groundwater is being treated using an *in situ* bioremediation technology. Although considered "voluntary", this remedial action is being performed in accordance with an Administrative Order of Consent between Abbott and the State of North Carolina.

### 2. Fuel Oil Remediation

Abbott has performed voluntarily remedial actions in response to a release of No. 2 fuel oil at the property that occurred in January 2000. Initial response actions included soil and free product removal activities. Soil analyses demonstrate that no further soil remediation is required. In the immediate vicinity of the release, benzene and ethyl benzene have been observed in groundwater samples in excess of North Carolina groundwater standards. A Comprehensive Site Assessment has been submitted to the North Carolina Department of Environment and Natural Resources Groundwater Section, and it is anticipated that a monitored natural attenuation corrective action program will be approved to address the residual groundwater impacts from the release.

## ATTACHMENT C

## ESTOPPEL CERTIFICATE

_____, 20__

_____
c/o _____
_____
_____
_____

Ladies and Gentlemen:

The undersigned (***"Donor"***) and [Scotland Development Corporation] (***"Donee"***) are parties to that certain Agreement to Donate Real Property, dated _____ _____, as amended on _____(the ***"Agreement"***), by which Donor donated approximately fifty (50) acres of real property and improvements located at 16900 North Highway 15-401 By-Pass, Laurinburg, North Carolina 28352, as more particularly described in the Agreement (***"Property"***), to Donee, and that certain Release and Right of Entry Agreement, dated _____, as amended on _____ _____(***"Entry Agreement"***), by which Donee provides Donor with a continuing right of access to the Property to allow Donor to perform assessment, monitoring and remediation measures on the Property.

We understand and have received notice that _____, a _____ (***"Purchaser"***), is purchasing the Property (the ***"Acquisition"***). As a condition to the Acquisition, you are requiring this letter from the undersigned.

The undersigned hereby certifies to Purchaser as follows:

1. Subject to the terms thereof, the Agreement is in full force and effect and has not been modified or amended, except as set forth above. A true and complete copy of the Agreement (including all amendments, modifications and assignments of the Agreement, if any) is attached hereto as Exhibit A.

2. The Entry Agreement is in full force and effect in accordance with its terms and has not been modified or amended, except as set forth above. A true and complete copy of the Entry Agreement (including all amendments, modifications and assignments of the Entry Agreement, if any) is attached hereto as Exhibit B.

3. The Agreement and the Entry Agreement are the sole and exclusive agreements between Donor and Donee (or its successors and assigns) with respect to the Property.

4. As of the date hereof, Donor has not assigned or otherwise transferred all or any portion of its legal or beneficial right and interest in or to the Agreement or the Entry Agreement.

5. Donor intends for Purchaser and its successors and assigns, who hold title to the Property (collectively, "***Permitted Successors and Assigns***"), to be, and Purchaser and the Permitted Successors and Assigns hereby are, express third party beneficiaries of all covenants, representations and warranties of Donor in and to the Agreement and the Entry Agreement and of all of Donee's rights and interest in and to the Agreement and the Entry Agreement. As third party beneficiaries, Purchaser and the Permitted Successors and Assigns shall be entitled to enforce all covenants, representations and warranties of Donor in and to the Agreement and the Entry Agreement and all of Donee's rights and interest in and to the Agreement and the Entry Agreement as if they were parties to the Agreement and the Entry Agreement. In addition, Donor shall be entitled to enforce all covenants, representations and warranties of Donee in and to the Entry Agreement and all of Donor's rights and interest in and to the Entry Agreement as if the Permitted Successors and Assigns were original parties to the Entry Agreement.

6. Donor acknowledges that the covenant made by Donee in Section X.E. of the Agreement is personal to Donee.

7. All notices to Donor under the Agreement and the Entry Agreement should be addressed as follows:

ABBOTT LABORATORIES
200 Abbott Park Road
Dept. 052T, Bldg. AP52S
Abbott Park, IL 60064-6212
Attn: Director, Corporate Real Estate

**With a copy to:**
ABBOTT LABORATORIES
100 Abbott Park Road
Dept. 364, Bldg. AP6D
Abbott Park, IL 60064
Attn: Senior Vice President, Secretary and General Counsel

8. Donor and the person(s) executing this Certificate on behalf of Donor have the full power and authority to execute and deliver this Certificate on behalf of Donor.

9. The agreements contained herein shall be binding upon and inure to the benefit of the respective heirs, administrators, executors, legal representatives, successors and assigns of Purchaser, Donee and Donor.

[signatures contained on next page]

The undersigned hereby acknowledges and agrees that Purchaser shall be entitled to rely on the truth and accuracy of the foregoing certifications made by Donor in connection with Purchaser's acquisition of the Property.

**DONOR:**

**ABBOTT LABORATORIES, an Illinois corporation**

By: _____
Name:
Title:
Date:

STATE OF ILLINOIS

COUNTY OF LAKE

I, _____, a Notary Public, certify that _____ personally came before me this day and acknowledged that he (or she) is _____, of Abbott Laboratories, an Illinois corporation, and that he/she as _____, being authorized to do so, executed the foregoing on behalf of the corporation.

Witness my hand and official seal, this the _____ day of _____, 20__.

_____
Notary Public

My Commission Expires:

_____

**EXHIBIT A**

Copy of Agreement to Donate Real Property

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# A. Site History

The operational history and a summary of previous investigations at the Former Abbott Facility in Laurinburg, North Carolina were previously presented in an Underground Injection Control (UIC) permit application submitted by Abbott Laboratories to the North Carolina Department of Environment and Natural Resources (NCDENR) Division of Water Quality on May 24, 2002. The NCDENR subsequently issued UIC permit No. WI0600011 to Abbott that allowed injection of Hydrogen Release Compound (HRC®) and HRC-X® to remediate volatile organic compounds (VOCs) in groundwater. UIC Permit No. WI0600011 expired in September 2008.

A summary of the Site history, investigations, and past remediation is provided in the following sections, including information that has been updated since 2002.

## 1. Operational History

The Former Abbott facility is located on approximately 51 acres of land at the northeast intersection of U.S. Highway 401 and U.S. Highway 15-501 in Laurinburg, Scotland County, North Carolina. Figure 1 shows the Site location on a regional topographic map. The property is currently developed with a main plant building, parking lots, adjacent warehouse and several smaller support buildings. The facility was constructed by Abbott on agricultural land in 1969 (Radian, 1993). Figure 2 shows a site plan with the locations of existing and abandoned monitoring wells, buildings, parking lots, and other features at the facility.

Beginning in 1970, Abbott used the facility to manufacture medical support devices for their Hospital Products Division. Medical devices manufactured at the facility included polyvinyl chloride (PVC) tubing and adapters that were used for intravenous drug administration and health maintenance equipment. The manufacturing process included injection molding of PVC and other plastics, parts washing, parts assembly, packaging, and ethylene oxide sterilization. Chemicals used in the manufacturing process included cyclohexanone, methyl ethyl ketone (MEK); toluene; acetone; 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113); phthalates; and various chlorinated volatile organic compounds (CVOCs) such as trichloroethene (TCE) and methylene chloride (Radian, 1993).

Abbott donated the Site property and facility to Scotland County in 2002 and ceased manufacturing operations that same year. Scotland County then transferred the facility to its current owner Marketta, LLC. QualPak (a unit of Marketta) is the current tenant and operator of the Site facility. QualPak currently uses the facility to manufacture and package Purell® brand alcohol-based hand sanitizer products. Additional infrastructure has been added to the facility to support QualPak's operations.

## 2. Contaminant Origins and Previous Investigations

During their ownership of the Laurinburg facility, Abbott operated a solvent evaporation pit at the Site from 1970 through 1976. Solvents including TCE were disposed of in the pit. Abbott informed the NCDENR-DWM Superfund Section of the existence of the solvent disposal pit in 1989 and subsequently began to investigate Site soil and groundwater quality. Contaminants detected in soil and groundwater around the pit included TCE, acetone, MEK, methylene chloride, toluene, 1, 2-dichloroethene (DCE), Freon 113, 1,1,1-trichloroethane (TCA), and bis-(2-ethylhexyl) phthalate (Radian, 1993). The location of the former solvent disposal pit is shown in Figure 2.

In 1991 Abbott entered into an Administrative Order on Consent (AOC) with the NCDENR. The AOC required Abbott to complete a remedial investigation (RI), develop a remedial action plan (RAP) for meeting site soil and groundwater cleanup criteria, and implement the RAP for the solvent waste disposal pit. Abbott conducted the RI process from 1989-1992 and submitted the RI report to NCDENR in August 1993.

The RI conducted at the Site identified groundwater impacted with volatile organic compounds (VOCs) extending from the solvent pit area to the downgradient (i.e., southern) portion of the facility. Concentrations of dissolved TCE and other VOCs indicated the presence residual dense non-aqueous phase liquid (DNAPL) in the aquifer. A DNAPL layer consisting of TCE and methylene chloride was found at a depth of 18 feet bgs during the initial RI work. Floating light non-aqueous phase liquid (LNAPL) was also observed downgradient of the source area during past phases of investigations. Soils impacted by VOCs were identified in an area surrounding the former evaporation waste pit (Radian, 1993).

From October 2002 through June 2004, an additional thirteen groundwater monitoring wells (MW-100A through MW-104C) were installed as multi-depth clusters (i.e., well nests) in the northern and middle sections of the VOC plume. These wells were installed as the primary monitoring locations to track the remediation progress of the HRC® bioremediation remedy that was implemented under prior UIC Permit No. WI0600011 issued for this Site (see Section 3 below). Semi-annual monitoring of these wells has continued since 2002 as an operating condition of the previous UIC permit for the Site and plan for remediation approved by the NCDENR. Table 1 summarizes the construction details of the groundwater monitoring wells at the Site.

AECOM North Carolina, Inc. (AECOM) conducted a supplemental investigation on the former waste pit solvent plume at the Site from November 2009 through February 2010. Field activities during the investigation generally followed the work scope and methods described in the *Work Plan for Supplemental Subsurface Investigation and Remedial Actions, Solvent Release Remediation, Former Abbott Facility* (AECOM, 2009), which was approved by the NCDENR. The supplemental investigation focused on two areas: the solvent disposal pit source area in the north (upgradient) part of the VOC plume and the southwestern (downgradient) portion of the VOC plume at the southwest Site property boundary.

A copy of the *Progress Report for 3rd and 4th Quarters 2009: Groundwater Monitoring and Annual Remediation Effectiveness Evaluation* (AECOM, 2010a) is provided in Appendix A to demonstrate the most current (November 2009) semi-annual groundwater monitoring results for the Site. Additionally, a copy of the final results report *Supplemental Subsurface Investigation Report* (AECOM, 2010b) is provided in Appendix A to this permit application for reference. Table 2 and Table 3 summarize the groundwater elevation data and the groundwater VOC analytical data, respectively, from the November 2009 semi-annual sampling event. Combined information in these two AECOM reports represents the most updated subsurface conditions and remediation performance evaluation for the Site.

## 3. Previous Remedial Actions

Abbott has developed and implemented several phases of site remediation and cleanup strategies that have been ongoing since 1994. Several different technologies have been applied to remediate soils and groundwater during this period. The major phases of remedial actions and their results are summarized in the following sections.

*Remedial Action Plan*

Radian Corporation, on behalf of Abbott, developed an initial RAP and submitted the *Remedial Action Plan* report to NCDENR in August 1994. The recommended remedy in the RAP specified use of an innovative in-situ mixing and volatilization tool (i.e. the MecTool™) for the pit source area soil and shallow groundwater, combined with two-phase vacuum extraction (TPVE) technology for the shallow groundwater plume and conventional groundwater extraction and treatment for the deeper groundwater plume.

In 1994 Abbott began implementing the RAP that included in situ volatilization of VOCs for source area soil, shallow TPVE and treatment in the source area, and site-wide groundwater extraction and treatment. The MecTool™ in-situ mixing/volatilization process was used from August 1995 to January 1996 and removed approximately 1,900 pounds of VOCs from soil and shallow groundwater in the immediate vicinity of the former solvent waste pit. This soil treatment action resulted in a ten-fold reduction of dissolved VOCs in shallow groundwater surrounding the former waste pit.

The RAP groundwater extraction and treatment system included 11 recovery wells in the north plume source area and 1 recovery well (RW-7) at the southern property line. The south yard groundwater recovery system was installed and began operating in November 1993 and operated until 2006. The north yard groundwater recovery system, which began operations in August 1996, included a combination of TPVE wells for shallow groundwater and deeper groundwater pumping wells for the deeper plume near the former waste pit. The shallow TPVE component of the north yard recovery system was shut down in 1999 and the deeper groundwater recovery wells operated until October 2002. Approximately 739 pounds of VOCs were removed from the cumulative operations of both groundwater extraction and treatment systems through September 2006 (Phoenix, 2007).

