NEW YORK STATE DEPARTMENT OF
ENVIRONMENTAL CONSERVATION

In the Matter of Alleged Violations of Articles 3, 17, 27, and 71 of the New York State Environmental Conservation Law ("ECL") and Parts 370 through 373, and 703 of Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York ("NYCRR") and the Development and Implementation of a Remedial Program for an Inactive Hazardous Waste Disposal Site under Article 27, Titles 9 and 13, and, Article 71 of the Environmental Conservation Law By ELT Harriman LLC ("Respondent").	**ORDER ON CONSENT** Index # CO 3-20140425-70 Site # 336006 RCRA Permit No.: 3·3340-00027·4 EPA ID #: NYD002014595

WHEREAS,

1. A. The New York State Department of Environmental Conservation ("Department") is responsible for the Resource Conservation and Recovery Act Program (RCRA a/k/a the "Industrial Hazardous Waste Management Program") pursuant to Article 27, Title 9 of the Environmental Conservation Law ("ECL") and Title 6 of the Official Compilation of Codes, Rules and Regulations ("6 NYCRR") Parts 370 – 373 and may issue orders consistent with the authority granted to the Commissioner by such statute.

B. The Department is responsible for carrying out the policy of the State of New York to conserve, improve and protect its natural resources and environment and control water, land and air pollution consistent with the authority granted to the Department and the Commissioner by Article 1, Title 3 of the ECL.

C. This Order is issued pursuant to the Department's authority under, *inter alia,* ECL Article 27, Title 9 and 13, ECL Article 71-2727 and ECL 3-0301.

2. Respondent ELT Harriman LLC ("Respondent") is a corporation organized and existing under the laws of the State of Missouri and is authorized to do business in New York State. Respondent is the owner of a former chemical and pharmaceutical manufacturing facility located in the village of Harriman in Orange County, 41 Arden House Road, Harriman, NY (the "Facility"). Additionally, the Facility is contained within a larger class 2 site (the "Site") with a site number of 336006 in the *Registry of Inactive Hazardous Waste Disposal Sites in New York State.* A map depicting the general boundaries of the Site is attached hereto as Exhibit "A."

3. Manufacturing operations generated significant quantities of hazardous waste and hazardous constituents. The owner and operator of the Site immediately prior to Respondent,

Rutherford Chemicals LLC ("Rutherford"), remains currently listed as permittee for a 6 NYCRR Part 373 permit that governs corrective action, closure, and post-closure activities to address this contamination on portions of the Site (RCRA Permit No. 3·3340-00027·4 EPA ID #: NYD002014595) (the "RCRA Permit"). In December 2007, Respondent and Rutherford jointly requested transfer of the RCRA Permit to Respondent. Respondent has been carrying out activities pursuant to the RCRA Permit notwithstanding that a formal transfer or amendment of the RCRA Permit to Respondent has not yet been affected by the Department.

4. Respondent and its predecessors have performed some corrective action activities at the Site including investigations to determine the nature and extent of chemicals present in the soil, vapor and groundwater, and removal and/or closure of potential sources all as per Department-approved work plans.

5. Additionally, further remedial activity has occurred at the Site, which has been completed by previous owners of the Site and their successors pursuant to a Record of Decision dated March 27, 1997 ("ROD") and its implementing Consent Decree entered before the United States District Court for the Southern District of New York, 98 Civ. 3165, in 1998 ("Consent Decree"). Those parties are also completing further remedial investigations at the Site pursuant to a federal court Stipulation and Order entered in the action from which the Consent Decree was issued.

6. Manufacturing operations also released hazardous substances to groundwater, storm water, and a holding lagoon, requiring a State Pollutant Discharge Elimination System ("SPDES") permit pursuant to ECL Article 17 Title 8 for the Facility (the "SPDES permit").

7. On or about March 10th, 2011, in response to extensive and severe precipitation creating water levels substantially above normal levels that threatened a breach of the walls of the lagoon, Respondent requested and the Department issued to Respondent an Emergency Authorization to release water from its lagoon at the Facility. The Emergency Authorization set clear standards for the effluent, including an effluent limitation of 50 ng/l for mercury. Respondent sampled the lagoon on this date and on several occasions prior to the issuance of the Emergency Authorization to compare the water quality to that set forth in the Emergency Authorization, including samples testing the quantity of mercury present. All sample results indicated that mercury concentrations were below that set forth in the Emergency Authorization.

8. On March 14th, 2011, Respondent again took samples of the lagoon water to test for mercury.

9. On March 15th, 2011, based on the results of the March 10, 2011, sampling, but prior to receiving the March 14th, 2011, sample results, Respondent caused to be released approximately 2,000 gallons of contaminated water from the lagoon at the Facility into the Ramapo River.

10. On March 16th, 2011, based on the results of the March 10, 2011, sampling, but prior to receiving the March 14th, 2011, sample results, Respondent caused to be released approximately 116,000 gallons of contaminated water from the lagoon at the Facility into the Ramapo River.

11. Sampling results from samples taken from the lagoon on March 14 and other dates subsequent, show levels of Mercury at over 500 ng/l, in excess of the Emergency Authorization Permit. Upon discovering the results of the March 14, 2011, sampling event, Respondent immediately ceased discharging from the lagoon.

12. Respondent subsequently engaged in substantial efforts to address stormwater at the Site, including transporting the water offsite to qualified treatment facilities to reduce dangerous levels in the lagoon and avoid the stormwater overtopping; researching, purchasing, and operating permanent on-site treatment systems; and maintaining and improving the lagoon and related discharge facilities at the Site. Respondent has expended substantial funds to accomplish these improvements. Further, Respondent has maintained compliance with the SPDES Permit water quality requirements for all stormwater discharges since.

13. Respondent admits that releases of water from the lagoon into the Ramapo River in excess of the Emergency Authorization were in violation of the Article 17 of the Environmental Conservation Law and the Emergency Authorization Permit.

14. The purpose of this Order is to provide for the implementation of a supplemental Remedial Investigation/Feasibility Study ("RI/FS") that is attached to this Order and to provide for the payment of $10,000 to resolve past violations and the payment of $103,000 to resolve unpaid past fees.

15. Respondent consents to the issuance of this Order without (i) an admission or finding of liability, fault, wrongdoing, or violation of any law, regulation, permit, order, requirement, or standard of care of any kind whatsoever (other than the admission in paragraph 11 above); (ii) an acknowledgment that there has been a release or threatened release or disposal of hazardous waste, hazardous substances or petroleum at or from the Site; and/or (iii) an acknowledgment that a release or threatened release of hazardous waste, hazardous substances or petroleum at or from the Site constitutes a significant threat to the public health or environment.

16. Solely with regard to the matters set forth below, Respondent hereby waives any right to a hearing as may be provided by law, consents to the issuance and entry of this Order, and agrees to be bound by its terms. Respondent consents to and agrees not to contest the authority or jurisdiction of the Department to issue or enforce this Order in accordance with its terms, and agrees not to contest the validity of this Order or its terms.

NOW, having considered this matter and being duly advised, **IT IS ORDERED THAT**:

I. Effect of Order

Except as otherwise described herein, this Order shall have no effect on the existing RCRA Permit for the Facility, except that, subsequent to the effective date of this Order, the Department shall amend the RCRA Permit administratively to add Respondent as a co-permittee, and both the Department and Respondent reserve all of their rights and defenses existing under the RCRA Permit, under Article 27, Title 9 of the ECL, and under 6 NYCRR Parts 370 – 373.

The parties to this Order acknowledge that while this Order addresses remedial obligations related to the RCRA Permit, it is the intention of the parties that the Work Plan itself will be carried out consistent with governing legal requirements and standards, including but not limited to, as applicable, the soil cleanup objectives contained within 6 NYCRR Part 375. The parties also acknowledge that it is currently the intent of the parties to enter into a subsequent order pursuant to 6 NYCRR Part 375 to address any necessary remedial action remaining after implementation of the Work Plan.

Additionally, this Order shall not in any way regulate or affect the SPDES permit for the Facility except that the SPDES permit will require modification to authorize discharges that may occur during demolition and remediation activities, which Respondent agrees to apply for and the Department agrees to support and process as expeditiously as possible.

II. Financial Assurance

A. Rutherford, a listed permitee on the RCRA Permit, currently maintains financial assurance in the form of a letter of credit and unfunded standby trust agreement for closure of the Facility in the amount of $973,842 and insurance coverage for sudden accidental occurrences as required by 6 NYCRR 373-2.8(h). Within 30 days of the effective date of this Order, Respondent agrees to assume this responsibility, and will post financial assurance in the amount of $250,000 as documented in the approved Work Plan. Respondent will obtain necessary liability coverage as required by 6 NYCRR 373-2.8(h) as soon as is reasonably practicable. Once Respondent posts financial assurance in the amount of $250,000, the Department will release the Rutherford letter of credit and unfunded standby trust agreement.

B. The parties hereby acknowledge and agree that Respondent will establish financial assurance and liability coverage utilizing one or more of the mechanisms contained in 6 NYCRR 373-2.8(d) and 2.8(h), respectively.

C. After posting financial assurance for closure as required by 6 NYCRR 373-2.8(d), Respondent shall have the ability to submit documentation to the Department showing that the Facility has been properly closed consistent with the requirements of 6 NYCRR Parts 370-373 and the RCRA Permit and requesting release of the financial assurance. The specific requirements to achieve "closure" are specified in the approved Work Plan that is annexed hereto and incorporated herewith as Exhibit B. Upon completion of the specific requirements to achieve "closure" Respondent shall submit a report to the Department, certified by a licensed Professional Engineer, certifying that all of the requirements for "closure" have been completed. The Department shall not unreasonably withhold its determination that the Facility has been properly closed and that financial assurance can be released. The liability coverage will be released pursuant to the procedure contained in 6 NYCRR 373-2.8(h).

D. The Department contends that financial assurance for corrective action at the Facility is required and currently inadequate. Respondent contends that financial assurance for corrective action is not yet required and that the current financial assurance for closure is adequate. Both parties reserve all of their rights under the RCRA Permit, under Article 27, Title

9 of the ECL, and under 6 NYCRR Parts 370 – 373 regarding financial assurance for corrective action at the Facility.

III. Development, Performance and Reporting of Work Plans

A. Work Plans

Upon execution of this Order by the Commissioner, the Supplemental RI/FS work plan attached to this Order as Exhibit B is approved and is hereby incorporated into and is an enforceable part of this Order. All activities at the Site shall be conducted pursuant to the Work Plan, which was developed in accordance with DER-10, and this Order and all activities shall be consistent with the RCRA Permit and governing statutes, regulations, and guidance documents.