*Remedial Action Plan Amendment No. 1*

In June 2002, Matrix Environmental Southeast, Inc. (Matrix), on behalf of Abbott, submitted a *Remedial Action Plan Amendment* (No. 1) report to NCDENR. This RAP Amendment was approved by the NCDENR. The RAP Amendment proposed an alternate groundwater treatment approach using in-situ anaerobic bioremediation (via reductive dechlorination processes) based on an on-site pilot test conducted by URS in 2001. The RAP Amendment also proposed to discontinue groundwater extraction and treatment in the north yard source area, and to continue operating the south yard groundwater extraction system on a short-term basis. The organic substrate selected in the RAP Amendment for the bioremediation program was HRC®, a polylactate ester that releases lactic acid upon hydration. The 2002 RAP Amendment No. 1 proposed to conduct up to three phases of bioremediation treatment using HRC® (i.e. lactic acid) as the primary organic substrate (Matrix, 2002).

Abbott submitted a UIC permit application for the HRC® injections in May 2002 and subsequently was issued Permit No. WI0600011 by NCDENR. In November 2002 Abbott began injecting HRC® to stimulate in-situ reductive dechlorination of VOCs in groundwater, with particular emphasis in biological reduction of TCE. For the Phase I bioremediation program, a total of 39,600 pounds of HRC® were injected at 133 locations in and around the waste pit source area. Several rows of HRC® injection borings were installed downgradient of the waste pit area to form permeable biological treatment barriers (Matrix, 2008).

Subsequently, Phase II of the bioremediation program was conducted in June 2004 by injecting 31,290 pounds of Hydrogen Release Compound-Extended Release (HRC-X™ an extended release, longer lasting version of HRC®) at 123 locations. The Phase II injections targeted the remaining high-concentration northern end of the dissolved VOC plume located between the north side of the main plant building and the waste pit area. Additional injections of HRC-X™ were also performed in the waste pit source area during Phase II.

In September 2006 the south yard groundwater pumping system was shut down and was replaced by an HRC® in-situ biological treatment system. During this injection event 14,880 pounds of HRC® was injected at 73 locations in the southern plume area. This part of the remedial action was referred to as the Phase II Supplemental bioremediation program (Matrix, 2008).

Abbott also began separate free product removal efforts at wells MW-100A and MW-101A using a mobile multi-phase extraction (MMPE) system. Free product removal with MMPE occurred in 2004 (two events) and again in 2006. Approximately 1,800 gallons of liquids (groundwater and free product mixture) were removed during the cumulative MMPE events.

*Remedial Acton Plan Amendment No. 2*

In April 2008, Phoenix Environmental Associates, Inc. (Phoenix) submitted the *Remedial Action Plan Amendment 2: Solvent Release Remediation* report to NCDENR on behalf of Abbott, which was then approved by NCDENR. The RAP Amendment No. 2 report provided a summary of the effectiveness of the ongoing bioremediation program, contaminant fate and transport modeling analysis of the remaining TCE plume, and a modified plan for continued bioremediation and natural attenuation of VOCs in groundwater.

Data presented in the RAP Amendment No. 2 report demonstrated that biological reductive dechlorination from the HRC® injections had reduced the TCE mass remaining in the source area by approximately 90 percent during a five-year period. The data showed that TCE biodegradation daughter products were being generated and the aquifer geochemistry was responding favorably to support the reductive dechlorination process. A contaminant fate and transport modeling analysis in the report concluded that a 99.99 percent reduction of TCE is required in the source area to achieve the Title 15A North Carolina Administrative Code (NCAC) Subchapter 2L Groundwater Standard (2L Standard) cleanup level required for site closure.

The RAP Amendment No. 2 also compared the HRC® biological treatment strategy to alternate strategies including Monitored Natural Attenuation (MNA). As a result of these evaluations, MNA was selected as the preferred technology to treat VOC-impacted groundwater due to the cost savings and the lower level of site disruption associated with this alternative. To this end, the preferred MNA alternative in RAP Amendment No. 2 included a contingency remedy that specifies additional HRC® enhanced bioremediation should the progress of the MNA remediation deviate significantly from the plume model predictions (Phoenix, 2008). This remedial action contingency allows additional engineered (i.e., substrate enhanced) bioremediation to be initiated on an as-needed basis under the NCDENR-approved RAP Amendment No. 2. It should be noted that Abbott is not seeking this permit to complete supplemental bioremediation because the progress of the MNA remediation has deviated from plume model predictions. Rather, Abbott's intent in completing the supplemental bioremediation is to take more of a conservative and aggressive approach to expedite remediation.

# B. Hydrogeologic Description

A detailed description of the regional and local geology and hydrogeology for the Former Abbott Facility was previously presented in the UIC permit application submitted by Abbott to the NCDENR-DWQ on May 24, 2002. This information is essentially unchanged since that application submittal and the subsequent issuance of UIC permit No. WI0600011. Additional subsurface lithologic data are provided in the attached report *Supplemental Subsurface Investigation Report* (AECOM, 2010b). A description of the geology and hydrogeology as summarized in previous investigation reports submitted for the Site are discussed in the following sections.

## 1. Regional Geology and Hydrogeology

The Former Abbott Laurinburg Facility is located in the southwest portion of North Carolina's Inner Coastal Plain physiographic province, within a regional plain known as the Flatwoods Section of the Coastal Plain. The Coastal Plain of North Carolina consists of flat lying to gently dipping sedimentary strata consisting of sand, sandstones, siltstones, clays, shales, carbonates, and peat. The Coastal Plain sediments overlay crystalline and volcanic basement rocks.

In the Laurinburg region, the Coastal Plain strata consist of surficial sediments with interbedded sands and clays that overlay the older Middendorf Formation of Cretaceous age. The sand units locally contain gravel lenses. In the Flatwoods Section the surficial sediments have an average thickness of 30 feet and generally contain the first groundwater-bearing strata that form the water table. Water-bearing discontinuous sand units in the surficial formation form the first regional aquifer (the Surficial Aquifer) that can be tapped for water supply wells.

Beneath the surficial sediments, the regionally-extensive Middendorf Formation consists of laterally discontinuous layers of sands and massive light-gray to bluish-gray clay layers. Thin beds of sandstone and mudstone, as well as local deposits of lignite, are also present in the Middendorf Formation. The Middendorf Formation attains a maximum thickness of between 250 feet to 300 feet in the Laurinburg area. Water bearing lenticular sand units in the Middendorf Formation form a regionally extensive aquifer that is the most productive and widely used source of groundwater in the Laurinburg area (Schipf, 1961).

Many areas of the southern Coastal Plain province contain shallow, elliptical depressions in the sediments known as "Carolina Bays". The long axes of the Carolina Bays trend from northwest to southeast and the bays are often filled with peat and/or sand deposits that overlay a basal layer of clay-rich soil. Elliptical lakes and ponds of various sizes have formed inside many of the Carolina Bays.

## 2. Site Geology

Past investigations have determined that a large portion of the Site property boundary is located within the remnants of a Carolina Bay geomorphic feature. Soils mapped within the bay feature are generally poorly drained sediments described as gray sandy clay loam to sand clay. Soil borings advanced beneath the Site within the boundary of the bay feature show a heterogeneous stratigraphic sequence of sands, silts and clays in the upper 25 feet. A basal clay layer was not found in the bay. Below 25 feet within the bay the stratigraphy is predominantly sand with intermittent clay lenses to a

depth of 80 feet. Outside of the bay feature the soils are more homogeneous and contain less sand content in the upper 25 feet. A thick layer of sandy clay is found from approximately 12 feet to 38 feet below ground surface on portions of the Site located outside of the remnant bay feature (Radian, 1993).

### 3. Site Hydrogeology

The water table is typically found at an average depth of 8 feet bgs but can fluctuate from 2 feet bgs to 10 feet bgs (see Table 2 for most recent well gauging data). Groundwater flow is generally toward the south and southwest through two primary units: a shallow hydrostratigraphic unit that extends to depths up to 22 feet bgs, and a deeper hydrostratigraphic aquifer unit that is found at depths of approximately 35-78 feet bgs (Matrix, 2002). The deeper aquifer unit contains thick beds of sand, is generally more homogeneous and more permeable than the shallow unit, and exhibits confined and semi-confined hydraulic behavior. The deeper unit below a depth of 35 feet represents the upper sedimentary layers of the Middendorf Formation. A potential confining layer of hard gray clay is found at an average depth of 80 feet bgs in the southern portions of the Site (Radian, 1993).

The predominant groundwater flow direction is toward the south and southwest at an average hydraulic gradient of 0.003 ft/ft. Historical water level gauging records have demonstrated that groundwater flow can be toward the southeast direction during seasonal low water and drought periods. Figure 3 and Figure 4 show groundwater potentiometric maps for the shallow and deep aquifer zones, respectively, during the November 2009 semi-annual sampling event.

The average groundwater seepage velocity was calculated as 0.010 feet per day. The nearest surface water body is an unnamed tributary of Leith Creek located 2000 feet southwest of the Site (Radian, 1993). A man-made pond on a tributary of Leith Creek is located 1,000 feet west of the former disposal pit source area (see Figure 1).

### 4. Hydraulic Properties

During the RI, a series of groundwater pumping test and slug tests were conducted to measure aquifer hydraulic properties. Details of the aquifer test methods and data evaluations were provided in the previous application for UIC Permit No. WI0600011. A summary of the averaged hydraulic properties from these tests (Radian, 1993) are provided below:

- Transmissivity (T): $1.4 \times 10^{-2}$ to $1.8 \times 10^{-2}$ $ft^2/min$
- Storativity (S): $2.1 \times 10^{-3}$
- Hydraulic Conductivity (K): $6.4 \times 10^{-4}$ to $8.2 \times 10^{-4}$ cm/sec

# C. Injection Fluid Composition

The proposed injection fluid discussed in this permit application, Anaerobic Biochem® (ABC®), is an organic substrate that has many similarities to the HRC®/HRC-X® that was previously injected at Site under prior UIC Permit No. WI0600011. Each of these commercially-available organic substrate products operates along the same biological metabolic pathways for contaminant reduction. Additionally, the current UIC permit application includes an optional injection fluid containing RTB-1, a biological culture of *Dehalococcoides spp.* dehalogenating bacteria. ABC® and RTB-1 are both on the NCDENR-DWQ list of approved tracers and remediation injectates.

ABC®, manufactured by Redox Tech, LLC, is a patented mixture of lactates (ethyl lactate and sodium lactate), a small molar volume of fatty acid oil, and di-potassium phosphate (DKP) for pH buffering. The buffer provides phosphates, which are a micronutrient for bioremediation. In addition, the buffer helps to maintain the pH in a range that is best suited for microbial growth. ABC® contains soluble, fermentable slow- and long-term releasing organic components. Each of these constituents has a unique purpose for this application. The lactate-based products are quicker release electron donors that will 'jump start' the carbohydrate fermentation process and subsequent reductive dechlorination. Fatty acid oils are long-term carbohydrate electron donors that have the potential to last several years in the aquifer. Ethyl lactate is also a strong, biodegradable organic co-solvent that can desorb VOCs from the aquifer matrix. Due to its low viscosity, ABC® can be injected in most geologic environments, including low-permeability silt and clay.

The ABC® product will be mixed with municipal water to form a 10-30% by weight of ABC® aqueous solution. The weight concentration of ABC® in the solution will vary by the location and depth of each injection boring. A 10-20% by weight of ABC® solution will be injected into strata that contain moderate concentrations (<20,000 µg/L) of total VOCs. A higher concentration (up to 30% by weight) of ABC® will be injected into strata that contain elevated concentrations of total VOCs >20,000 µg/L. Higher concentrations of ABC® ranging from 20-30% by weight will also be injected into lower permeability strata that will not accept larger volumes of the aqueous injectate solution.

Some of the injection borings will be bioaugmented with an approximate 0.75 percent (by weight) of the NCDENR approved commercially available *Dehalococcoides* (DHC) bacteria culture RTB-1, with a designed concentration of $1 \times 10^{11}$ DHC cells per milliliter. RTB-1 is manufactured by Shaw Environmental for Redox Tech. The injection details (volumes and well information) are provided on the attached UIC-5I/5T application form.

Material Safety Data Sheets (MSDS) for ABC® and RTB-1 are attached in Appendix B. Dilution water will be obtained from public potable water sources (i.e. City of Laurinburg).

# D. Injection Rationale

The purpose of the injections requested in this UIC permit application is to maintain and further enhance the biological enhanced reductive dechlorination (ERD) in-situ groundwater treatment program (i.e., anaerobic bioremediation) that was initiated at the Site in 2002 under prior UIC Permit No. WI0600011. Previous ERD injection programs at the Site used HRC® and HRC-X® as the organic substrate (i.e., electron donor source) to promote biological degradation of VOCs in groundwater. The proposed injection solution discussed in this permit application, ABC®, is also an organic substrate that has many similarities to HRC®/HRC-X® since it facilitates the same biological metabolic pathways for contaminant reduction.

ABC® was selected over HRC® for the next round of injections because it will not only replenish the declining levels of available organic carbon (electron donor) but it is also expected to be more effective than HRC® at increasing the aqueous phase solubility of the remaining NAPL and the residual VOC mass that is sorbed to the aquifer matrix. The 'aqueous flushing' process used for the co-solvent injection also provides more aggressive treatment of the residual source material compared to the emplacement methods that were previously used for the HRC® electron donor product.

## 1. Goals of Injection Project

The goal of the injection project is to maintain and further enhance the ongoing biological ERD groundwater treatment program (i.e., anaerobic bioremediation) that was initiated at the Site in 2002. Recent investigations and groundwater sampling events conducted at the Site during the past 18 months demonstrate that the Total Organic Carbon (TOC) content has been declining in Site groundwater within the areas previously injected with HRC® products. The groundwater oxidation-reduction potential (ORP) and dissolved oxygen have also been increasing in the areas previously treated with HRC® in 2002 and 2004. These results show that the Site groundwater is returning to its pre-injection, oxic conditions due to depletion of the available organic substrate. Thus, re-establishing strongly reducing (anaerobic) conditions and higher TOC in groundwater will be necessary to restore geochemical conditions that are more favorable for continuing the in-situ ERD treatment program.

The ABC® electron donor will be injected into the remaining source area hot spots and high concentration portions of the plume based on the data and findings presented in the *Supplemental Subsurface Investigation Report* (AECOM, 2010b). Bioaugmentation with DHC dehalogenating bacteria will also be performed since the DHC populations were also very low. The bioaugmentation component will first be conducted as a limited pilot test in the southern extent of the proposed ABC® injection grid, while the remainder of the treatment area is monitored for natural rebound of indigenous DHC bacteria. An expanded injection of DHC bacteria may occur at a later date if the indigenous populations do not flourish within the area injected with the electron donor.

## 2. Treatment Area Volume Calculations

The scale of this injection program is based on an assumed aquifer volume of between 500,000 to 600,000 cubic feet ($ft^3$) that contains high-concentration dissolved VOCs and possible residual NAPL that would be targeted for enhanced biological treatment. Depths and locations of aquifer material requiring additional treatment is based on results of the Supplemental Investigation and analytical data

collected during recent groundwater sampling events. Table 3 summarizes the most recent November 2009 semi-annual VOC data for groundwater, and the results for TCE are shown in Figure 5 (shallow TCE plume map) and in Figure 6 (deep TCE plume map).

The target treatment bulk volume of the aquifer is approximately 100 feet (ft) wide x 150 ft long x 40 ft thick. Based on this estimated treatment area, approximately 20-25 DPT injection borings are assumed, each with an approximate 15-ft radius of contact influence for injection of the ABC® electron donor solution. This radius of contact influence is reasonable based on the hydraulic conductivity of the soil strata that will be injected.

Based on the estimated treatment volume, approximately 51,000 pounds of the ABC® electron donor product (diluted with water to form 59,900 gallons of 10% aqueous solution) will be injected. This volume is equivalent to an average 2,400 gallons of 10% electron donor solution injected at each of the 25 DPT injection borings. Up to 3,300 gallons of ABC® solution may be injected at other borings, depending on their depth. Using a minimum 10% by weight dilution concentration, the concentration of sodium lactate and ethyl lactate in solution could vary from 11 grams per liter (g/L) to 70 g/L, respectively. These concentrations would produce an equivalent total organic carbon content in the injectate solution of 3,697 mg/L of sodium lactate and 34,879 mg/L of ethyl lactate (assuming 20% of the undiluted ABC® composition consists of sodium lactate and 80% consists of ethyl lactate). In some injection borings, the ABC® concentration may be as high as 30% by weigh in solution. This higher strength dilution would product an equivalent total organic carbon concentration >100,000 mg/L in the injection solution.

### 3. Reaction and Breakdown Products

Many common organic groundwater contaminants can be treated in situ by enhanced anaerobic processes. These types of contaminants include chlorinated solvents. With anaerobic biodegradation, the target contaminant trichloroethylene (TCE) is broken down to dichloroethylene (DCE) isomers, vinyl chloride, ethene, and ethane, and then further broken down to the final byproducts of carbon dioxide and water.

The ABC® electron donor product undergoes biological fermentation, which produces free hydrogen that is used by dehalogenating microbes in the reductive dechlorination process. Fermentation of the initial organic substrate produces metabolic fatty acids (lactic acid, acetic acid, pyruvic acid, etc.) as byproducts. Methane is also a common byproduct generated during fermentation.

The ethyl lactate component of ABC® is a strong, biodegradable organic co-solvent. When mixed with water, ethyl lactate converts to ethanol and lactic acid via the process of hydrolysis. The ethyl lactate and sodium lactate ingredients in ABC® are known to decrease the interfacial tension between NAPL and groundwater, thereby increasing NAPL dissolution and mass transfer to the aqueous phase for more efficient biological ERD treatment. Additionally, the ethanol produced from hydrolysis of ethyl lactate is also a strong co-solvent that increases the solubility of NAPL and sorbed-phase organic contaminants to the aqueous phase. This solubility reaction can cause a temporary increase in the concentrations of certain soluble, dissolved VOCs in groundwater.

Both the ethanol and lactic acid produced from the ethyl lactate component of ABC® are metabolically consumed (fermented) as available organic substrates by the bacteria. The lactate acid produced via hydrolysis of ethyl lactate has proven to be effective at the Site, since this is the primary organic acid that is released by the HRC® product.

### 4. Injection Zones and Targeted DNAPL Treatment

The MIP survey and groundwater sampling conducted during the Supplemental Investigation identified several lithologic zones that contain varying concentrations of residual VOCs in the aquifer. Beneath the former waste pit, the highest VOC concentrations are found at depths of 16-40 feet bgs. Further downgradient, the highest groundwater VOC concentrations occur in strata generally located 30-53 feet bgs. Both of these intervals will be targeted for injections with ABC® concentrations up to 30% by weight. Above 20 feet bgs and below 53 feet bgs the VOC concentrations again decrease. These areas will be injected with a 10% by weight of ABC® solution.

The MIP survey and dissolved concentrations of TCE (55,000 µg/L) in groundwater suggest that small pockets DNAPL and residual contaminant mass may reside in the saturated soil strata. The MIP survey identified these remaining hot spots for targeted additional treatment via high concentration ethyl lactate injection. Approximately 10 percent of the aquifer treatment volume will be targeted for injection with a blend of the electron donor solution that contains higher concentrations of the ethyl lactate co-solvent ingredient of ABC®. Up to 40 percent by weight of ethyl lactate may be injected in these discrete zones. The injections of higher concentration co-solvent solution will target residual DNAPL or high concentration areas as previously characterized by the MIP survey.

The proposed ABC® injection grid is shown in Figure 7. The grid has been divided into three primary injection zones labeled as Zones A, B, and C based on the VOC concentrations and plume distribution in the aquifer. Each of these zones will have varying concentrations of ABC® solution injected based on the following estimations:

| Injection Zone | Depth Interval (ft, bgs) | ABC® Concentration (percent by weight) | Comments |
|---|---|---|---|
| A | 16-40 | 30% | North of MW-100 well cluster |
| | 40-50 | 10% | North of MW-100 well cluster |
| | 20-53 | 20-30% | South of MW-100 well cluster |
| B | 20-53 | 20-30% | North of concrete ditch |
| | 15-25 | 10% | South of concrete ditch |
| | 25-53 | 20-30% | South of concrete ditch; locally inject higher concentrations of ethyl lactate component |
| C | 15-25 | 10% | North of MW-102 well cluster |
| | 25-50 | 20% | North and adjacent to MW-102 well cluster |
| | 50-62 | 10% | North and adjacent to MW-102 well cluster |

## 5. Bioaugmentation Amendments

Microbial sampling conducted during the Supplemental Investigation showed that Site groundwater has very low to nondetectable concentrations of DHC bacteria. Unfavorable geochemical conditions may be contributing to the currently observed DHC suppression. A two-step approach is planned to monitor and, if necessary, bioaugment portions of the Site groundwater with a solution of RTB-1 DHC bacteria.

After injecting the ABC®, a limited area in the downgradient portion of the injection grid near well cluster MW-102 will be injected with RTB-1 to perform a bioaugmentation pilot test. The bioaugmented area and upgradient areas that are not inoculated will then be monitored for DHC bacteria for a period of six months. The upgradient areas will be monitored to determine if DHC bacteria will naturally flourish in groundwater (without bioaugmentation) after the ABC® injections. The bioaugmented area near MW-102 well cluster will also be monitored to determine if the injected DHC populations survive and grow.

If bioaugmentation is selected for a larger area of the Site, the RTB-1 proprietary DHC culture will be injected into the remaining source area or other areas of the plume that show bacterial deficiency and that are targeted for enhanced bioremediation. Injections of the DHC bacteria will be performed during separate injections at least six months after the electron donor injections. A conservative estimate for a bioaugmentation program is that up to 95 liters of DHC bacteria would be injected into the source area of the plume, using approximately 5-liters of DHC culture per injection boring. The actual volume of DHC culture may be adjusted based on site-specific conditions and the outcome of the bioaugmentation pilot test.

# E. Injection Procedures and Equipment

The ABC® will be injected under varying pressures directly into boreholes advanced hydraulically with a Geoprobe® direct push technology (DPT) rig operated by a licensed North Carolina driller. Each DPT injection boring will be advanced to the maximum targeted injection depth and the injection rods will be lifted in 2- to 3-foot increments for pressure injection of the ABC® solution. Based on the characteristics of the aquifer strata encountered, more than one injection boring per location may be installed at different depths to effectively deliver the ABC® solution to the targeted depths without short-circuiting to non-targeted strata. The actual injection locations, volumes of injection and number of injection points will be based on the results of source area delineation as discussed in the previous Section D.

The concentrated ABC® product will be mixed with tap water in poly tanks at the surface to create an average product/water 1:5 ratio prior to injection (Note: the mixed concentration will vary for different zones as discussed in Section D). The ABC® solution will be prepared on-site using water derived from on-site municipal water sources. Mixing operations will be performed in truck-mounted 500 gallon tanks.

Each primary injection "cluster" location will have up to three individual boreholes to deliver varying concentrations of the ABC® solution to different depth intervals of the aquifer. The maximum injection depth will be 62 feet bgs. After completing an injection boring, boreholes will be sealed at the surface with grout or bentonite. Spacing of the injection borehole clusters will be on 20-foot or 30-foot centers. Within the former waste pit area, the injection borings will be more closely spaced. Up to 72 individual DPT injection boreholes, with combined injection depth intervals from 15-62 feet bgs, may be installed at up to 25 locations.

The ABC® solution will be applied through the DPT rods with a high pressure pump at injection pressures less than 100 psi. The injection flowrates are expected to be 15 gallons per minute (gpm) or less, depending on the soil characteristics at that depth. The actual injection rate and amount will be adjusted based on field conditions. The flow rate will be monitored by timing the decrease in fluid level in the make-up tank and with flow gauges.

Bioaugmentation Procedures

Several injection borings in injection Zone C will be bioaugmented with an approximate 0.75 percent (by weight) of the DHC bacteria culture RTB-1, with a designed concentration of $1 \times 10^{11}$ DHC cells per milliliter. The RTB-1 culture is shipped in oxygen-free, pressurized 20-liter stainless steel containers. Prior to injection, groundwater in the area will be tested to make sure the dissolved oxygen and ORP levels are sufficiently low to indicate anaerobic (reducing) conditions in the aquifer.

The RTB-1 culture will be mixed with makeup chase water (or additional ABC® solution) that is also oxygen-free during the injection process. The makeup water will be municipal water that is bubbled with nitrogen or spiked with zero-valent iron as an oxygen scavenger, to remove oxygen prior to injecting the water it along with the DHC bacteria.

Each bioaugmentation injection boring will utilize approximately 5 liters of DHC bacteria per boring. The injection program will be staged so that the ABC® injections are performed first in injection Zone C to allow more time for the groundwater to achieve reducing conditions prior to DHC bacteria injections, which will occur at the end of the injection program. A subsequent, separate mobilization may be required for the DHC injections if optimal geochemical conditions are not achieved in groundwater during the main ABC® injection event.

# F. Monitoring Plan

A network of twenty-three (23) existing groundwater monitoring wells is currently monitored on a semi-annual basis to track the plume movement and ERD performance. Table 4 summarizes the semi-annual groundwater sampling program that is currently being used at the Site. Abbott will continue to monitor these wells in accordance with the NCDENR-approved groundwater monitoring and Progress Report program specified in the *RAP Amendment* (Matrix, 2002), the *Phase II Preconstruction Report* (Matrix, 2004), and the *Phase II Preconstruction Report Addendum* (Phoenix, 2006) that is currently ongoing in 2010. This program includes the minimum parameters necessary to monitor the performance of the bioremediation program and the results were submitted in accordance with the expired UIC permit WI0600011. Annual remediation effectiveness evaluations will continue to be provided in a January Progress Report.

The existing 23 wells will be analyzed prior to injection of the ERD solution to establish baseline VOC concentrations and geochemical parameters. Groundwater samples will be analyzed on a semi-annual basis for VOCs using United States Environmental Protection Agency (USEPA) Method 8260B. Standard sampling parameters such as fluid elevation, pH, temperature, conductivity, dissolved oxygen and ORP will be measured in each well during the sampling events. In addition, select monitoring wells will be analyzed semi-annually for one or more of the monitored natural attenuation (MNA) geochemical parameters (total and dissolved iron, total and dissolved manganese, sulfate, nitrite/nitrate, alkalinity, carbon dioxide, chloride, TOC, and dissolved gases of methane, ethene, and ethane).