B. Submission/Implementation of Work Plans

1. (a) Within thirty (30) days of the effective date of this Order, Respondent agrees to commence implementation of the Supplemental RI/FS Work Plan that is attached to this Order as Exhibit B.

(b) The Department may request that Respondent submit additional or supplemental Work Plans for the Site to complete an RI/FS investigation of those portions of the Site that are addressed in the approved Work Plan that is attached to this order as Exhibit B. Within thirty (30) days after the Department's written request, Respondent shall advise the Department in writing whether the requested additional or supplemental Work Plan will be submitted and implemented. If Respondent elects to submit and implement such Work Plan, Respondent shall submit the requested Work Plan within sixty (60) days after such election.

(c) Respondent may opt to propose one or more additional or supplemental Work Plans at any time, which the Department shall review for appropriateness and technical sufficiency.

(d) Any request made by the Department under Subparagraph III.B.1.(b) shall be subject to dispute resolution pursuant to Paragraph XI.

2. A Professional Engineer must stamp and sign all Work Plans, except as otherwise authorized by DER-10-1.5.

C. Modifications to Work Plans

The Department shall notify Respondent in writing if the Department determines that any element(s) of a Department-approved Work Plan needs to be modified in order to achieve the objectives of the Work Plan as set forth in Subparagraph III.A or to ensure protection of human health and the environment. Upon receipt of such notification, Respondent shall either provide written notification as provided at 6 NYCRR 375-1.6(d)(3) as to whether it will modify the Work Plan, or invoke dispute resolution. Any agreed-upon modifications or modifications

resulting from the dispute resolution process will be incorporated into and become an enforceable part of this Order.

D. Submission of Final Reports and Periodic Review Reports

1. In accordance with the schedule contained in the Supplemental RI/FS Work Plan, Respondent shall submit a final report meeting applicable RCRA Permit, regulatory and guidance requirements, including DER-10.

2. Within sixty (60) days after the Department's approval of a final report, Respondent shall submit such final report, as well as all data gathered and drawings and submittals made pursuant to such Work Plan, in an electronic format acceptable to the Department. If any document cannot be converted into electronic format, Respondent shall submit such document in an alternative format acceptable to the Department.

E. Review of Submittals

1. The Department shall make a good faith effort to review and respond in writing to each submittal Respondent makes pursuant to this Order within sixty (60) days. The Department's response shall include an approval, modification request, or disapproval of the submittal, in whole or in part.

2. If the Department modifies or requests modifications to a submittal, it shall specify the reasons for such modification(s). Within thirty (30) days after the date of the Department's written notice that Respondent's submittal has been disapproved, Respondent shall notify the Department of its election to either modify the submittal as requested by the Department, to accept a Department modified submittal, or to invoke dispute resolution. If Respondent elects to modify or accept the Department's modifications to the submittal, Respondent shall, within sixty (60) days after such election, make a revised submittal that incorporates all of the Department's modifications to the first submittal. In the event that Respondent's revised submittal is disapproved, the Department shall set forth its reasons for such disapproval in writing and Respondent shall be in violation of this Order unless it invokes dispute resolution pursuant to Paragraph XII and its position prevails. Failure to make an election or failure to comply with the election is a violation of this Order.

3. If the Department disapproves a submittal, it shall specify the reasons for its disapproval. Within thirty (30) days after the date of the Department's written notice that Respondent's submittal has been disapproved, Respondent shall notify the Department of its election to either modify the disapproved submittal to invoke dispute resolution. If Respondent elects to modify the submittal, Respondent shall, within sixty (60) days after such election, make a revised submittal that addresses all of the Department's stated reasons for disapproving the first submittal. In the event that Respondent's revised submittal is disapproved, the Department shall set forth its reasons for such disapproval in writing and Respondent shall be in violation of this Order unless it invokes dispute resolution pursuant to Paragraph XII and its position prevails. Failure to make an election or failure to comply with the election is a violation of this Order.

IV. Penalties

A. Respondent shall pay a civil penalty to resolve violations surrounding exceedances of its SPDES permit in March of 2011 in the amount of TEN THOUSAND DOLLARS ($10,000). Respondent will pay this amount within thirty (30) calendar days of the effective date of this Order, by check made payable to the order of the New York State Department of Environmental Conservation. Respondent will submit such settlement payments as required by this Order to:

Office of General Counsel
New York State Department of Environmental Conservation
625 Broadway, Floor 14th Floor
Albany, New York 12233-5500
Attn: Andrew Guglielmi, Esq.

B. Respondent's failure to comply with any term of this Order constitutes a violation of this Order and the ECL.

C. 1. Respondent shall not suffer any penalty or be subject to any proceeding or action in the event it cannot comply with any requirement of this Order as a result of any event arising from causes beyond the reasonable control of Respondent, of any entity controlled by Respondent, and of Respondent's contractors, that delays or prevents the performance of any obligation under this Order despite Respondent's best efforts to fulfill the obligation ("Force Majeure Event"). The requirement that Respondent exercises best efforts to fulfill the obligation includes using best efforts to anticipate the potential Force Majeure Event, best efforts to address any such event as it is occurring, and best efforts following the Force Majeure Event to minimize delay to the greatest extent possible. "Force Majeure" does not include Respondent's economic inability to comply with any obligation, the failure of Respondent to make complete and timely application for any required approval or permit, and non-attainment of the goals, standards, and requirements of this Order.

2. Respondent shall notify the Department in writing within fifteen (15) days after it obtains knowledge of any Force Majeure Event. Respondent shall include in such notice the measures taken and to be taken to prevent or minimize any delays and shall request an appropriate extension or modification of this Order. Failure to give such notice within such fifteen (15) Day period constitutes a waiver of any claim that a delay is not subject to penalties. Respondent shall be deemed to know of any circumstance which it, any entity controlled by it, or its contractors knew or should have known.

3. Respondent shall have the burden of proving by a preponderance of the evidence that (i) the delay or anticipated delay has been or will be caused by a Force Majeure Event; (ii) the duration of the delay or the extension sought warranted under the circumstances; (iii) best efforts were exercised to avoid and mitigate the effects of the delay; and (iv) Respondent complied with the requirements of Subparagraph IV.B.2 regarding timely notification.

4. If the Department agrees that the delay or anticipated delay is attributable to a Force Majeure Event, the time for performance of the obligations that are affected by the Force Majeure Event shall be extended for such time as is reasonably necessary to complete those obligations.

V. Entry upon Site

A. Respondent hereby consents, upon reasonable notice under the circumstances presented, to entry upon the Site (or areas in the vicinity of the Site which may be under the control of Respondent) by any duly designated officer or employee of the Department or any State agency having jurisdiction with respect to matters addressed pursuant to this Order, and by any agent, consultant, contractor, or other person so authorized by the Commissioner, all of whom shall abide by the health and safety rules in effect for the Site, for inspecting, sampling, copying records related to the contamination at the Site, testing, and any other activities necessary to ensure Respondent's compliance with this Order. Upon request, Respondent shall (i) provide the Department with suitable work space at the Site, including access to a telephone, to the extent available, and (ii) permit the Department full access to all non-privileged records relating to matters addressed by this Order. Raw data is not considered privileged and that portion of any privileged document containing raw data must be provided to the Department. In the event Respondent is unable to obtain any authorization from third-party property owners necessary to perform its obligations under this Order, the Department may, consistent with its legal authority, assist in obtaining such authorizations.

B. The Department shall have the right to take its own samples and scientific measurements and the Department and Respondent shall each have the right to obtain split samples, duplicate samples, or both, of all substances and materials sampled. The Department shall make the results of any such sampling and scientific measurements available to Respondent.

VI. Payment of State Costs and Fees

A. Within thirty (30) Days after the effective date of this Order, Respondent shall pay to the Department $103,000, which shall constitute payment in full and complete satisfaction of all outstanding past regulatory fees at the Facility. While this Order is in effect, all subsequent regulatory fees at the Facility will be suspended.

B. Subsequent to the effective date of this Order, the Department will begin to account and charge for State Costs for work performed at or in connection with the Site through and including the Termination Date, as provided in 6 NYCRR 375-1.5(b)(3). State Costs shall not include any costs incurred by the Department relative to the activities identified in Whereas Paragraph 5 above.

C. Costs shall be documented as provided by 6 NYCRR 375-1.5(b)(3(ii). The Department shall not be required to provide any other documentation of costs, provided however, that the Department's records shall be available consistent with, and in accordance with, Article 6 of the Public Officers Law.

D. Such invoice shall be sent to Respondent at the following address:

ELT Harriman LLC
1650 Des Peres Rd., Suite 303
St. Louis, MO 63131

E. Each such payment shall be made payable to the Department of Environmental Conservation and shall be sent to:

Bureau of Program Management
Division of Environmental Remediation
New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233-7010

F. Each party shall provide written notification to the other within ninety (90) Days of any change in the foregoing addresses.

G. Respondent may contest invoiced costs as provided at 6 NYCRR 375-1.5(b)(3)(v) and (vi).

VII. Reservation of Rights

A. Nothing contained in this Order shall be construed as barring, diminishing, adjudicating, or in any way affecting any of the Department's rights or authorities, including, but not limited to, the right to require performance of further investigations and/or response action(s), to recover natural resource damages, and/or to exercise any summary abatement powers with respect to any person, including Respondent. Additionally, nothing contained in this Order shall affect the rights the Department may have pursuant to the existing RCRA Permit, including but not limited to the right the Department has regarding the posting of financial assurance for corrective action, closure, and post-closure care.

B. Except as otherwise provided in this Order, Respondent specifically reserves all rights and defenses under applicable law respecting any Departmental assertion of remedial liability and/or natural resource damages against Respondent, and further reserves all rights respecting the enforcement of this Order, including the rights to notice, to be heard, to appeal, and to any other due process. Additionally, nothing contained in this Order shall affect the rights the Respondent may have pursuant to the existing RCRA Permit, and/or under Article 27, Title 9 of the ECL, and under 6 NYCRR Parts 370 – 373, including but not limited to any and all rights and remedies available to Respondent regarding financial assurance for corrective action, closure, and post-closure care, as well as in relation to Respondent's right to contest any requested modification to the RCRA Permit utilizing procedures applicable to permit modification contained in 6 NYCRR Part 621. The existence of this Order or Respondent's compliance with it shall not be construed as an admission of liability, fault, wrongdoing, or breach of standard of care by Respondent, and shall not give rise to any presumption of law or

finding of fact, or create any rights, or grant any cause of action, which shall inure to the benefit of any third party. Further, Respondent reserves such rights as it may have to seek and obtain contribution, indemnification, and/or any other form of recovery from its insurers and from other potentially responsible parties or their insurers for past or future response and/or cleanup costs or such other costs or damages arising from the contamination at the Site as may be provided by law, including but not limited to rights of contribution under section 113(f)(3)(B) of CERCLA, 42 U.S.C. § 9613(f)(3)(B).