Following the ABC® injections, several key monitoring wells located in the injection treatment zones will be analyzed more frequently (i.e., monthly and/or quarterly) for a period of six months to determine the short-term ERD results and to confirm the injection area coverage. In addition to the parameters listed above, other parameters that will be monitored at these wells include metabolic organic acids, DHC bacteria, and *Dehalobacter spp.* (DHB) bacteria. MNA parameters will be evaluated after each sampling event and some parameters may be eliminated from subsequent sampling events if they do not provide useful data. The MNA data will be used to evaluate the long-term performance of the ERD injection.

# G. Well Data

See Table 1 and Figure 2 for well data. Also reference data used in May 2002 permit application for prior UIC permit WI0600011 issued for the Site.

# H. Maps

Applicable maps are included in the Figures section of this document. Also, lithologic cross sections are unchanged from those cross sections provided in the May 2002 permit application for prior UIC permit WI0600011 issued for the Site.

Additionally, reference various maps in the attached data reports (Appendix A) that provide detailed current sampling data, cross sections, and VOC plume distribution maps:

- *Supplemental Subsurface Investigation Report* (AECOM, April 2010)
- *Progress Report for 3rd and 4th Quarters 2009: Groundwater Monitoring and Annual Remediation Effectiveness Evaluation* (AECOM, February 2010)

# I. References

Schipf, Robert G., 1961. Geology and Ground-Water Resources of the Fayetteville Area. North Carolina Department of Water Resources, Ground-Water Bulletin No. 3.

Radian, 1993. *Remedial Investigation Report, Abbott Laboratories, Laurinburg, North Carolina.* Radian Corporation.

RUST, 1994. *Remedial Action Plan, Abbott Laboratories, Laurinburg, North Carolina.* RUST Environment & Infrastructure and Radian Engineering, Inc., August 1994.

Matrix, 2002. *Remedial Action Plan Amendment, Abbott Laboratories, Laurinburg, North Carolina.* Matrix Environmental, Inc. June 2002.

Matrix, 2004. *Phase II In Situ Bioremediation Preconstruction Letter Report, Abbott Laboratories, Laurinburg, North Carolina.* Matrix Environmental Southeast, February 2004.

Phoenix, 2008. *Remedial Action Plan Amendment 2-Solvent Release Remediation, Former Abbott Facility, Laurinburg, North Carolina.* Phoenix Environmental Associates, Inc. April 2008.

Excel, 2009. *1st and 2nd Quarters 2009 Progress Report-Solvent Release Remediation, Former Abbott Facility, Laurinburg, Scotland County, North Carolina.* Excel Civil & Environmental Associates, PLLC. June 10, 2009.

AECOM, 2009. *Work Plan for Supplemental Subsurface Investigation and Remedial Actions, Solvent Release Remediation, Former Abbott Facility.* AECOM North Carolina, Inc., August 2009.

AECOM, 2010a. *Progress Report for 3rd and 4th Quarters 2009: Groundwater Monitoring and Annual Remediation Effectiveness Evaluation, Former Abbott Facility, Solvent Release Remediation.* AECOM North Carolina, Inc., February 2010.

AECOM, 2010b. *Supplemental Subsurface Investigation Report, Former Abbott Facility, Solvent Release Remediation.* AECOM North Carolina, Inc., April 2010.

**Table 1**
**Monitoring Well Construction Details**
**Former Abbott Facility**
**Laurinburg, Scotland County, North Carolina**

| WELL CONSTRUCTION DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Well Number | Date Installed | Well Construction | Top of Casing MP Elevation (ft, msl) | Screened Interval (ft, bgs) | | | Total Well Depth (ft, bgs) | Total Well Depth (ft, msl) |
| MW-100A | 10/8/2002 | 2 in Sch 40 PVC | 228.86 | 20 | - | 30 | 30.0 | 198.86 |
| MW-100B | 10/7/2002 | 2 in Sch 40 PVC | 228.92 | 35 | - | 45 | 45.0 | 183.92 |
| MW-101A | 10/11/2002 | 2 in Sch 40 PVC | 228.18 | 20 | - | 30 | 30.0 | 198.18 |
| MW-101B | 10/11/2002 | 2 in Sch 40 PVC | 228.17 | 35 | - | 45 | 45.0 | 183.17 |
| MW-102A | 10/11/2002 | 2 in Sch 40 PVC | 229.56 | 20 | - | 30 | 30.0 | 199.56 |
| MW-102B | 10/10/2002 | 2 in Sch 40 PVC | 229.47 | 35 | - | 45 | 45.0 | 184.47 |
| MW-102C | 10/10/2002 | 2 in Sch 40 PVC | 229.54 | 55 | - | 65 | 65.0 | 164.54 |
| MW-103A | 10/9/2002 | 2 in Sch 40 PVC | 230.58 | 20 | - | 30 | 30.0 | 200.58 |
| MW-103B | 10/8/2002 | 2 in Sch 40 PVC | 230.58 | 35 | - | 45 | 45.0 | 185.58 |
| MW-103C | 10/9/2002 | 2 in Sch 40 PVC | 230.60 | 55 | - | 65 | 65.0 | 165.60 |
| MW-104A | 6/5/2004 | 2 in Sch 40 PVC | 230.58 | 2 | - | 12 | 12.0 | 218.58 |
| MW-104B | 6/5/2004 | 2 in Sch 40 PVC | 230.59 | 35 | - | 45 | 45.0 | 185.59 |
| MW-104C | 6/5/2004 | 2 in Sch 40 PVC | 230.56 | 63.5 | - | 73.5 | 73.5 | 157.06 |
| MW-105C | 2/9/2010 | 2 in Sch 40 PVC | *NA | 54 | - | 64 | 64.0 | *NA |
| MW-6B | 7/25/1990 | 2 in Sch 40 PVC | 230.30 | 14.0 | - | 19.0 | 19.0 | 211.30 |
| MW-10B | 7/24/1990 | 2 in Sch 40 PVC | 229.10 | 16.5 | - | 26.5 | 26.5 | 202.60 |
| MW-10D | 1/17/1996 | 2 in Sch 40 PVC | 228.70 | 30 | - | 40 | 40.0 | 188.70 |
| MW-13B | 7/18/1991 | 2 in Sch 40 PVC | 230.30 | 9.3 | - | 18 | 18.0 | 212.30 |
| MW-16B | 1/17/1991 | 2 in Sch 40 PVC | 227.90 | 15.25 | - | 24.25 | 24.3 | 203.65 |
| MW-16D | 1/18/1991 | 2 in Sch 40 PVC | 228.90 | 62.5 | - | 71.5 | 71.5 | 157.40 |
| MW-18B | 2/5/1992 | 2 in Sch 40 PVC | 228.70 | 5.5 | - | 14.5 | 14.5 | 214.20 |
| MW-18D | 2/7/1992 | 2 in Sch 40 PVC | 228.70 | 48.1 | - | 57.1 | 57.1 | 171.60 |
| MW-19B | 4/24/1992 | 2 in Sch 40 PVC | 228.70 | 15 | - | 25 | 25.0 | 203.70 |
| MW-19D | 4/27/1992 | 2 in Sch 40 PVC | 228.70 | 63.8 | - | 73.8 | 73.8 | 154.90 |
| MW-20B | 4/28/1992 | 2 in Sch 40 PVC | 227.90 | 17 | - | 27 | 27.0 | 200.90 |
| MW-20D | 4/27/1992 | 2 in Sch 40 PVC | 228.10 | 68 | - | 78 | 78.0 | 150.10 |
| MW-21B[1] | 1996 | 2 in Sch 40 PVC | 227.00 | 15 | - | 25 | 25.0 | 202.00 |
| MW-27D[2] | 1/11/1996 | 2 in Sch 40 PVC | 231.10 | 30 | - | 40 | 40.0 | 191.10 |

**Notes:**

[1]Well construction logs are not available for MW-21B. Screened intervals are estimates.
[2]Well MW-27D could not be located and is recorded as abandoned.
*Well MW-105C has not been surveyed. The land surface and well elevations are currently unknown.
ft = feet
bgs = below ground surface
msl = mean sea level
PVC=Polyvinyl chloride

## Table 2
## Groundwater Elevation Data: November 2009
## Former Abbott Facility
## Laurinburg, Scotland County, North Carolina

| Well Identication | TOC Elevation (ft msl) | Depth to Water (ft btoc) | Groundwater Elevation (ft msl) |
|---|---|---|---|
| MW-100A | 228.86 | 8.00 | 220.86 |
| MW-100B | 228.92 | 9.99 | 218.93 |
| MW-101A | 228.18 | 8.97 | 219.21 |
| MW-101B | 228.17 | 9.70 | 218.47 |
| MW-102A | 229.56 | 12.43 | 217.13 |
| MW-102B | 229.47 | 11.45 | 218.02 |
| MW-102C | 229.54 | 8.18 | 221.36 |
| MW-103A | 230.58 | 9.89 | 220.69 |
| MW-103B | 230.58 | 12.13 | 218.45 |
| MW-103C | 230.60 | 13.10 | 217.50 |
| MW-104A | 230.58 | 10.23 | 220.35 |
| MW-104B | 230.59 | 11.57 | 219.02 |
| MW-104C | 230.56 | 13.25 | 217.31 |
| MW-6B | 230.30 | 8.00 | 222.30 |
| MW-10B | 229.10 | 9.48 | 219.62 |
| MW-10D | 228.70 | 11.98 | 216.72 |
| MW-13B | 230.30 | 10.91 | 219.39 |
| MW-16B | 227.90 | 9.20 | 218.70 |
| MW-16D | 228.90 | 11.85 | 217.05 |
| MW-18B | 228.70 | 10.62 | 218.08 |
| MW-18D | 228.70 | 12.50 | 216.20 |
| MW-19B | 228.70 | 8.80 | 219.90 |
| MW-19D | 228.70 | 12.60 | 216.10 |
| MW-20B | 227.90 | 9.35 | 218.55 |
| MW-20D | 228.10 | 11.67 | 216.43 |
| MW-21B | 227.00 | 6.35 | 220.65 |

**Notes:**
Water levels were measured on November 3, 2009
TOC: Top of Casing
ft: Feet
ft btoc: feet below the top of casing
msl: mean sea level

## Table 3
## Volatile Organic Compound Analytical Results in Groundwater: November 2009
## Former Abbott Facility
## Laurinburg, Scotland County, North Carolina

| Sample ID | Date | Chemical Name* | 1,1,1-TCA | 1,1-DCA | 1,1-DCE | 1,2-DCA | Chloroform | cis-1,2-DCE | MEK | MTBE | Methylene Chloride | Toluene | trans-1,2-DCE | TCE | Freon 113 | Vinyl Chloride |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Units | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| | | 2L Standard (µg/L) | 200 | 6 | 7 | 0.4 | 70 | 70 | 4,000 | 20 | 5 | 600 | 100 | 3 | 200,000 | 0.03 |
| | | Method | | | | | | | | | | | | | | |
| MW-100A | 11/5/2009 | 8260B | **720** | < 500 | < 500 | < 500 | < 500 | **38,000** | < 2500 | < 500 | **920** | **2,300** | < 500 | **3,200** | **5,200** | < 500 |
| MW-100B | 11/5/2009 | 8260B | **870** | < 500 | **680** | < 500 | < 500 | **47,000** | **4400** | < 500 | **890** | **2,400** | < 500 | < 500 | **25,000** | < 500 |
| MW-101A | 11/5/2009 | 8260B | **5,400** | < 500 | **510** | < 500 | < 500 | **12,000** | < 2500 | < 500 | < 500 | **2,700** | < 500 | **55,000** | **29,000** | < 500 |
| MW-101B | 11/5/2009 | 8260B | **1,700** | < 500 | < 500 | < 500 | < 500 | **28,000** | < 2500 | < 500 | < 500 | **1,200** | < 500 | **1,100** | **14,000** | < 500 |
| MW-102A | 11/4/2009 | 8260B | **84** | < 50 | **550** | < 50 | < 50 | **24,000** | < 250 | < 50 | < 50 | **150** | < 50 | **790** | **8,900** | < 50 |
| MW-102B | 11/4/2009 | 8260B | **17** | < 5 | **71** | < 5 | < 5 | **1,100** | < 25 | < 5 | < 5 | **13** | < 5 | **590** | **3,900** | < 5 |
| MW-102C | 11/4/2009 | 8260B | < 5 | < 5 | **5.8** | < 5 | < 5 | **11** | < 25 | < 5 | < 5 | < 5 | < 5 | < 5 | **1,500** | < 5 |
| MW-103A | 11/4/2009 | 8260B | < 20 | < 20 | < 20 | < 20 | < 20 | **220** | < 100 | < 20 | < 20 | < 20 | < 20 | **29** | **21,000** | < 20 |
| MW-103B | 11/4/2009 | 8260B | < 5 | < 5 | **31** | < 5 | < 5 | **290** | < 25 | < 5 | < 5 | **6.6** | < 5 | **27** | **8,800** | **12** |
| MW-103C DUP | 11/4/2009 | 8260B | < 200 | < 200 | < 200 | < 200 | < 200 | **340** | < 1000 | < 200 | < 200 | < 200 | < 200 | < 200 | **7,600** | < 200 |
| MW-103C | 11/4/2009 | 8260B | < 10 | < 10 | **22** | < 10 | < 10 | **280** | < 50 | < 10 | < 10 | < 10 | < 10 | **23** | **7,300** | **12** |
| MW-104A | 11/4/2009 | 8260B | < 10 | **3.1** | **2.8** | **3.8** | **2.1** | **590** | < 50 | < 10 | < 10 | < 10 | **3.3** | **2.4** | **940** | **12** |
| MW-104B | 11/4/2009 | 8260B | < 5 | < 5 | **12** | < 5 | < 5 | **99** | < 25 | **9.2** | < 5 | < 5 | < 5 | **18** | **2,100** | < 5 |
| MW-104C | 11/4/2009 | 8260B | < 5 | < 5 | **20** | < 5 | < 5 | **150** | < 25 | **8** | < 5 | < 5 | < 5 | **15** | **2,700** | < 5 |
| MW-10B DUP | 11/3/2009 | 8260B | < 5 | < 5 | **8** | < 5 | < 5 | **90** | < 25 | **2.1** | < 5 | < 5 | < 5 | **3.3** | **610** | **1.3** |
| MW-10B | 11/3/2009 | 8260B | < 1 | < 1 | **9** | < 1 | < 1 | **87** | < 5 | **2** | < 1 | < 1 | < 1 | **3.5** | **640** | **1.2** |
| MW-10D | 11/3/2009 | 8260B | < 1 | < 1 | **10** | < 1 | **1.3** | **130** | < 5 | **2.4** | < 1 | < 1 | < 1 | **4.7** | **820** | **2** |
| MW-16B | 11/3/2009 | 8260B | < 1 | < 1 | < 1 | < 1 | < 1 | **3.4** | < 5 | **1.2** | < 1 | < 1 | < 1 | < 1 | **36** | < 1 |
| MW-16D | 11/3/2009 | 8260B | < 1 | < 1 | < 1 | < 1 | < 1 | **3.8** | < 5 | < 1 | < 1 | < 1 | < 1 | < 1 | **5.8** | < 1 |
| MW-18B | 11/4/2009 | 8260B | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | < 5 | < 1 | < 1 | < 1 | < 1 | < 1 | < 5 | < 1 |
| MW-18D | 11/4/2009 | 8260B | < 1 | < 1 | **1.3** | < 1 | < 1 | **18** | < 5 | < 1 | < 1 | < 1 | < 1 | **1.4** | **220** | < 1 |
| MW-19B | 11/3/2009 | 8260B | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | < 5 | < 1 | < 1 | < 1 | < 1 | < 1 | < 5 | < 1 |
| MW-19D | 11/3/2009 | 8260B | < 1 | < 1 | **3.3** | < 1 | **1** | **54** | < 5 | < 1 | < 1 | < 1 | < 1 | **7.7** | **670** | < 1 |
| MW-20B | 11/3/2009 | 8260B | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | < 5 | < 1 | < 1 | < 1 | < 1 | < 1 | < 5 | < 1 |
| MW-20D | 11/3/2009 | 8260B | < 1 | < 1 | < 1 | < 1 | < 1 | < 1 | < 5 | < 1 | < 1 | < 1 | < 1 | < 1 | < 5 | < 1 |