VIII. Indemnification

Respondent shall indemnify and hold the Department, the State of New York, the Trustee of the State's natural resources, and their representatives and employees harmless for all claims, suits, actions, damages and costs resulting from the acts and/or omissions of Respondent, intentional, negligent, or otherwise, of every nature and description, arising out of or resulting from the compliance or attempted compliance with the provisions of this Order by Respondent or its employees, servants, agents, successors or assigns.

IX. Communications

A. All written communications required by this Order shall be transmitted by United States Postal Service, by electronic transmission including email or facsimile, by private courier service, or hand delivered as follows:

1. Communication from Respondent shall be sent to:

Attn: NYSDEC Project Manager, currently, Paul Patel, P.E.
NYS Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway, Albany, New York 12233-7014
appatel@gw.dec.state.ny.us

Note: One (1) hard copy of plans is required, as well as one (1) electronic copy.

with electronic copies to:

Attn: Andy Guglielmi, Esq.
NYS Department of Environmental Conservation
Office of General Counsel
625 Broadway, Albany, New York 12233-1500
aoguglie@gw.dec.state.ny.us

Section Chief in Remedial Bureau C, currently, David A. Crosby, P.E.
NYS Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway, Albany, New York 12233-7014
dacrosby@gw.dec.state.ny.us

Krista Anders (electronic copy only)
New York State Department of Health
Bureau of Environmental Exposure Investigation
Empire State Plaza
Corning Tower Room 1787
Albany, NY 12237
kma06@health.state.ny.us

2. Communication to be made from the Department to Respondent shall be sent to:

ELT Harriman LLC
1650 Des Peres Rd., Suite 303
St. Louis, MO 63131

With copies to:

Thomas West, Esq.
The West Firm, PLLC
677 Broadway, 8th Floor
Albany, NY 12207

B. The Department and Respondent reserve the right to designate additional or different addressees for communication upon written notice to the other.

C. Each party shall notify the other within ninety (90) days after any change in the addresses in this Paragraph IX.

X. Public Notice

A. Within thirty (30) Days after the effective date of this Order, Respondent shall provide notice as required by 6 NYCRR 375-1.5(a). Within sixty (60) Days of such filing, Respondent shall provide the Department with a copy of such instrument certified by the recording officer to be a true and faithful copy.

B. If Respondent proposes to transfer by sale or lease the whole or any part of Respondent's interest in the Site, or becomes aware of such transfer, Respondent shall, not fewer than sixty (60) days before the date of transfer, or within sixty (60) days after becoming aware of such conveyance, notify the Department in writing of the identity of the transferee and of the nature and proposed or actual date of the conveyance, and shall notify the transferee in writing (with a copy to the Department) of the applicability of this Order. However, such obligation shall not extend to a conveyance by means of a corporate reorganization or merger or the granting of any rights under any mortgage, deed, trust, assignment, judgment, lien, pledge, security agreement, lease, or any other right accruing to a person not affiliated with Respondent to secure the repayment of money or the performance of a duty or obligation.

XI. Not Applicable

XII. Dispute Resolution

In the event disputes arise under this Order, Respondent may, within thirty (30) Days after Respondent knew or should have known of the facts which are the basis of the dispute, initiate dispute resolution in accordance with the provisions of 6 NYCRR 375-1.5(b)(2); provided, however, that nothing contained in this Order shall be construed to impair the reservation of rights provided in Paragraph VII(B) above, including but not limited to Respondent's right to contest any requested modification to the RCRA Permit, or other actions taken in relation to the RCRA Permit, utilizing procedures applicable to permit modification contained in 6 NYCRR Part 621.

XIII. Termination of Order

A. This Order will terminate upon the Department's approval of the final report submitted by Respondent detailing the successful implementation of the Supplemental RI/FS work plan that is attached to this Order as Exhibit B ("Termination Date").

B. Notwithstanding the foregoing, the provisions contained in Paragraphs VI and VIII shall survive the termination of this Order and any violation of such surviving Paragraphs shall be a violation of this Order, and the ECL, subjecting Respondent to penalties as provided under Paragraph IV so long as such obligations accrued on or prior to the Termination Date.

C. Respondent shall ensure that it does not leave the Site in a condition, from the perspective of human health and environmental protection, worse than that which existed before any activities under this Order were commenced.

D. The existence and ultimate termination of this Order shall have no effect on the existing RCRA Permit and the obligations contained therein.

XIV. Standard Provisions

Respondent will further comply with the standard provisions which are attached and which constitute material and integral terms of this Order and are hereby incorporated into this document.

DATED: Albany, New York
MAY 29, 2014

Commissioner Joseph Martens
New York State Department of Environmental Conservation

By: _____
Robert Schick
Director
Division of Environmental Remediation

CONSENT BY RESPONDENT ELT Harriman LLC

Respondent hereby consents to the issuing and entering of this Order without further notice, waive their right to a hearing herein, and agree to be bound by the terms, conditions and provisions contained in this Order.

By (Signature): _____

Print Name: Michael Roberts

Title: Manager

Date: 5-27-14

ACKNOWLEDGMENT

STATE OF Missouri) ss:
COUNTY OF St. Louis)

On the 27 day of May in the year 2014 before me personally came Michael Roberts to me known, who, being by me duly sworn, did depose and say that s/he resides in St. Louis County that s/he is the manager of ELT Harriman LLC, the limited liability company described in and which executed the above instrument; and that s/he signed his/her name thereto by authority of the member(s) of said limited liability company.

_____
Notary Public
Signature and Office of individual taking acknowledgment

NOTARY PUBLIC NOTARY SEAL STATE OF MISSOURI

REBECCA LYDON
My Commission Expires
November 1, 2017
St. Louis County
Commission #13540330

STANDARD PROVISIONS

Payment. Any penalty assessed pursuant to the terms and conditions of this Order shall be paid by submitting a certified or cashier's check or money order, payable to the Department of Environmental Conservation, to: Department of Environmental Conservation, Office of General Counsel, Attn: Andrew Guglielmi, Esq., 625 Broadway, 14th Floor, Albany, New York 12233-5550. Unpaid penalties imposed by this Order shall bear interest at the rate of 9 percent per annum for each day the penalty, or any portion thereof, remains unpaid. Payments received shall first be applied to accrued interest charges and then to the unpaid balance of the penalty.

Duration. This Order shall take effect when it is signed by the Commissioner of Environmental Conservation, or his designee, and shall expire when Respondent has fully complied with the requirements of this Order.

Access. For the purpose of monitoring or determining compliance with this Order, employees and agents of the Department shall be provided access to any facility, site, or records owned, operated, controlled or maintained by Respondent, in order to inspect and/or perform such tests as the Department may deem appropriate, to copy such records, or to perform any other lawful duty or responsibility.

Force Majeure. If Respondent cannot comply with a deadline or requirement of this Order, because of an act of God, war, strike, riot, catastrophe, or other condition which was not caused by the negligence or willful misconduct of Respondent and which could not have been avoided by the Respondent through the exercise of due care, Respondent shall apply in writing to the Department within a reasonable time after obtaining knowledge of such fact and request an extension or modification of the deadline or requirement.

Modifications. No change in this Order shall be made or become effective except as specifically set forth by written order of the Commissioner, being made either upon written application of Respondent, or upon the Commissioner's own findings after notice and opportunity to be heard has been given to Respondent. Respondent shall have the burden of proving entitlement to any modification requested pursuant to this Standard Provision or the "Force Majeure" provision, supra. Respondent's requests for modification shall not be unreasonably denied by the Department, which may impose such additional conditions upon Respondent as the Department deems appropriate. Notwithstanding the foregoing, if Respondent seeks to modify an approved Work Plan, a written request shall be made to the Department.

Permit Exemption. The Department may exempt Respondent from the requirement to obtain any state or local permit or other authorization for activities conducted pursuant to this Order as provided at 6 NYCRR 375-1.12(b), (c), and (d).

Other Rights. Nothing contained in this Order shall be construed as barring, diminishing, adjudicating or in any way affecting (1) any legal, administrative or equitable rights or claims, actions, suits, causes of action or demands whatsoever that the Department may have against anyone other than Respondent; (2) any right of the Department to enforce administratively or at law or in equity, the terms, provisions and conditions of this Order; (3) any right of the Department to bring any future action, either administrative or judicial, for natural resource damages, or for any other violations of the ECL, the rules and regulations promulgated thereunder, or conditions contained in orders or permits, if any, issued by the Department to Respondent; (4) the summary abatement powers of the Department, either at common law or as granted pursuant to statute or regulation.

Entire Agreement. This Order shall constitute the entire agreement of the Department and Respondent with respect to settlement of those violations specifically referenced herein.

Headings. The paragraph headings set forth in this Order are included for convenience of reference only and shall be disregarded in the construction and interpretation of any provisions of this Order.

Signature of Order. This Order may be executed for the convenience of the parties hereto, individually or in combination, in one or more counterparts, each of which shall be deemed to have the status of an executed original and all of which shall together constitute one and the same.

Binding Effect. The provisions, terms, and conditions of this Order shall be deemed to bind Respondent and Respondent's heirs, legal representatives, receivers, trustees in bankruptcy, successors and assigns.

Service. If either Respondent is represented by an attorney with respect to the execution of this Order, service of a duly executed copy of this Order upon Respondent's counsel by ordinary mail shall be deemed good and sufficient service.

Multiple Respondents. 1. If more than one Respondent is a signatory to this Order, use of the term "Respondent" in these Standard Provisions shall be deemed to refer to each Respondent identified in the Order unless the Order clearly identifies one of the Respondents.

2. If there are multiple parties signing this Order, unless the Order clearly identifies one of the Respondents, the term "Respondent" shall be read in the plural, the obligations of each such party under this Order are joint and several, and the insolvency of or failure by any Respondent to implement any obligations under this Order shall not affect the obligations of the remaining Respondent(s) under this Order.

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LEGEND

BUILDING
TANK FARM
CONTAINMENT PAD
LAGOON
100 YEAR FLOOD PLAIN
INDUSTRIAL SEWER / SANITARY LINE
ABANDONED INDUSTRIAL SEWER / SANITARY LINE

0 80 160
SCALE IN FEET

BROWN AND CALDWELL ASSOCIATES
ALLENDALE, NEW JERSEY

SUBMITTED: KEVIN McGUINNESS, PROJECT MANAGER DATE: 10/8/2007
APPROVED: JEFF CAPUTI, BROWN AND CALDWELL DATE: 10/08/2007

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED:
DRAWN:
CHECKED:
CHECKED:
APPROVED:

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

FIGURE 4
SITE PLAN

FORMER NEPERA SITE
HARRIMAN, NEW YORK

FILENAME: FIGURE 2-2
BC PROJECT NUMBER: 133664
CLIENT PROJECT NUMBER: NA
DRAWING NUMBER: NA
SHEET NUMBER

2 Park Way, Suite 2A
Upper Saddle River, New Jersey 07458

T: 201.574.4700
F: 201.236.1607

May 19, 2014

Paul Patel, P.E.
New York State Department of Environmental Conservation
Division of Solid and Hazardous Materials
625 Broadway – 11th Floor
Albany, New York 12207

145302.300

Subject: Nepera- Harriman
Supplemental RI/FS Work Plan
Harriman, Orange County

Dear Mr. Patel:

Enclosed is one copy of the final Supplemental Remedial Investigation/Feasibility Study (RI/FS) Work Plan for the referenced site. The work plan has been revised to incorporate the two conditions noted in the Department's approval letter dated May 2, 2014.

An electronic copy is being distributed via email to you and all of the parties listed below.

Please let us know if you require anything further.

Very truly yours,
Brown and Caldwell Associates

Jeffrey R. Caputi, P.E.
Vice President

cc: Andrew Guglielmi, Esq., DEC (w/encl.)
David Crosby, DEC (w/encl.)
Benjamin Conlon, Esq., DEC
Thomas Pike, Esq., ELT
Matthew Robinson, ELT
Thomas West, Esq., The West Firm
Alita Giuda, Esq., The West Firm
Andrew Learn, Morris Associates
Kimo Peluso, Esq., Manatt, Phelps & Phillips, LLP
Seth Levine, Cambrex
Thomas Mesevage, Vertellus Specialties

Enclosure

FINAL

Supplemental Remedial Investigation/Feasibility Study Work Plan

Former Nepera Plant Site
Harriman, New York
EPA ID# NYD002014595

Prepared for
ELT Harriman LLC, St. Louis, Missouri
May 2014

FINAL

Supplemental Remedial Investigation/ Feasibility Study Work Plan Former Nepera Plant Site Harriman, New York EPA ID# NYD002014595

Prepared for
ELT Harriman LLC
1650 Des Peres Road, Suite 303
St. Louis, Missouri 63131

May 2014

Project Number: 144726.001

Brown and Caldwell Associates
2 Park Way, Suite 2A
Upper Saddle River, New Jersey 07458

Certification Statement

I, Jeffrey Caputi, certify that I am currently a NYS registered professional engineer, that this Supplemental Remedial Investigation/Feasibility Study Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10), and that all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications.

Jeffrey R. Caputi, P.E.
N.Y.P.E. License Number 082196

5/19/14
Date

Brown AND Caldwell

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Section 1

Introduction

This Supplemental Remedial Investigation/Feasibility Study (RI/FS) Work Plan has been prepared in response to the letter from the New York State Department of Environmental Conservation (the "Department" or "DEC") Office of General Counsel, dated October 28, 2013, as revised on October 29, 2013, which sets forth outstanding liability for remediation at the Nepera-Harriman Site, and the parties responsible for various aspects of the remediation (the "DEC Determination"). Specifically, the DEC Determination requested that ELT Harriman LLC submit a work plan to the Department to address outstanding obligations contained in the July 1999, 6 NYCRR Part 373 Hazardous Waste Management Permit ("RCRA Permit") and generally consistent with the DEC Determination.

The Nepera-Harriman Site, also referred to as the Former Nepera Plant Site (the "Site") is located on NY Route 17 in the Village of Harriman, Orange County, approximately one mile west of Exit 16 of the New York State Thruway (Figure 1-1). The Site was used for the manufacture of pharmaceutical and specialty chemicals from 1942 until operations were discontinued in 2005. The facility is currently inactive and the tank farms, distilling operations, and other manufacturing areas have been decommissioned.

The Site has been the subject of extensive investigation and remediation under the New York State Inactive Hazardous Waste Site (State Superfund) program and is listed as Site No. 3-36-006. The DEC issued a Record of Decision (ROD) in March 1997 that specifies the remedy for the Site. A Consent Decree was entered into in 1998 between the Estate of William S. Lasdon, Nepera Inc., and Warner-Lambert Company, which provides for the implementation and funding of the Remedy selected in the ROD. Work completed at the Site is carried out by the parties to the Consent Decree and the Maybrook and Harriman Environmental Trust (collectively, the "Trust Parties").

Module III of the RCRA Permit includes Corrective Action requirements for Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs). The RCRA Permit was issued to Nepera Inc. by the DEC, and subsequently transferred to Rutherford Chemicals, LLC ("Rutherford"). Rutherford began addressing the Corrective Action requirements in 2006 following plant shutdown. ELT Harriman LLC ("ELT") purchased the Site in November 2007 and contractually assumed the responsibility for Rutherford's obligations under the RCRA Permit. ELT and Rutherford submitted a permit transfer application that is pending approval by the Department. ELT is continuing to progress the work required under the RCRA Permit, which includes the work contemplated by this Supplemental RI/FS Work Plan, although this Supplemental RI/FS Work Plan is being carried out pursuant to an Order on Consent.

This Supplemental RI/FS Work Plan is intended to address certain data gaps identified in discussions and correspondence with the Department and outline the remedial alternatives to be evaluated in the Feasibility Study. The scope of this work plan addresses the SWMUs and AOCs consistent with the DEC Determination specifically Section B: "Corrective Action and Closure Work to be done under the RCRA Permit" (Appendix A). Subsequent to the DEC Determination, a Stipulation and Order Concerning the Consent Decree between the State of New York and Estate of William S. Lasdon, Nepera, Inc., and

Warner Lambert Company with Respect to the Harriman Site, dated December 17, 2013, was entered (the "Stipulation and Order"). The Stipulation and Order clarifies the meaning and application of the DEC Determination and includes a scope of work that supersedes Section A of the DEC Determination which is to be addressed in a Supplemental RI/FS Work Plan to be submitted and implemented by the Trust Parties.

It has been and remains ELT's position that the scope of the Corrective Action requirements is identified in and limited by the RCRA Permit. Previously, the Department requested that ELT go beyond the expressly delineated boundaries identified in the RCRA Permit. In an effort to cooperate with the Department, ELT agreed to expand the scope of the investigations and studies. ELT's acquiescence, however, was and is subject to a full and complete reservation of ELT's rights regarding DEC's ability to enlarge the boundaries of Corrective Action at the Site or any other alleged obligation or responsibility of ELT. Further, the Department and ELT have reserved their respective rights with respect to the RCRA Permit, including these issues, in the Order on Consent. Accordingly, and to the extent that any portion of this or any other submission related to the RCRA Permit or any other document prepared by or on behalf of ELT relative to the Site identifies, considers, and/or analyzes geographic areas of the Site beyond the RCRA Permit's specifically-delineated study areas or boundaries, such shall not be deemed or construed an admission by ELT that such areas are properly within the scope of the Corrective Action requirements, and any such analysis shall be subject to a full and complete reservation of any and all of ELT's rights as a matter of law.

The site background is presented in Section 2 including the site setting, regulatory history, and a description of on-site surface water drainage. The investigation objectives are outlined in Section 3. Section 4 provides the technical and analytical approach for the supplemental investigation, feasibility study, demolition and RCRA closure activities. The proposed activities and procedures are detailed in Section 5. The remaining sections cover project management, schedule, data management, quality assurance, and health and safety.

Section 2

Site Background

This section presents a brief description of the site setting and regulatory history. References to prior work plans and reports containing further details are provided. A description on on-site surface water drainage also is provided.

2.1 Site Location and Description

The Site as shown on Figure 2-1 is located in the Village of Harriman, Orange County, New York. Most of the Site lies within the Town of Woodbury; the southwest corner of the Site is in the Town of Monroe. The Site is bounded to the northwest by NYS Route 17, to the northeast by the West Branch of the Ramapo River, and to the south by undeveloped land currently owned by ELT (commonly referred to as the "Avon parcel"). The Site occupies approximately 28 acres and can generally be divided into two areas: (1) approximately 10 acres located to the northeast of Arden House Road on which the former administrative offices, a parking lot, and the lagoon are located, and (2) approximately 18 acres to the southwest of Arden House Road on which the former manufacturing facilities are located. The facility is currently inactive and the tank farms, distilling operations, and other manufacturing areas have been decommissioned.

A detailed description of the regional and site setting is presented in the Site-Wide Characterization Summary Report (Brown and Caldwell Associates and Cornerstone Engineering and Land Surveying, PLLC, March 2011). The Site-Wide Characterization Summary Report was prepared at the request of the Department and describes the scope of the investigatory and remedial activities previously implemented at the Site; the regional and site setting including physiography, geology, hydrogeology and hydrology, water use, and site conceptual model; nature and extent of contamination; exposure and ecological assessments; significant events; and data usability.

2.2 Site Regulatory History

The following sections provide an overview of the site history and the activities undertaken pursuant to the DEC's Superfund and RCRA Corrective Action programs. A comprehensive presentation of the investigations and remedial actions that have been performed at the Site is provided in the Site-Wide Characterization Summary Report.

2.2.1 Site Chronology

A brief description of historical operational and waste management practices follows. Additional site history, including developments under both the State Superfund and RCRA regulatory programs, is summarized in Table 2-1, Site Chronology. The Site is currently owned by ELT. The Site was used for the manufacture of pharmaceutical and specialty chemicals from 1942 to 2005.

Chemical by-products (organic compounds) were incinerated on Site from September 1945 through May 1957. This activity was conducted on a regular basis in two areas. During the mid 1940s, a "burn pit" apparently was located near the former blind lagoon and the current SPDES lagoon. From the late 1940s until 1957, a second "burn pit" was located near where the cyano reactor now stands. In 1978, an incinerator was installed in Building 61 and later became subject to the RCRA Permit. The incinerator was shut down in August 2005.

From the late 1940s to approximately 1953, calcium sulfate material, which was used as a catalyst in the manufacturing of niacinamide, was disposed of on site, primarily in a low lying area where the administration building and parking lot are now located. The calcium sulfate material contains inorganic mercury in a form that is highly immobile.