**Notes:**

1,1,1-TCA: 1,1,1-Trichloroethane
1,1-DCA: 1,1-Dichloroethane
1,1-DCE: 1,1-Dichloroethylene
1,2-DCA: 1,2-Dichloroethane
cis-1,2-DCE: cis-1,2-dichloroethene
MEK: Methyl Ether Ketone
MTBE: Methyl tert butyl ether
TCE: Trichloroethylene
trans-1,2-DCE: trans-1,2-dichloroethene
Freon 113: Trichlorotrifluoroethane

* Only those VOCs detected in one or more wells during the November 2009 sampling event are listed in this table.
2L Standard: North Carolina Administrative Code (15A NCAC) Subchapter 2L Groundwater Standards (January 2010)
µg/L: micrograms per liter
**Bold:** Constituent concentration reported above the method detection limit.
**Bold and Shaded**: Constituent concentratrion reported above the NCAC 2L Groundwater Standard

## Table 4
## Summary of Semi-Annual Groundwater Monitoring Program
## Former Abbott Facility
## Laurinburg, Scotland County, North Carolina

| Well No. | Fixed-Base Laboratory Analyses[1] | | | | | | Field-Measured Geochemistry and Parameters[2] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | VOCs (Method 8260B) | VOC TICs (Method 8260) | Total Organic Carbon (Method 5310B) | Alkalinity (Method 2320B)[3] | Methane/Ethane/Ethene (Method RSK-175) | Chloride[3] | Ferrous Iron (Colorimetric)[4] | Carbon Dioxide (Colorimetric)[5] | Water Quality Indicators[6] | Water Level | Free Product Gauging[7] |
| MW-100A | X | X | X | X | X | X | X | X | X | X | X |
| MW-100B | X | X | X | X | X | X | X | X | X | X | X |
| MW-101A | X | X | X | X | X | X | X | X | X | X | X |
| MW-101B | X | X | X | X | X | X | X | X | X | X | X |
| MW-102A | X | X | X | X | X | X | X | X | X | X | X |
| MW-102B | X | X | X | X | X | X | X | X | X | X | X |
| MW-102C | X | X | X | X | X | X | X | X | X | X | |
| MW-103A | X | | X | X | | X | X | X | X | X | |
| MW-103B | X | | X | X | X | X | X | X | X | X | |
| MW-103C | X | | X | X | | X | X | X | X | X | |
| MW-104A | X | | X | X | | X | X | X | X | X | |
| MW-104B | X | | X | X | | X | X | X | X | X | |
| MW-104C | X | | X | X | | X | X | X | X | X | |
| MW-6B | | | | | | | | | | X | |
| MW-10B | X | | X | X | | X | | | X | X | |
| MW-10D | X | | X | X | | X | | | X | X | |
| MW-13B | | | | | | | | | | X | |
| MW-16B | X | | X | X | | X | X | X | X | X | |
| MW-16D | X | | X | X | | X | X | X | X | X | |
| MW-18B | X | | X | X | | X | X | X | X | X | |
| MW-18D | X | | X | X | | X | X | X | X | X | |
| MW-19B | X | | X | X | | X | X | X | X | X | |
| MW-19D | X | | X | X | | X | X | X | X | X | |
| MW-20B | X | | X | X | | X | | | X | X | |
| MW-20D | X | | X | X | | X | | | X | X | |
| MW-21B | | | | | | | | | | X | |

**Notes:**

[1] Fixed-base laboratories include Pace Analytical and Abbott Laboratories

[2] Field measurements made with HACH colorimetric field test kits and portable field meters

3 Alkalinity and free chloride are measured at each well during the April sampling event. Alkalinity is measured at six select wells during the October sampling event.

[4] HACH colorimetric test methods

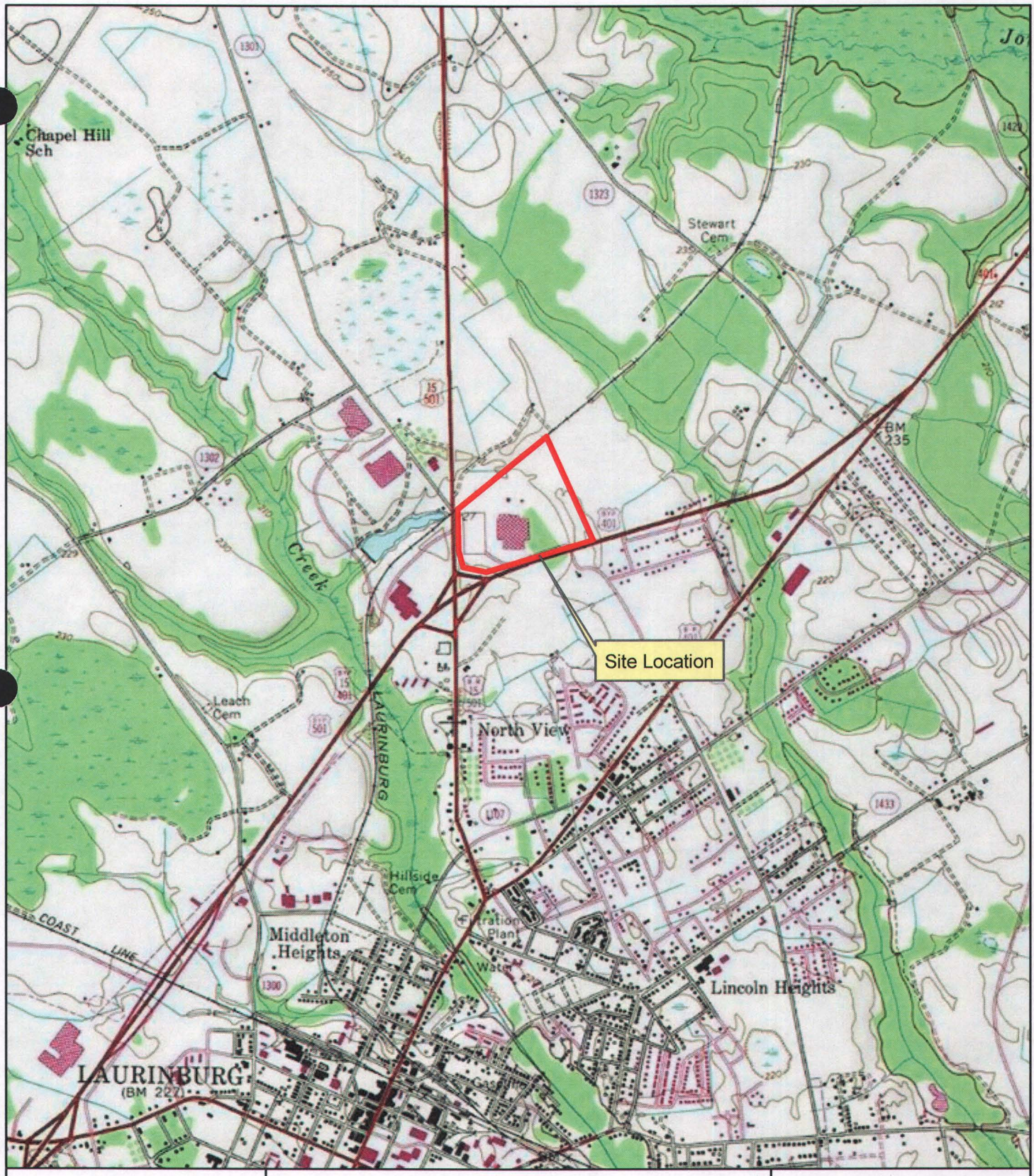
[5] HACH colorimetric test methods

[6] Water quality indicators include pH, temperature, dissolved oxygen, oxidation-reduction potential, turbidity, and specific conductance

[7] Free product gauging performed with electronic oil-water interface probe in each well shown.

VOCs = volatile organic compounds

TICs = Tentatively Identified Compounds




Map Location

## Site Location Map

Former Abbott Facility
Laurinburg, North Carolina

Laurinburg, NC Topographic Quadrangle (1978)

0 2,000 4,000 Feet

N

March 2010

60135880.300

Figure 1

AECOM

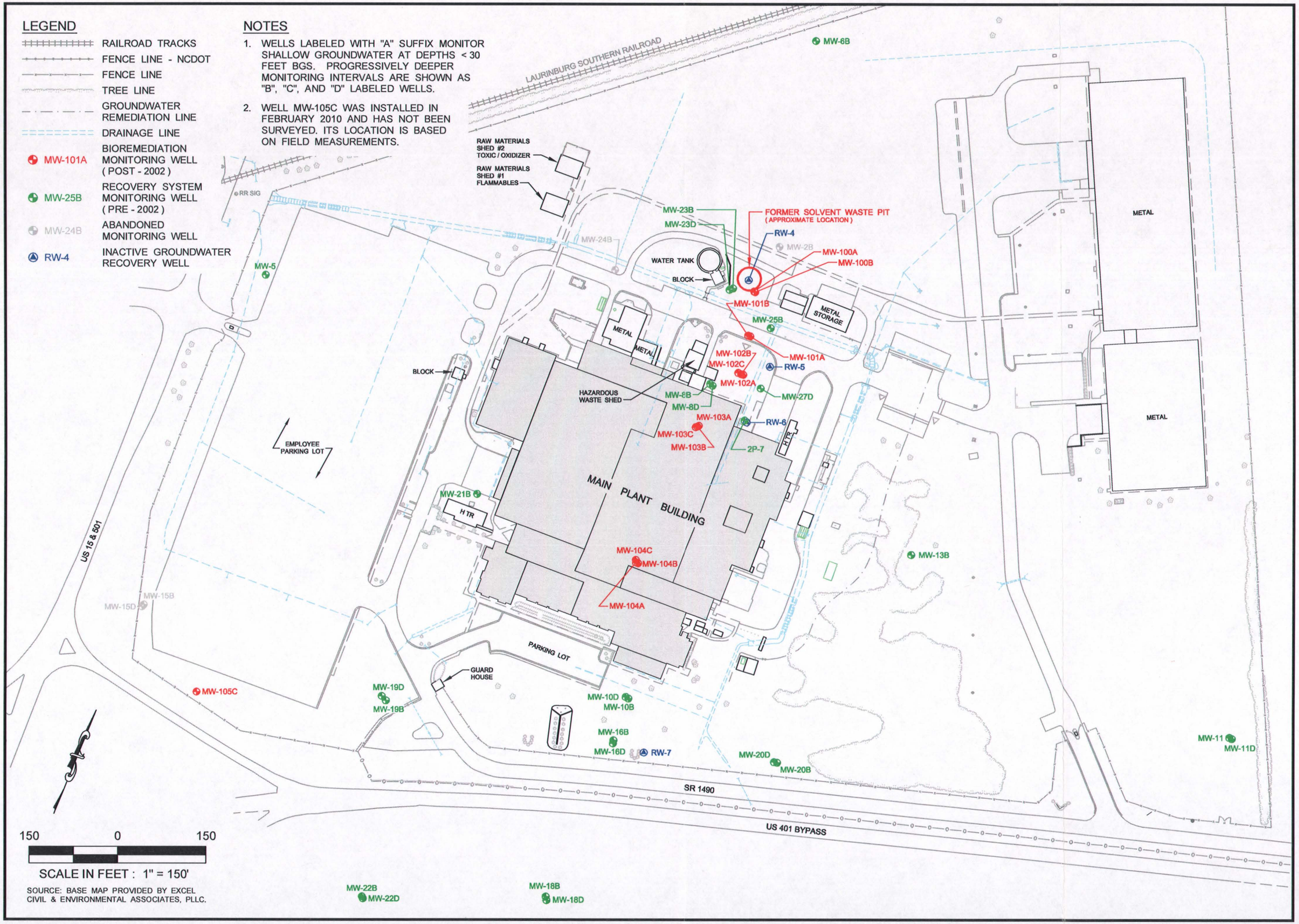
AECOM North Carolina Inc.
7041 Old Wake Forest Rd, Suite 103
Raleigh, NC 27613-3013
Phone: (919) 872-6600
Fax: (919) 872-7996
Web: http://www.aecom.com

## LEGEND

- RAILROAD TRACKS
- FENCE LINE - NCDOT
- FENCE LINE
- TREE LINE
- GROUNDWATER REMEDIATION LINE
- DRAINAGE LINE
- MW-101A — BIOREMEDIATION MONITORING WELL ( POST - 2002 )
- MW-25B — RECOVERY SYSTEM MONITORING WELL ( PRE - 2002 )
- MW-24B — ABANDONED MONITORING WELL
- RW-4 — INACTIVE GROUNDWATER RECOVERY WELL

## NOTES

1. WELLS LABELED WITH "A" SUFFIX MONITOR SHALLOW GROUNDWATER AT DEPTHS < 30 FEET BGS. PROGRESSIVELY DEEPER MONITORING INTERVALS ARE SHOWN AS "B", "C", AND "D" LABELED WELLS.
2. WELL MW-105C WAS INSTALLED IN FEBRUARY 2010 AND HAS NOT BEEN SURVEYED. ITS LOCATION IS BASED ON FIELD MEASUREMENTS.




SOURCE: BASE MAP PROVIDED BY EXCEL CIVIL & ENVIRONMENTAL ASSOCIATES, PLLC.

| REVISIONS | | | |
|---|---|---|---|
| NO.: | DESCRIPTION: | DATE: | BY: |

DESIGNED BY:
DRAWN BY: KLR
CHECKED BY:
APPROVED BY:

AECOM


**AECOM North Carolina, Inc.**
RALEIGH, NORTH CAROLINA 27616
PHONE: (919) 872-6600
FAX: (919) 872-7996
WEB: HTTP://WWW.AECOM.COM


# SITE PLAN

Former Abbott Facility
Laurinburg, North Carolina

| SCALE: | DATE: | PROJECT NUMBER: |
|---|---|---|
| 1"=150' | 3/29/10 | 60135880.300 |

FIGURE NUMBER: 2

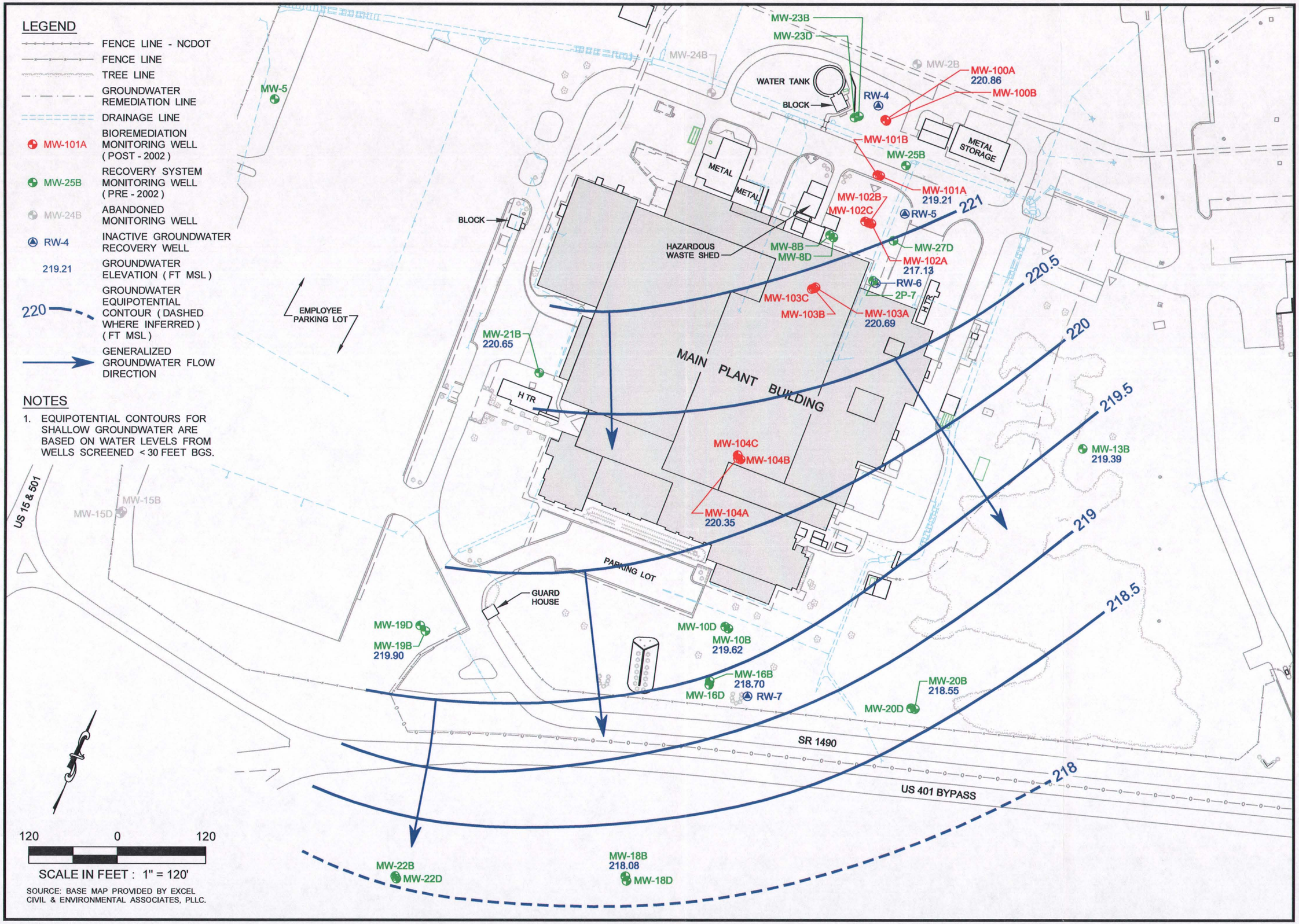
SHEET NUMBER: B100127B

## LEGEND

- FENCE LINE - NCDOT
- FENCE LINE
- TREE LINE
- GROUNDWATER REMEDIATION LINE
- DRAINAGE LINE
- MW-101A — BIOREMEDIATION MONITORING WELL (POST - 2002)
- MW-25B — RECOVERY SYSTEM MONITORING WELL (PRE - 2002)
- MW-24B — ABANDONED MONITORING WELL
- RW-4 — INACTIVE GROUNDWATER RECOVERY WELL
- 219.21 — GROUNDWATER ELEVATION (FT MSL)
- 220 — GROUNDWATER EQUIPOTENTIAL CONTOUR (DASHED WHERE INFERRED) (FT MSL)
- GENERALIZED GROUNDWATER FLOW DIRECTION

## NOTES

1. EQUIPOTENTIAL CONTOURS FOR SHALLOW GROUNDWATER ARE BASED ON WATER LEVELS FROM WELLS SCREENED < 30 FEET BGS.




SOURCE: BASE MAP PROVIDED BY EXCEL CIVIL & ENVIRONMENTAL ASSOCIATES, PLLC.

| REVISIONS | | | |
|---|---|---|---|
| NO.: | DESCRIPTION: | DATE: | BY: |

DESIGNED BY:
DRAWN BY: KLR
CHECKED BY:
APPROVED BY:

AECOM


AECOM North Carolina, Inc.
RALEIGH, NORTH CAROLINA 27616
PHONE: (919) 872-6600
FAX: (919) 872-7996
WEB: HTTP://WWW.AECOM.COM

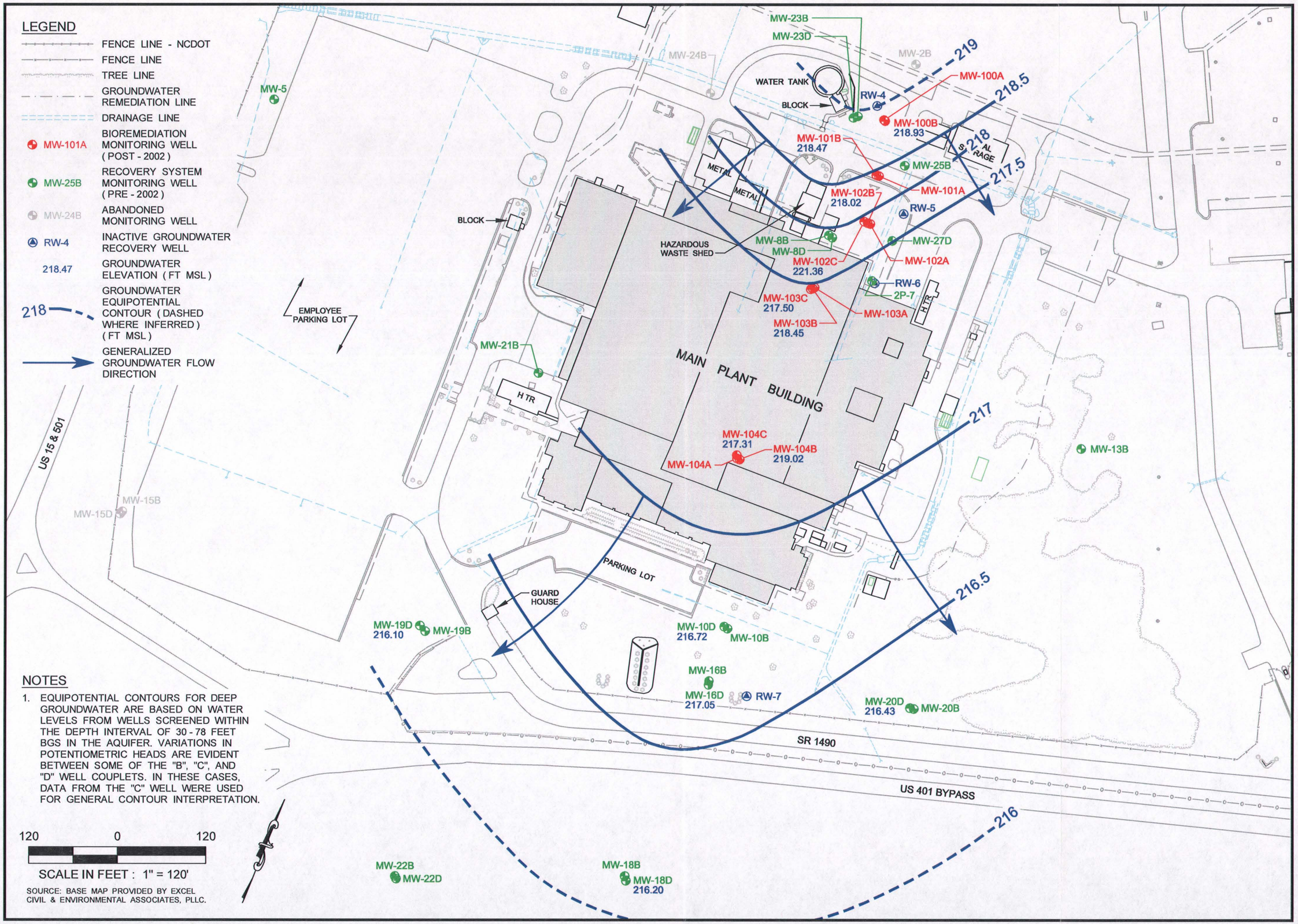

# SHALLOW GROUNDWATER POTENTIOMETRIC SURFACE MAP NOVEMBER 2009

Former Abbott Facility
Laurinburg, North Carolina

| SCALE: | DATE: | PROJECT NUMBER: |
|---|---|---|
| 1"=120' | 3/29/10 | 60135880.300 |

FIGURE NUMBER: 3

SHEET NUMBER: B100128B




## NOTES

1. EQUIPOTENTIAL CONTOURS FOR DEEP GROUNDWATER ARE BASED ON WATER LEVELS FROM WELLS SCREENED WITHIN THE DEPTH INTERVAL OF 30 - 78 FEET BGS IN THE AQUIFER. VARIATIONS IN POTENTIOMETRIC HEADS ARE EVIDENT BETWEEN SOME OF THE "B", "C", AND "D" WELL COUPLETS. IN THESE CASES, DATA FROM THE "C" WELL WERE USED FOR GENERAL CONTOUR INTERPRETATION.