Drum burial occurred in an area near Buildings 67 and 75 and in an area near the southern boundary of the Site. Drum removal from these areas was conducted during the mid 1980s. Additional soils removal including drum fragments was completed in Area F and Building 53 in 2001.

The lagoon, constructed in the mid 1960s, is located southeast of the parking lot. It is reportedly approximately 12 feet deep, lined with compacted clay, and stores approximately 5.5 million gallons of water that prior to plant shutdown was derived from boiler blowdown and non-contact cooling water, storm water runoff and treated groundwater. Currently, water in the lagoon is derived solely from stormwater. Water from the lagoon is discharged to the west branch of the Ramapo River under a State Pollutant Discharge Elimination System (SPDES) permit. Prior to its current use, the lagoon served as a settling pond for aluminum hydroxide and magnesium silicate precipitates from manufacturing. The former blind lagoon (previously located where the existing lagoon is situated) was used to drain fire-system sprinkler (deluge) water, which was conveyed via gravity flow through underground pipes. Until recently, deluge water was collected in a 20,000-gallon underground storage tank, and periodically pumped to an above-ground 300,000-gallon storage tank. The deluge water system currently is inactive.

ELT purchased the Site in November 2007 and submitted an application for transfer of the SPDES Permit on December 22, 2007. The DEC elected not to transfer the permit and it expired on April 30, 2010. ELT submitted an application for a new SPDES Permit on August 20, 2010. A new SPDES Permit was issued to ELT on August 26, 2011. ELT has taken steps to ensure compliance with the SPDES Permit including:

- Installation and operation of temporary and permanent water treatment systems including reverse osmosis, ion exchange and filtration;
- Monitoring, sampling and reporting discharges in accordance with the SPDES Permit;
- Continued review of all aspects of the lagoon treatment and discharge system;
- Providing improvements to the lagoon level gauge and the floating suction strainer; and
- Ensuring the level of water within the lagoon is properly maintained.

2.2.2 New York State Inactive Hazardous Waste Disposal Site Program

The Site has been the subject of extensive investigation and remediation under the New York State Inactive Hazardous Waste Disposal Site (State Superfund) program (Site No. 336006). Various Work Plans, a Remedial Investigation (RI), a Feasibility Study (FS), Interim Remedial Measures (IRMs), and other remedial measures have all been undertaken at the Site, starting with preliminary investigations in 1986 and continuing forward. The RI/FS was completed in accordance with Stipulation Agreement Index No. W3-0004-8101 (SA), and formed the basis for the DEC to select a site remedy and issue the March 1997 ROD. Subsequent to the 1997 ROD, the Trust Parties entered into a Consent Decree that was filed in the United States District Court for the Southern District of New York (U.S. District Court, April 21, 1998) to implement the remedy selected in the 1997 ROD.

An IRM consisting of groundwater extraction and treatment was initiated in 1990. The IRM, specifically recovery wells RW-1S and RW-3, operated from 1990 through 2004. As a result of decreased well efficiencies and pumping rates from these wells resulting from siltation and other factors, pumping from both wells was discontinued in September 2004 as a part of biosparge system implementation and monitoring.

As a part of the 1997 ROD selected remedy implementation, a number of activities were undertaken as follows:

- Drum and contaminated soil source materials were removed from several areas of the Site (Areas F and Building 53). Surface soil was also removed in Area K. Work performed was documented in the Excavation Summary Report (Arcadis, March 2001).
- A biosparge system was installed for contaminant mass removal in lieu of soil vapor extraction (SVE), which was pilot-tested and found to be impractical. The work was documented in the Interim Pilot Test Report (Arcadis, March 2001).
- Surface water, sediments, and stream bank investigation and assessment were performed by the Trust Parties and the DEC. The work was documented in the RI Report and a fact sheet was issued (NYSDEC, June/July 2001).
- Interim erosion controls were implemented along the stream bank. A final design was proposed to the DEC in "Concept Plan for River Bank Stabilization, West Branch of the Ramapo River (Southern Bank)" (Arcadis, November 2005).
- A Conceptual Site Model and Supplemental Remedial Action Work Plan report (HydroQual, May 2008) was developed and the work plan was implemented, which further defined groundwater flow and quality.
- In response to the implementation of the Supplemental Remedial Action Work Plan, the biosparge system was discontinued in 2008 and the Site entered a routine monitoring phase to confirm that groundwater impacts remain within the boundaries of the Site. Monitored natural attenuation to address residual ground water contaminants is on-going.

Additional details of the investigation and remediation work performed under the NYS Inactive Hazardous Waste Disposal Site program are provided in the Site-Wide Characterization Summary Report and other referenced documents.

2.2.3 RCRA Closure and Corrective Action

Manufacturing operations ceased in May 2005 triggering the Closure and Corrective Action requirements of the RCRA Permit. The hazardous waste incinerator was shutdown in August 2005 and the last product was shipped off site in September 2005. Equipment shutdown, cleanout and decontamination were completed between July 2005 and October 2006. The above-ground portions of TSD Units were closed pursuant to the RCRA Permit and the approved RCRA Closure Plan (Shaw Environmental, Inc., November 2005). Closure activities were documented in the Revised RCRA Closure Certification Report (Shaw Environmental, Inc., April 2007).

Following the cessation of manufacturing operations, areas previously deemed inaccessible because of ongoing operations became accessible and subject to the Module III Corrective Action Requirements of the RCRA Permit. Table III-1 of the RCRA Permit lists the SWMUs and AOCs known to exist when the permit was issued. The list includes Treatment, Storage and Disposal ("TSD") Units, "Accessible Remediation SWMUs" and "Inaccessible SWMUs". The TSD Units, which include an incinerator, two container storage areas and five tanks, have undergone closure pursuant to the RCRA Permit and the approved RCRA Closure Plan - Hazardous Waste Container Storage Area and Incinerator (Shaw Environmental, Inc., 2005). The Accessible Remediation SWMUs correspond to study areas identified in the ROD as Areas A through J and include the thermal water sewers conveying blowdown from boiler and cooling tower systems, the deluge water collection system and building trench drains. The Inaccessible SWMUs include potentially contaminated soil under 72 buildings and process areas within Study Areas A, B, E, G, I, and J as shown on Figure 2-2.

In a letter dated May 3, 2006, the Department required that Rutherford prepare a RFI Work Plan to address specific SWMUs and AOCs subject to the Corrective Action requirements of the RCRA Permit. A draft RFI Work Plan was submitted to the DEC on August 31, 2006. Conditional approval of the RFI Work Plan was given by the Department in correspondence dated October 13, 2006. The comments and questions provided by the DEC in the conditional approval were addressed and the final RFI Work Plan was submitted on November 9, 2006.

The RFI was implemented from October 2006 until January 2007 and included the collection and analysis of over 150 shallow soil samples and over 200 subsurface soil samples. The RFI activities and findings were documented in the report entitled RCRA Facility Investigation Report, Former Nepera Plant Site, Harriman, New York dated April 2007 ("RFI Report"). The Department issued comments on the RFI Report in a letter dated July 10, 2007. An Addendum to the RFI Report, dated October 8, 2007, was submitted to the DEC as a response to the RFI Report comment letter.

In its July 10, 2007 letter the Department required that a Phase II RFI be conducted to investigate off-site areas adjacent to the former plant facility and across the Ramapo River. The DEC also required, in its July 10, 2007 letter that Rutherford move forward with a CMS. In response, an Addendum to the RFI Report was submitted dated October 8, 2007.

ELT purchased the Site in November 2007 and contractually assumed the responsibility for Rutherford's obligations under the RCRA permit. ELT and Rutherford submitted a permit transfer application that is pending approval by the Department. ELT is continuing to progress the work required under the RCRA Permit.

A Phase II RFI Work Plan was prepared and submitted to the DEC in November 2007. The Department approved the work plan in February 2008. ELT completed the sampling and analyses for the locations for which access could be obtained in June 2008. Analytical results were transmitted to the DEC in a technical memorandum dated August 6, 2008.

A CMS Plan and Task I Report was prepared and submitted to the DEC in November 2007. The CMS Plan and Task I Report presented the corrective action objectives, identified and screened remedial technologies, and described the approach to completing the remaining tasks of the CMS. The Department issued a letter dated September 11, 2008, that provided comments on the CMS Plan and Task I Report and guidance pertaining to the hazardous constituents and target cleanup levels to be evaluated in the CMS. The Department also requested an interim report providing "rough cost estimates for the various alternatives and the likely final use of the site". The cost estimates were intended to provide a basis for establishing the financial assurance limits.

ELT submitted the Interim Report – Corrective Measure Alternatives and Preliminary Cost Estimates to the DEC on March 16, 2009. The Interim Report presented a range of alternatives for remediation of the SWMUs and AOCs and preliminary cost estimates. The Department issued comments on the Interim Report in a letter dated May 21, 2009. The DEC indicated that no further evaluation of excavation/removal actions for achieving site wide "unrestricted use" and "residential use" for mercury, PCBs or benzene was necessary; the DEC also requested that further study include alternatives for consolidation and excavation and address the potential use of the lagoon as a consolidation unit. The DEC also provided comments regarding the development of Soil Cleanup Objectives (SCOs) for mercury and specifically the use of mercury speciation that needed to be resolved for the CMS to be completed.

A work plan for Supplemental Mercury Speciation Evaluation was prepared and submitted to the DEC in September 2009. The Department issued comments on the Work Plan in a letter dated November 24, 2009 and indicated that further discussion of the study goals and proposed methods was needed. ELT continued to discuss this matter with DEC representatives. A conference call was held on August 6, 2010 in which the DEC indicated that further study is not necessary and that alternate SCOs may be used in the evaluation of remedial options for the CMS.

A meeting was held on December 1, 2010 to introduce newly assigned DEC staff to the project and review the previously completed work and current status. Following the meeting, in an email on December 21, 2010, the Department provided a draft Scope of Work for additional investigation to be performed at the Site. After further discussion and exchange of comments on the draft Scope of Work, the DEC issued a letter dated February 4, 2010 requesting submission of a Sitewide Characterization Summary Report. ELT and the Trust Parties prepared and submitted the Sitewide Characterization Summary Report to the DEC on March 8, 2011. Additional details of the investigations and studies performed under the RCRA Permit are provided in the Site-Wide Characterization Summary Report and other referenced documents.