120 0 120

SCALE IN FEET : 1" = 120'

SOURCE: BASE MAP PROVIDED BY EXCEL CIVIL & ENVIRONMENTAL ASSOCIATES, PLLC.

| REVISIONS | | | |
|---|---|---|---|
| NO.: | DESCRIPTION: | DATE: | BY: |

DESIGNED BY:
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# DEEP GROUNDWATER POTENTIOMETRIC SURFACE MAP NOVEMBER 2009

Former Abbott Facility
Laurinburg, North Carolina

| SCALE: | DATE: | PROJECT NUMBER: |
|---|---|---|
| 1"=120' | 3/29/10 | 60135880.500 |

FIGURE NUMBER: 4

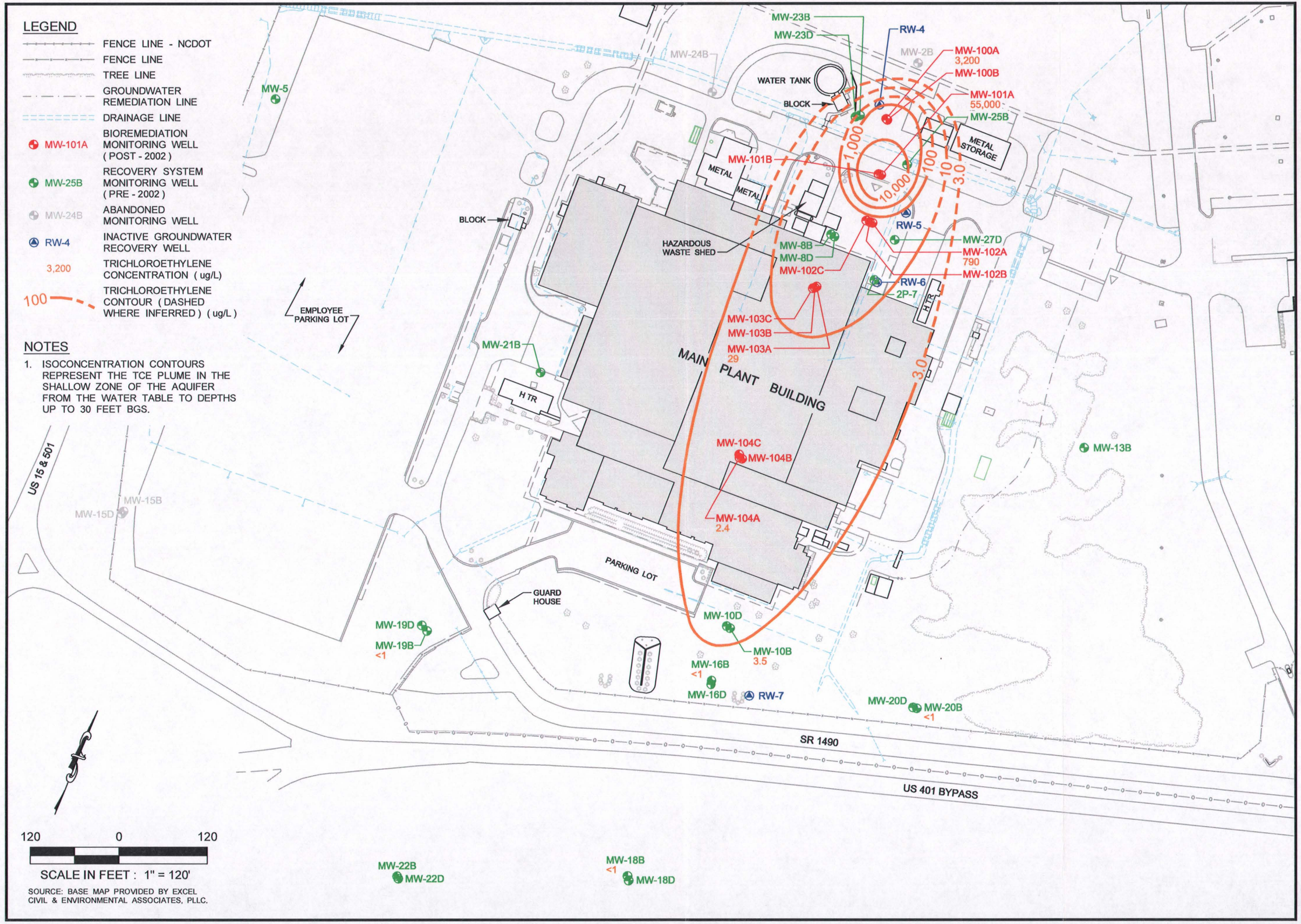
SHEET NUMBER: B100129B

## LEGEND

- FENCE LINE - NCDOT
- FENCE LINE
- TREE LINE
- GROUNDWATER REMEDIATION LINE
- DRAINAGE LINE
- MW-101A — BIOREMEDIATION MONITORING WELL ( POST - 2002 )
- MW-25B — RECOVERY SYSTEM MONITORING WELL ( PRE - 2002 )
- MW-24B — ABANDONED MONITORING WELL
- RW-4 — INACTIVE GROUNDWATER RECOVERY WELL
- 3,200 — TRICHLOROETHYLENE CONCENTRATION ( ug/L)
- 100 — TRICHLOROETHYLENE CONTOUR ( DASHED WHERE INFERRED ) ( ug/L )

## NOTES

1. ISOCONCENTRATION CONTOURS REPRESENT THE TCE PLUME IN THE SHALLOW ZONE OF THE AQUIFER FROM THE WATER TABLE TO DEPTHS UP TO 30 FEET BGS.




SOURCE: BASE MAP PROVIDED BY EXCEL CIVIL & ENVIRONMENTAL ASSOCIATES, PLLC.

| REVISIONS | | | |
|---|---|---|---|
| NO.: | DESCRIPTION: | DATE: | BY: |

DESIGNED BY:
DRAWN BY: KLR
CHECKED BY:
APPROVED BY:

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PHONE: (919) 872-6600
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# TCE IN GROUNDWATER: SHALLOW AQUIFER ZONE NOVEMBER 2009

Former Abbott Facility
Laurinburg, North Carolina

SCALE: 1"=120'
DATE: 3/29/10
PROJECT NUMBER: 60135880.300

FIGURE NUMBER: 5

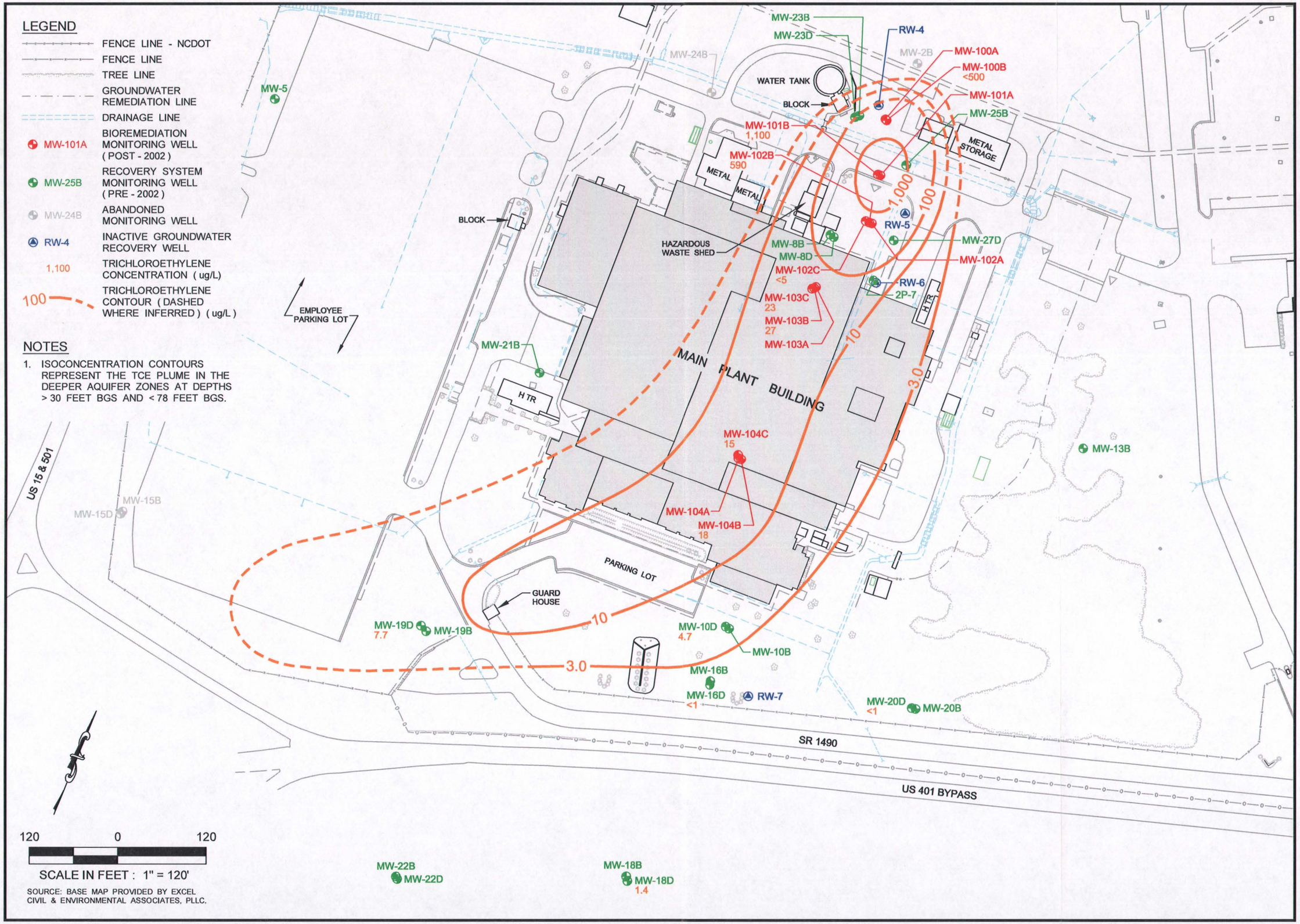
SHEET NUMBER: C100130B

## LEGEND

- FENCE LINE - NCDOT
- FENCE LINE
- TREE LINE
- GROUNDWATER REMEDIATION LINE
- DRAINAGE LINE
- MW-101A — BIOREMEDIATION MONITORING WELL ( POST - 2002 )
- MW-25B — RECOVERY SYSTEM MONITORING WELL ( PRE - 2002 )
- MW-24B — ABANDONED MONITORING WELL
- RW-4 — INACTIVE GROUNDWATER RECOVERY WELL
- 1,100 — TRICHLOROETHYLENE CONCENTRATION ( ug/L)
- 100 — TRICHLOROETHYLENE CONTOUR ( DASHED WHERE INFERRED ) ( ug/L )

## NOTES

1. ISOCONCENTRATION CONTOURS REPRESENT THE TCE PLUME IN THE DEEPER AQUIFER ZONES AT DEPTHS > 30 FEET BGS AND < 78 FEET BGS.




120 0 120

SCALE IN FEET : 1" = 120'

SOURCE: BASE MAP PROVIDED BY EXCEL CIVIL & ENVIRONMENTAL ASSOCIATES, PLLC.

| REVISIONS | | | |
|---|---|---|---|
| NO.: | DESCRIPTION: | DATE: | BY: |

DESIGNED BY:
DRAWN BY: KLR
CHECKED BY:
APPROVED BY:

AECOM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RALEIGH, NORTH CAROLINA 27616
PHONE: (919) 872-6600
FAX: (919) 872-7996
WEB: HTTP://WWW.AECOM.COM

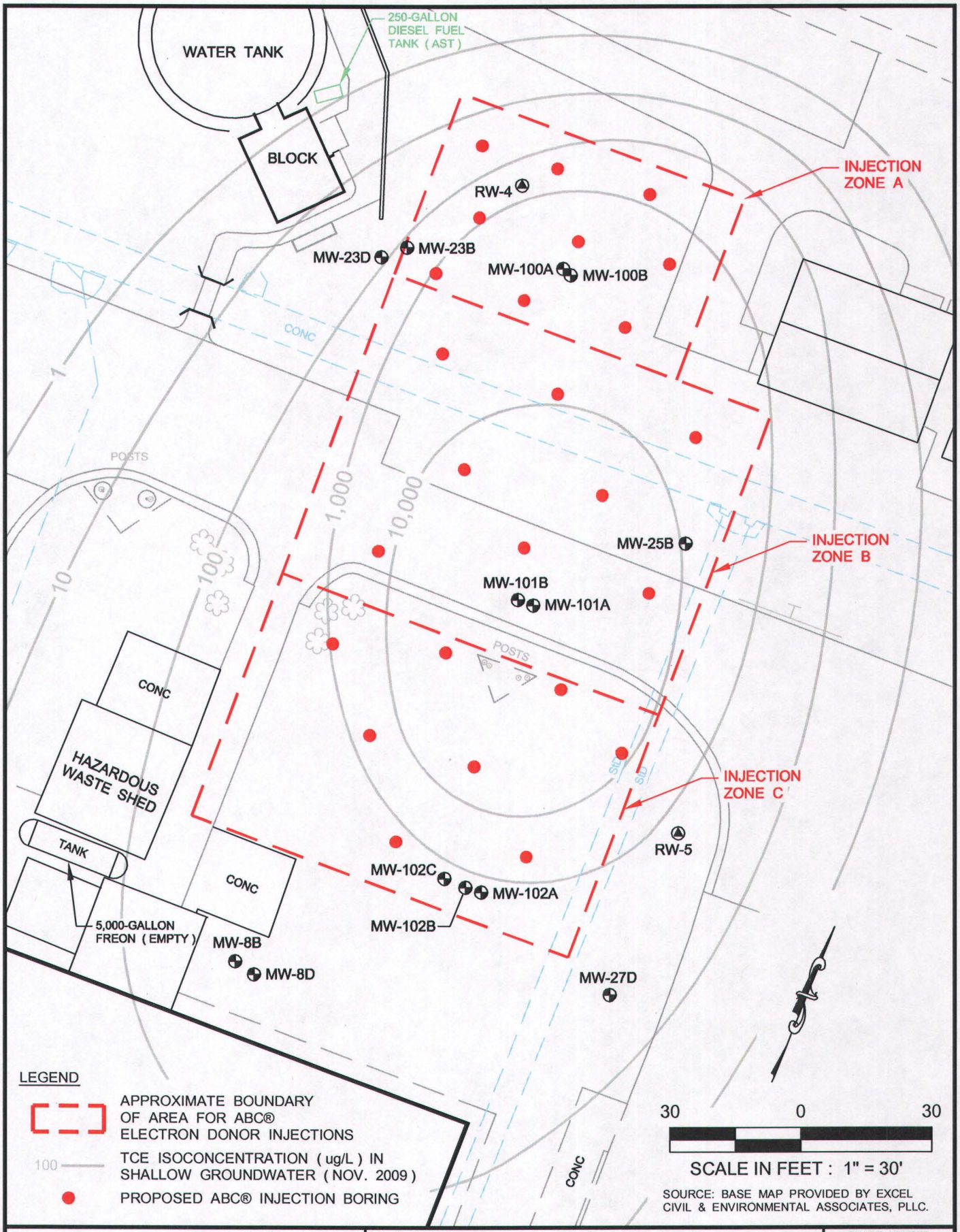

# TCE IN GROUNDWATER: DEEP AQUIFER ZONE NOVEMBER 2009

Former Abbott Facility
Laurinburg, North Carolina

| SCALE: | DATE: | PROJECT NUMBER: |
|---|---|---|
| 1"=120' | 3/29/10 | 60135880.300 |

FIGURE NUMBER: 6

SHEET NUMBER: C100131B




AECOM

**AECOM North Carolina, Inc.**
RALEIGH, NORTH CAROLINA 27615
PHONE: (919) 872-6600
FAX: (919) 872-7996
WEB: HTTP://WWW.AECOM.COM

APPROXIMATE ABC® ELECTRON DONOR INJECTION AREA
SOLVENT PLUME REMEDIATION

Former Abbott Facility
Laurinburg, North Carolina

| FIGURE NUMBER: | |
|---|---|
| 7 | |

| DRAWN BY: | DATE: | PROJECT NUMBER: | DRAWING NUMBER: |
|---|---|---|---|
| KLR | 3/29/10 | 60135880.300 | B100132A |

# Appendix A

## AECOM Reports (2010) on CD Format

***Supplemental Subsurface Investigation Report (April 2010)***

***Progress Report for 3rd and 4th Quarters 2009: Groundwater Monitoring and Annual Remediation Effectiveness Evaluation (February 2010)***

# Appendix B

# Material Safety Data Sheets

**Material Safety Data Sheet**
May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910 1200. Standard must be consulted for specific requirements.

**U.S. Department of Labor**
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY *(as Used on Label and List)*
*ABC (Anaerobic BioChem)*

*Note: Blank spaces are not permitted. If any item is not applicable or no information is available, the space must be marked to indicate that.*

**Section I**

| | |
|---|---|
| Manufacturer's name<br>REDOX TECH, LLC | Emergency Telephone Number 919-678-0140 |
| Address *(Number, Street, City, State and ZIP Code)*<br>200 Quade Dr, Cary NC 27513 | Telephone Number for Information 919-678-0140 |
| | Date Prepared MAY 2004 |
| | Signature of Preparer *(optional)* |

**Section II—Hazardous Ingredients/Identity Information**

| Hazardous Components (Specific Chemical Identity, Common Name(s)) | OSHA PEL | ACGIH TLV | Other Limits Recommended | % (optional) |
|---|---|---|---|---|
| Mixture of : | | | | |
| Lactate salts | NA | NA | | (0 to 60%) |
| Lactic acid esters | NA | NA | | (0 to 98.5%) |
| Phosphate buffer | NA | NA | | (0 to 0.1%) |
| Ferrous Iron | NA | NA | | (0 to 0.1%) |
| Fatty Acids | NA | NA | | (0 to 5%) |

**Section III—Physical/Chemical Characteristics**

| | | | |
|---|---|---|---|
| Boiling Point | > 100 C | Specific Gravity ($H_20$ = 1) | 1.04 |
| Vapor Pressure (mm Hg) Lactic acid esters | 2.7 mbar. 20 °C | pH | 6.0 to 8.0 |
| Vapor Density (AIR = 1) Lactic acid esters | 3.8 | Evaporation Rate (Butyl Acetate = 1) | No information |

Solubility in Water: Fully soluble and miscible

Appearance and Odor: Light yellow to colorless liquid, slight to mild, characteristic odor

**Section IV—Fire and Explosion Hazard Data**

| Flash Point (Method Used) | Flammable Limits | LEL | UEL |
|---|---|---|---|
| Lactic acid esters: 61 °C (ISO 2719, closed cup) | Lactic acid esters: | 1.5% (100 °C) | 11.4% (100 °C) |

Extinguishing Media: Water spray, carbon dioxide, dry powder, AFFF, foam

Special Fire Fighting Procedures

Standard procedures for chemical fires

Unusual Fire and Explosion Hazards

Thermal decomposition can release irritating gases and vapors

## Section V—Reactivity Data

| Stability | Unstable | | Conditions to Avoid |
|---|---|---|---|
| | Stable | X | Temperatures above 61 °C. Will hydrolyze in presence of water, acids and bases |

Incompatibility *(Materials to Avoid)* Strong oxidants

Hazardous Decomposition or Byproducts no known

| Hazardous Polymerization | May Occur | | Conditions to Avoid |
|---|---|---|---|
| | Will Not Occur | X | |

## Section VI—Health Hazard Data

Route(s) of Entry Inhalation? Yes, esters only Skin? Yes Ingestion? Yes

Health Hazards *(Acute and Chronic)* Acid esters: Risk of irritation to eyes. Irritating to respiratory system. May degrease skin.

Carcinogenicity None NTP? No IARC Monographs? No OSHA Regulated? No

Signs and Symptoms of Exposure Red irritated skin. May cause light-headedness when used in poorly ventilated area without proper vapor mask..

Medical Conditions Generally Aggravated by Exposure Persons susceptible or sensitive to eye and respiratory irritation

Emergency and First Aid Procedures Inhalation: Move to fresh air; Skin: Wash skin immediately with water. Eyes: Flush with water for at least 15 minutes, consult physician; Ingestion: Drink water and consult physician.

## Section VII—Precautions for Safe Handling and Use

Use safety glasses and latex or nitrile gloves. Work in well ventilated area.

Waste Disposal Method ABC can be disposed as waste water or landfilled when in compliance with local regulations

Precautions to Be Taken in Handling and Storing May be F lammable - Do not store near ignition sources or at elevated temperatures.

Avoid long storage times, will break down to innocuous products

Other Precautions Wear PPE when handling and keep containers tightly closed when stored.

## Section VII—Control Measures

Respiratory Protection *(Specify Type)* If ventilation inadequate or in confined space, use respirator with filter (DIN 141)

| Ventilation | Local Exhaust | Special |
|---|---|---|
| | Acid esters have low vapor pressure (2.7 mbar at 20 °C) Standard HVAC conditions typically adequate | Ensure fumes can not reach ignition source |
| | Mechanical *(General)* Floor or stand fans | Other |

Protective Gloves PVA, nitrile or latex Eye Protection Safety glasses with side shields

Other Protective Clothing or Equipment

Work/Hygienic Practices Do not eat, drink or smoke while handling. Remove/wash contaminated clothing before reuse.

# Material Safety Data Sheet


## *Shaw Environmental, Inc.*

***17 PRINCESS ROAD***
***LAWRENCEVILLE, N.J. 08648***
***(609) 895-5340***


### SECTION 1 - MATERIAL IDENTIFICATION AND INFORMATION

Material Name: DHC microbial consortium (RTB-1) MSDS #: ENV 1033

Date Prepared: 10/06/2003 CAS #: N/A (Not Applicable)

Prepared By: Simon Vainberg Formula #: N/A

Material Description: Non-hazardous, naturally occurring non-altered anaerobic microbes and enzymes in a water-based medium.

**24 HOUR EMERGENCY RESPONSE PHONE NUMBER (800)424-9300**

### SECTION 2 - INGREDIENTS

| Components | % | OSHA PEL | ACGIH TLV | OTHER LIMITS |
|---|---|---|---|---|
| Non-Hazardous Ingredients | 100 | N/A | N/A | N/A |

### SECTION 3 - PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point: 100°C (water)

Specific Gravity ($H_2O$ = 1): 0.9 - 1.1

Vapor Pressure @ 25°C: 24 mm Hg (water)

Melting Point: 0°C (water)

Vapor Density: N/A

Evaporation Rate ($H_2O$ = 1): 0.9 - 1.1

Solubility in Water: Soluble

Water Reactive: No

pH: 6.0 - 8.0

Appearance and Odor: Murky, yellow water. Musty odor.

## SECTION 4 - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

Flammable Limits: N/A

Extinguishing Media: Foam, carbon dioxide, water

Special Fire Fighting Procedures: None

Unusual Fire and Explosion Hazards: None

## SECTION 5 - REACTIVITY DATA

Stability: Stable

Conditions to Avoid: None

Incompatibility (Materials to Avoid): Water-reactive materials

Hazardous Decomposition Byproducts: None

## SECTION 6 - HEALTH HAZARD DATA

HEALTH EFFECTS

The effects of exposure to this material have not been determined. Safe handling of this material on a long-term basis will avoid any possible effect from repetitive acute exposures. Below are possible health effects based on information from similar materials. Individuals hyper allergic to enzymes or other related proteins should not handle.

Ingestion: Ingestion of large quantities may result in abdominal discomfort including nausea, vomiting, cramps, diarrhea, and fever.

Inhalation: Hypersensitive individuals may experience breathing difficulties after inhalation of aerosols.

Skin Absorption: N/A

Skin Contact: May cause skin irritation. Hypersensitive individuals may experience allergic reactions to enzymes.

Eye Contact: May cause eye irritation.

FIRST AID

Ingestion: Get medical attention if allergic symptoms develop (observe for 48 hours). Never give anything by mouth to an unconscious or convulsing person.

Inhalation: Get medical attention if allergic symptoms develop.

Skin Absorption: N/A

Skin Contact: Wash affected area with soap and water. Get medical attention if allergic symptoms develop.

Eye Contact: Flush eyes with plenty of water for at least 15 minutes using an eyewash fountain, if available. Get medical attention if irritation occurs.

**NOTE TO PHYSICIANS:** All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to materials other than this material may have occurred.

## SECTION 7 - SPILL AND LEAK PROCEDURES

Reportable quantities (in lbs of EPA Hazardous Substances): N/A

Steps to be taken in case of spill or release: No emergency results from spillage. However, spills should be cleaned up promptly. All personnel involved in the cleanup must wear protective clothing and avoid skin contact. Absorb spilled material or vacuum into a container. After clean-up, disinfect all cleaning materials and storage containers that come in contact with the spilled liquid.

Waste Disposal Method: No special disposal methods are required. The material may be sewered, and is compatible with all known biological treatment methods. To reduce odors and permanently inactivate microorganisms, mix 100 parts (by volume) of DHC consortium with 1 part (by volume) of bleach. Dispose of in accordance with local, state and federal regulations.

## SECTION 8 - HANDLING AND STORAGE

Hand Protection: Rubber gloves.

Eye Protection: Safety goggles with side splash shields.

Protective Clothing: Use adequate clothing to prevent skin contact.

Respiratory Protection: Surgical mask.

Ventilation: Provide adequate ventilation to remove odors.

Storage & Handling:
Material may be stored for up to 3 weeks at 2-4°C without aeration.

Other Precautions: An eyewash station in the work area is recommended.

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While the information and recommendations set forth herein are believed to be accurate as of the date hereof, Shaw Environmental, Inc. MAKES NO WARRANTY WITH RESPECT HERETO AND DISCLAIMS ALL LIABILITY FROM RELIANCE THEREON.