Subsequent to submission of the Site-Wide Characterization Summary Report, a series of meetings was held among representatives of the Department, ELT and the Trust Parties and comments were exchanged on the draft Scope of Work. On January 31, 2013, the Department indicated via email that the proposed comments were acceptable and provided a modified version of the Scope of Work. During this time period and prior to the DEC Determination, ELT was not directed by the Department to proceed further with the CMS or other activities required under the RCRA Permit.

2.3 On-Site Surface Water Drainage

In discussions regarding the Scope of Work for further site investigations, the Department requested that a description of the on-site surface water flows systems as they currently exist be provided and that sediment samples be collected and analyzed from reasonably accessible major lines and catch basins. A drainage analysis was performed by Morris Associates, PLLC and is presented herein. Proposed sediment sampling locations are discussed in Sections 4.4 and 5.1.3 of this Work Plan.

The Site analyzed consists mainly of former industrial buildings surrounded by paved surfaces. Small pockets of gravel with new growth vegetation were observed in the central portion of the Site. Areas of well-established lawn were observed around the perimeter of the Plant Area, primarily in the easterly portion of the Site as well as surrounding the Lagoon. The Site is bordered by railroad tracks along the southwesterly property line, NYS Route 17 along the northwesterly property line, the Ramapo River along the northeasterly property line and undeveloped land along the southeasterly property line. Arden House Road passes through the Site from Route 17 in a southeasterly direction and divides the Site into two distinct areas, referred to for the purposes of the drainage analysis as the “Plant Area” and the “Lagoon Area”.

The On-Site Surface Water Drainage Map is provided in Appendix B. Most runoff from the Plant Area flows overland via paved and vegetated channels toward Arden House Road where it is collected by a system of four catch basins. The catch basins in Arden House Road direct runoff to the Lagoon Influent Sump, located along Arden House Road near the westerly corner of the Lagoon. Runoff collected in the sump is automatically transferred to the Lagoon via a system of floats and pumps. Runoff collected in the Lagoon is periodically discharged to the Ramapo River via a Treatment System designed to meet the discharge parameters of the Individual SPDES Permit (NYR 0275123) issued for the Site. The Ramapo River is a Class C stream in the vicinity of the Site, but changes to Class A(T) approximately 1.2 miles downstream. The discharge limits established in the SPDES Permit were based upon the downstream classification of the stream and the understanding that the nearby outfall from the local sewage treatment facility utilizes all of the available assimilative capacity of the stream.

Runoff from the Plant Area that is not collected and stored in the Lagoon is collected by a catch basin along Arden House Road near the former Administration Building, directed to a swale near the southernmost corner of the Site, or directed to the undeveloped land along the southeasterly side of the Site.

Within the Plant Area, surface runoff is conveyed primarily by overland flow; however, a small number of drainage structures have been identified on the On-Site Surface Water Drainage Map provided in Appendix B. These structures include a trench drain along the southwesterly side of the former Pilot Plant building (identified as Buildings 40 and 20 on Figure 2-2), located in Area A. Mapping of the underground storm sewer piping is not well documented; however, it appears that this drain although now full of sediment, was intended to discharge along the southeasterly side of the building and into the Lagoon Influent Sump collection system. A grass swale along the driveway for the former Drum Warehouse building located in Area E collects runoff from a small diameter culvert located along the southeasterly side of the building. This swale also directs runoff to the Lagoon Influent Sump collection system. A catch basin was discovered at the upstream end of the grass swale near the southernmost corner of the Site. This catch basin also contains a fair amount of accumulated sediment.

Aside from overland flow and the limited number of drainage structures located within the Plant Area, the former boiler blowdown system may also be a collection point for stormwater runoff. The boiler blowdown system was a pressurized system used to convey boiler blowdown water from various parts of the plant to the Lagoon. In most parts of the Site the system is closed and runoff cannot enter the system, with the exception of the westerly portion of the Site near the former Warehouse building and the former Boiler House. In this area open grates along the northeasterly side of the former Boiler House and the loading dock sump of the former Warehouse building have the potential to collect runoff. Although runoff cannot be conveyed to the Lagoon from these areas without operational pumps, they do have the potential to collect sediment. The On-Site Surface Water Drainage Map, provided in Appendix B, identifies all known storm sewer piping and catch basins. The portion of the boiler blowdown system that collects runoff has also been included on the drainage map.

2.3.1 Drainage Analysis

This analysis utilizes the methods stated in Technical Release No. 55 (TR-55), Urban Hydrology for Small Watersheds, published by the U.S. Department of Agriculture, Soil Conservation Service. A Type III Orange County rainfall distribution was used to generate tabular hydrographs for the 1, 2, 10, 25 and 100-year storm events, with respective 24-hour rainfall depths of 2.8, 3.5, 5.0, 6.5, and 8.0 inches.

Tabular hydrographs were prepared using HydroCAD, Version 8.5 to model the watershed characteristics. This computer aided design (CAD) program was developed by HydroCAD Software Solutions, LLC and simulates the USDA Soil Conservation Service's TR-20 hydrologic and hydraulic model to analyze stormwater runoff.

Soils

The runoff calculations performed rely in part on the underlying soil characteristics. Based on a review of the USDA Soil Survey of Orange County, New York, soils on the Site consist primarily of gravelly sandy loams. The following information describes the characteristics of the on-site soils:

- **Ca, Canandaigua silt loam** – This complex is about 75 percent Canandaigua soils and 25 percent other soils. The Hydrologic Soil Group rating for this complex is B/D.
- **Canandaigua soils** – More than 80 inches deep, poorly drained, with moderately high to high saturated hydraulic conductivity.
- **ErA, Erie gravelly silt loam (0 to 3 percent slopes)** – This complex is 75 percent Erie soils and 25% other soils. The Hydrologic Soil Group rating for this complex is D.
- **Erie soils** – Moderately shallow (10 to 21 inches), somewhat poorly drained with moderately low to moderately high saturated hydraulic conductivity.
- **Fd, Fredon loam** – This complex is about 50% Fredon, poorly drained soils, 25% Fredon, somewhat poorly drained soils and 25% other soils. The Hydrologic Soil Group rating for this complex is B/D.

- **Fredon, poorly drained soils** – More than 80 inches deep, poorly drained with a moderately high to high saturated hydraulic conductivity.
- **Fredon, somewhat poorly drained soils** – More than 80 inches deep, somewhat poorly drained with a moderately high to high saturated hydraulic conductivity.
- **HoB, Hoosic gravelly sandy loam (3 to 8 percent slopes)** – This complex is about 80 percent Hoosic soils and 20 percent other soils. The Hydrologic Soil Group rating for this complex is A.
- **Hoosic Soils** – More than 80 inches deep, somewhat excessively drained with a high to very high saturated hydraulic conductivity.
- **OtB, Otisville gravelly sandy loam (0 to 8 percent slopes)** – This complex is about 80 percent Otisville soils and 20 percent other soils. The Hydrologic Soil Group rating for this complex is A.
- **Otisville Soils** – More than 80 inches deep, excessively drained with a high to very high saturated hydraulic conductivity.

A Custom Soil Resource Report from the Natural Resources Conservation Service (NRCS) for the ELT Harriman site is provided in Appendix B.

Watersheds

The drainage analysis performed for the Site establishes peak flow rates and runoff volumes at several design points. Design points may be a point where concentrated runoff in a stream or swale leaves the site or just an indication of the general direction of overland flow across the property line or through a significant land feature. The site was divided into four (4) watersheds each with a chosen design point. A brief overview of each of the design points and contributing watersheds are described below. Refer to the On-Site Surface Water Drainage Map in Appendix B for the watershed boundaries.

Design Point 1 (DP 1) is the Lagoon Influent Sump, located along Arden House Road. This watershed discharges runoff from a highpoint within the Site near the railroad tracks towards the northeast where runoff flows overland toward Arden House Road before reaching the design point.

Design Point 2 (DP 2) is the catch basin along Arden House Road, near the former Administration Building. This watershed discharges runoff from a highpoint near the easterly corner of the former Warehouse Building and flows northeast along Route 17 before reach the design point.

Design Point 3 (DP 3) is the downstream end of a grassed swale near the southernmost corner of the site. This watershed discharges runoff from a highpoint near the southeasterly end of the former Warehouse Building and flows overland in a southeasterly direction along the railroad tracks before flowing through the tank farm area of the plant and then into the grassed swale.

Design Point 4 (DP 4) is located along the southeast boundary of the Site where runoff discharges to an open, undeveloped field. This watershed discharges runoff from a highpoint within the tank farm area of the site and flows overland in a generally southeasterly direction towards the design point.

Although a design point has not been assigned to the address the watershed that directly contributes to the Lagoon without flowing through the Lagoon Influent Sump, this area has also been analyzed to determine the total runoff entering the Lagoon during the design storm events. The Lagoon watershed consists primarily of the well vegetated banks of the Lagoon and the Lagoon water surface.

The results of the drainage analysis for the selected design points are summarized in Tables 2-2 and 2-3. Detailed drainage computations are included in Appendix B.

The peak flow rates and runoff volumes established in this analysis can be utilized for the sizing of conveyance practices during site remediation and may be useful as a baseline for comparison during future development. Considering the potential use of the Lagoon as a consolidation area, the transition of the Lagoon to uses other than stormwater collection must be carefully phased to ensure discharges from the Site meet the appropriate water quality standards. Construction of new stormwater collection and conveyance systems as well as stormwater management practices will be necessary prior to Lagoon closure.

Section 3

Investigation Objectives

The RFI was performed as outlined in the RFI Work Plan (Brown and Caldwell Associates, November 2006). The RFI objectives were to:

- Investigate the SWMUs, TSDs and other areas for potential environmental impacts associated with plant operations and historic releases;
- Collect adequate data to support decisions regarding potential remedial measures and support remedial design; and
- Fulfill the Corrective Action requirements in accordance with Module III of the RCRA Permit.

The RFI was implemented from October 2006 to January 2007 and included the collection and analysis of over 150 shallow soil samples and over 200 subsurface soil samples. The RFI activities and findings were documented in the report entitled RFI Report (Brown and Caldwell Associates, April 2007) and also presented in the Site-Wide Characterization Summary Report.

This Supplemental RI/FS Work Plan is intended to address certain data gaps identified in discussions and correspondence with the Department, provide data to support an evaluation of all potential SCOs, and outline the remedial alternatives to be evaluated in the Feasibility Study. The Supplemental RI/FS Work Plan objectives are to:

- Further investigate SWMUs where a relatively small number of samples were collected based on the size of the SWMU;
- Collect data to support the development of a working definition of “source material” and to refine the delineation of potential source material beneath SWMUs and in Areas A and E;
- Investigate the potential for soil vapor intrusion in areas of the Site where VOC groundwater contamination has been noted;
- Investigate surface water drainage structures to determine if they contain sediment impacted by site contaminants;
- Conduct an evaluation of the Lagoon to determine if it may be used as a consolidation area and conduct additional sampling and analysis to further characterize accumulated sediments; and
- Outline the remedial alternatives to be evaluated in the Feasibility Study.

3.1 Source Areas

Part 375 defines a source area or source to mean “a portion of a site or area of concern at a site where the investigation has identified a discrete area of soil, sediment, surface water or groundwater containing contaminants in sufficient concentrations to migrate in that medium, or to release significant levels of contaminants to another environmental medium, which could result in a threat to public health or the environment.” The definition then goes on to identify typical source materials as concentrated solid or semi-solid hazardous substance, non-aqueous phase liquids, and grossly contaminated media. Grossly contaminated media is further defined (Part 375) as that which contains sources or substantial quantities of mobile contamination in the form of NAPL, that is identifiable either visually, through strong odor, by elevated contaminant vapor levels or is otherwise readily detectable without laboratory analysis. Overall, the key, operative terms in this definition are that a source area be discrete and contain readily identifiable, concentrated sources of contamination.

Calcium sulfate material, which has been found to contain mercury, has been encountered primarily within the Parking Lot in Study Area B, and has also been identified in soil borings in other areas on the Site. While the calcium sulfate material represents a discrete area, multiple lines of evidence indicate the calcium sulfate material is not releasing "significant levels of contaminants to another environmental medium, which could result in a threat to public health or the environment." Such lines of evidence include knowledge of the manufacturing process that generated the waste, mercury speciation work completed during the RFI, and semi-annual water quality data documenting the absence of mercury above applicable water quality standards. Therefore, the calcium sulfate material does not represent a source with respect to adjacent soils or groundwater. However, the calcium sulfate material would meet the definition of a source material if it were exposed (i.e., uncovered) and eroded and transported within surface water.

Based on discussions with the Department, any on-site soil/material that exceeds 220 mg/kg for mercury or 50 mg/kg for PCBs shall be considered source material for the purposes of evaluating corrective measure alternatives in the CMS.

Section 4

Technical and Analytical Approach

4.1 Demolition

Demolition of the remaining on-site buildings and other structures will be performed. It is expected that none of the buildings qualify as historic. The State Historic Preservation Office (SHPO) will be contacted to confirm the status of the on-site buildings and if any buildings are determined to be historic, appropriate measures will be implemented to comply with SHPO's requirements.

4.1.1 Pre-Demolition Survey

Environmental conditions that may impact superstructure demolition may include:

- The presence of chemical residues on internal and external impermeable surfaces such as steel columns and sheathing;
- The presence of chemical residues within porous materials such as wood framing, wood roof trusses and sheetrock;
- The presence of Universal Wastes such as fluorescent lights, emergency exit lights, mercury switches and thermostats;
- Asbestos-containing materials (ACM) such as floor tiles, roofing and mastics;
- Polychlorinated biphenyl (PCB) residues; and
- Lead-based paint.

To evaluate potential conditions such as these, a combination environmental assessment and pre-demolition survey will be completed by a qualified firm possessing the required licenses to identify and document potential environmental concerns that may need to be addressed prior to or during the planned demolition and to characterize building materials to determine the appropriate handling and disposal requirements, regulatory requirements, and worker health and safety considerations associated with the potential demolition of the structure.

The environmental assessment and pre-demolition survey will consist of the following activities:

- Review of available documentation and construction drawings (if any) to confirm the historical building use and document potential environmental concerns that may impact the demolition of the structure. This includes prior inventories and/or assessments performed for the Site. Materials identified as having or containing regulated materials at the time of facility construction will be field verified during the visual assessment and onsite sampling activities and recorded.
- Visual assessment of the structure to include an inspection of readily visible components. Assumptions will be made based on facility use for areas not accessible or visible due to obstructions or safety concerns. In such instances, it may be appropriate to confirm those assumptions during the demolition work as the areas become accessible for inspection and/or sampling. The objectives of the visual assessment include the following:
  - Confirm the locations of potentially impacted areas identified during the review of site construction documents;
  - Identify and quantify potential items of environmental concern;

  - Determine the potential presence and quantity of hazardous and/or regulated materials within the building (excluding the actual building materials of construction) that will need to be addressed prior to or as part of demolition activities;
  - Investigate the nature of the materials of construction and obtain measurements to facilitate quantification of the various types of building materials; and
  - Confirm potential locations for ACM, PCBs, lead-based paint, and other hazardous materials (bulk and wipe) sampling.
- Following the visual inspection, a sampling program for the testing of building and other materials will be developed and carried out by ELT to evaluate the presence of potentially hazardous materials described above. Following the sampling, an environmental assessment and pre-demolition survey report will be prepared to summarize the activities and results of the environmental assessment and pre-demolition survey. The report will include building material quantities, areas of concern, waste types and quantities, and potential disposal options for various materials. Determinations will be made regarding the recycling or disposal of regulated and potentially regulated materials and other hazardous and non-hazardous materials found in Site buildings, tanks, and piping.

4.1.2 Pre-Demolition Abatement and Demolition

Technical documents (plans and specifications) will be prepared for use in the procurement of a qualified demolition contractor. The demolition contract will include management of asbestos and loose lead based paints (as may be found by the Pre-Demolition Survey) as appropriate in accordance with federal, state and local regulations. The contract will also include the disposal and/or recycling of regulated and potentially regulated materials and other hazardous and non-hazardous materials generated during demolition of buildings. The concrete slabs will be left intact and addressed during implementation of the selected remedial measures for the site.

The contract will include all labor, materials, services, insurance, equipment, and decontamination facilities to carry out site preparation, demolition, and management (segregate, process, handle, load and containerize) of waste generated from site preparation, remediation and demolition. The Contractor will be required to submit a Demolition Work Plan to describe site preparation, utility isolation/disconnection, demolition procedures, removal procedures, dust control, sequences, schedules, and debris stockpiling. In addition, the Contractor will be required to submit an Erosion and Sediment Control Plan, Asbestos and Lead Abatement Work Plan (if required), Waste Handling and Disposal Plan and Health & Safety Contingency Plan.

4.1.3 RCRA Closure

The remaining RCRA Closure activities will be completed during or prior to site demolition consistent with the RCRA Closure Plan, the Revised RCRA Closure Certification Report (Shaw Environmental, Inc., April 2007), and the DEC approval letter dated November 5, 2007. The remaining activities include the following:

- Remove and cut-up tank T-911;
- Demolish secondary containment around tank T-911;
- Remove and cut up tanks T-936, T-937 and T-939;
- Demolish secondary containment around tanks T-936, T-937 and T-939;
- Remove and cut-up tank T-105;
- Demolish secondary containment around tank T-105;
- Remove and cut-up incinerator components;
- Remove and cut-up hazardous waste feed lines;

- Off-site recycling (smelting) of steel components;
- On-site crushing and staging of concrete; and
- Off-site hazardous waste disposal of hazardous feed lines T-105, T-939 and cyano residue.

The concrete pads associated with the TSD Units were decontaminated as described in the Revised RCRA Closure Certification Report. Accordingly no further closure is required with respect to the concrete pads. The concrete pads will be left intact and addressed during implementation of the selected remedial measures for the Site, separate from closure activities. Remedial measures to address soil under and adjacent to the footprint of the TSD Units will be evaluated in the Feasibility Study and implemented with the selected remedy for the Site, separate from Closure activities.

A cost estimate for the remaining closure activities has been developed and is included in Appendix D.

4.2 Soil Investigation

The Supplemental RI soil investigation will consist of the investigation of subsurface soils at specific SWMUs and locations outside of SWMUs in Areas A and E. The investigation will be conducted for two specific purposes:

- Further investigate SWMUs where a relatively small number of samples was collected based on the size of the SWMU; and
- Collect data to support the development of a working definition of “source material” and to refine the delineation of potential source material beneath SWMUs and in Areas A and E that would potentially be considered “source material”.

The specific SWMUs identified for further investigation following demolition include Buildings 01, 02, 05, 13, 20, 28, 38, 57B, and 67. The SWMUs where sampling is intended to further delineate potential source material include Buildings 02, 05, 29, 37, and 70.

Sample locations are depicted on Figure 4-1. A list of each SWMU or study area along with the sampling rationale is presented in Table 4-1. Each sample location will be biased toward areas of the buildings/structures not previously investigated and with the highest probability of impact (i.e., cracks in slabs, visible staining, adjacent to floor drains, etc.). If there is no visual evidence or other rationale, the sample will be collected beneath the most heavily utilized area with a bias toward the center of the building.

It may not be feasible to collect samples from some of the planned sample locations prior to demolition as physical access may be blocked (e.g., by an existing tank or structure) or some structures may be unstable or otherwise unsafe to enter. However, the schedule for completing the planned investigation activities would be substantially longer if demolition were to occur in advance (refer to Section 7). To avoid such delay, the investigation will be performed prior to demolition and reasonable efforts will be made to sample as many of the planned locations as can be safely accessed. With the Department’s concurrence, some locations may be moved to facilitate sample collection without compromising data quality objectives. It is expected that sample collection will be completed at a majority of the planned locations, that the data obtained will be sufficient to proceed with the FS. It is also anticipated that any additional sampling the Department may seek pursuant to its authority under the Order on Consent would be identified and completed no later than at this time. Work on the FS will commence following the Department’s approval of the Supplemental RI Report and its concurrence that any sampling that was unable to be completed prior to demolition is not required for the purposes of preparing the FS.

4.3 Soil Vapor Investigation

The Supplemental RI soil vapor investigation will consist of the investigation of soil vapor above the water table at locations at SWMUs where prior soil and groundwater investigations have shown the highest concentrations of VOCs. The highest concentrations of VOCs, primarily benzene, in soil have previously been detected in the vicinity of Building 18. Benzene has also been detected in groundwater to the south and west of Building 18. Four soil vapor samples will be collected below buildings at the Site. SWMUs to be investigated include Building 18, downgradient Buildings 28, and 67, as well as upgradient Building 01. These buildings have been selected due to their large footprint and greater potential for accumulation of soil vapor below the slab. Soil vapor sample locations are presented on Figure 4-1.

As noted in Section 4.2, it may not be possible to sample some of the planned locations prior to demolition. The same approach will be taken with regards to the soil vapor investigation.

4.4 Stormwater Investigation

The Supplemental RI stormwater evaluation will include the collection of sediment samples from stormwater catch basins and drains that are described in Section 2.3. Sampling will be conducted to determine if Site-related contamination has accumulated in stormwater drainage features. Sampling will include a single grab sample of shallow sediment, to the degree recoverable, from each of the catch basins and drains. Sediment sample locations are presented in Figure 4-2.

4.5 Lagoon Evaluation

In order to assess the potential usage of the Lagoon as a consolidation area and landfill site, an inspection of the Lagoon will be conducted by a geotechnical engineer licensed in the State of New York. The evaluation of the Lagoon will include field observations as well as a review of prior investigations and other available information. The use of a clay or synthetic liner shall be assumed for the purpose of evaluating corrective measure alternatives in the CMS that include use of the Lagoon as a consolidation area. If such an alternative is selected for the Site, a more detailed evaluation of the existing clay liner (including testing) may be required prior to implementation of remedial activities.

Additional sediment samples will be collected and analyzed to further characterize the sediments in the Lagoon. Sample locations are depicted on Figure 4-2 and listed in Table 4-1.

4.6 Supplemental RI Report

Following the field investigation activities, a Supplemental RI Report will be prepared that describes the work performed and presents the results of the investigation. The report will include summary tables and figures of analytical results similar to the original RFI Report, The report will also include the analytical data packages and third party data validation reports, as discussed in Section 9. If any planned sample locations could not be accessed, the report will include a discussion of the significance of those data points with recommendations for proceeding with the FS and filling any remaining data gaps.

4.7 Feasibility Study

A Corrective Measures Study (CMS) Plan and Task I Report was prepared and submitted to the Department in November 2007 (Brown and Caldwell Associates, November 2007). A CMS is the RCRA program equivalent of a Feasibility Study (FS). The CMS Plan and Task I Report presented the corrective action objectives, identified and screened corrective measure technologies, and described the approach to completing the remaining CMS tasks. The Department issued a letter dated September 11, 2008,

that provided comments on the CMS Plan and Task I Report and guidance pertaining to the hazardous constituents and target cleanup levels to be evaluated in the CMS. The Department also requested an interim report providing "rough cost estimates for the various alternatives and the likely final use of the site".

The Interim Report was prepared and submitted to the Department on March 9, 2009 (Brown and Caldwell Associates, March 2009). The Interim Report established the CMS area, updated the Corrective Action Objectives from the 2007 CMS Plan and Task I Report to reflect guidance provided by the Department in the September 11, 2008 letter, identified the Corrective Measure Alternatives (CMAs), and provided quantity estimates and preliminary cost estimates for the CMAs along with a discussion of potential future Site uses.

At this time, it is the intent of ELT and the Department to carry out remedial action as part of a 6 NYCRR Part 375 Consent Order to be negotiated subsequent to implementation of this Supplemental RI/FS Work Plan. Accordingly, the FS will be developed consistent with the SCOs and other standards provided by 6 NYCRR Part 375, including the analysis of alternative remedial actions.

The following is a description of remedial alternatives that will be evaluated in the FS. The remedial alternatives are consistent with those previously developed in the Interim Report and have been updated consistent with the DEC Determination, recent discussions with the Department, and DER-10.

4.7.1 Study Area

As identified in the DEC Determination, and generally within the RCRA Permit, the FS will focus on soils associated with the previously Inaccessible SWMUs and TSD Units. This includes potentially contaminated soil under 72 buildings and process areas within Study Areas A, B, E, G, I, and J. Consistent with the DEC Determination, the FS also will address soils outside of the SWMUs and TSD Units within Study Areas A, E and I. The remediation areas to be addressed in the FS are shown on Figure 4-3. Other areas at the Site are being addressed by the Trust Parties pursuant to a separate Supplemental RI/FS Work Plan.

4.7.2 Remedial Action Objectives

As described in DER-10, remedial action objectives (RAOs) are medium or operable unit-specific objectives for the protection of public health and the environment and are developed based on contaminant-specific standards, criteria and guidance (SCGs) to address contamination at a site. The planned future use of the Site is an important consideration in developing RAOs. At this time there is no definitive redevelopment or reuse plan for the Site. It is likely that future Site use will consist of restricted-use scenarios (i.e. commercial and/or industrial) in combination with institutional and engineering controls that place restrictions on site activities and usage, and control potential exposure pathways. Note that institutional controls are a required component of the 1997 ROD remedy to restrict future use of Site groundwater and it is anticipated that institutional and engineering controls will be included to restrict activities and uses in areas of the Site outside the FS area (e.g., parking lot area). In addition, due to the presence of VOCs in groundwater, it is anticipated that institutional controls also would be required to specify evaluation of vapor intrusion and/or vapor mitigation for future buildings constructed on site.

Site and constituent-specific considerations also are important in developing RAOs and evaluating remedial alternatives (RAs) as described further under "baseline conditions" in Section 4.1(d) of DER-10. The primary COCs in unsaturated zone soil, which will drive the development of RAs, are mercury, PCBs and benzene:

- Mercury is the most widely distributed COC with the highest concentrations generally corresponding to locations at which the calcium sulfate sludge-like material was observed.

- Aroclor 1254, which was the only PCB congener detected in soil samples, was detected at low levels in borings located throughout the Site. However, only one sample was reported to contain Aroclor 1254 at a concentration above the Subpart 375.6 Industrial value of 25 mg/kg.
- Elevated benzene concentrations are primarily in the soils beneath Tank Farm 18 and adjoining tank farms.

Other COCs including VOCs (primarily petroleum hydrocarbons other than benzene), SVOCs (primarily PAHs, picoline, and pyridine), and metals (primarily arsenic) will be considered in developing RAs. However, these other COCs do not have a significant impact on the target areas/volumes or remedial approaches and therefore will not be evaluated in detail.

Based on the results of the investigations completed to date, the site-specific RAOs are to eliminate or control, where not otherwise addressed by the remedial measures required by and being implemented pursuant to the 1997 ROD, the 1998 Consent Order, and/or the Stipulation and Order, and as necessary to comply with applicable standards, criteria and guidelines, the following:

1. The potential for direct human contact with hazardous constituents in soils;
2. The potential for migration of hazardous constituents from soil to groundwater, which can occur via infiltration through impacted soils with subsequent leaching and transport of constituents from the vadose zone into the saturated zone;
3. The potential for migration of hazardous constituents from soil to adjacent surface water bodies or lands, which can occur via surface water runoff or soil erosion;
4. The potential for migration of hazardous constituents in ambient air, which can occur through volatilization or through dust when impacted soils are disturbed; and
5. The potential for migration of hazardous constituents into occupied structures through vapor intrusion.

As discussed above, the FS will consider a range of potential future uses scenarios. As such, the FS will consider a range of potential soil cleanup objectives (SCOs), including those identified in 6 NYCRR Subpart 375.6. The following table identifies potential SCOs that will be considered in the FS for the primary constituents of concern:

Potential Soil Cleanup Objective	Mercury (mg/kg)	PCBs (mg/kg)	Benzene (mg/kg)
Unrestricted Use SCO*	0.18	0.1	2.9
Residential Use SCO*	0.81	1	4.8
Commercial Use SCO*	2.8	1	44
Industrial Use SCO*	5.7	25	89
Protection of Ecological Resources SCO	0.18	1	70
Protection of Groundwater SCO	0.73	3.2	0.06
Alternate SCO 1**	47	-	-
Alternate SCO 2**	220	-	-

** Based on SCOs identified in 6 NYCRR Subpart 375.6. For mercury, with the exception of the unrestricted use SCO, which is based on rural background, the SCOs are based on the lower of the Final Human Health-based SCOs for mercury (elemental) or mercury (inorganic salts) in Table 5.6-1 of the NYSDEC's document entitled "New York State Brownfield Cleanup Program Development of Soil Cleanup Objectives Technical Support Document" (TSD) dated September 2006. The TSD explains the technical basis of the methods used to develop the SCOs that were promulgated under 6 NYCRR Part 375.6. For residential, restricted-residential, commercial, and industrial use SCOs, the elemental mercury Final Human Health-based SCO represents the lower of the two values.*

*** Alternate SCOs for mercury are based on Final Human Health-based SCOs for mercury (inorganic salts) in Table 5.6-1 of the TSD. Table 5.6-1 includes separate Final Human Health-based SCOs for mercury (elemental) and mercury (inorganic salts). Since mercury at the Site is not in elemental form, the criteria established for inorganic salts may be considered as SCOs.*

4.7.3 Technology Screening

Remedial technology screening has been performed and the results were presented in the CMS Plan and Task I Report. The technologies that were retained after screening are listed below. These technologies will be used in developing the RAs for the Site.

- No Action
- Containment:
  - Caps/Covers
  - Vapor Barriers
- Soil Excavation and Ex-Situ Treatment:
  - Complete Excavation
  - Partial Excavation (i.e., Targeted Excavation)
  - Landfill Disposal
  - Soil Recycling/Reuse
  - Thermal Desorption/Retorting
  - Incineration
  - Solidification/Stabilization (cement-based)
- In-Situ Treatment:
  - Stabilization/Solidification (cement-based)
  - Thermal Desorption
  - Aerobic Bioremediation
  - Chemical Oxidation
  - Sub-Slab Depressurization Systems (i.e., Vapor Intrusion Mitigation)

4.7.4 Identification of Remedial Alternatives

The proposed RAs have been developed based on the RAOs, list of retained remediation technologies, and range of potential future Site uses. Since the future development plans for the Site have not been determined, and to comply with the DEC's requirement to evaluate remediation to unrestricted and residential SCOs, the FS will consider a range of potential future uses. However, the proposed RAs are generally focused on future restricted-use scenarios, since the likely future Site use will consist of a restricted-use scenario that contemplates commercial and/or industrial use in combination with institutional and/or engineering controls.

The RAs proposed to be evaluated in the FS are listed below and a brief description and overview of the basis for each RA follows:

- **RA-1:** No Action
- **RA-2:** Excavation and Off-Site Treatment and/or Disposal
  - **2a:** Excavation to Unrestricted-Use SCOs (0.18 mg/kg Mercury, 0.1 mg/kg PCBs, and 0.06 mg/kg Benzene)
  - **2b:** Excavation to Residential-Use SCOs (0.81 mg/kg Mercury, 1 mg/kg PCBs, and 2.9 mg/kg Benzene)
  - **2c:** Excavation to Industrial-Use SCOs (5.7 mg/kg Mercury, 25 mg/kg PCBs, and 89 mg/kg Benzene)

- **RA-3:** Site Cover and Institutional Controls
- **RA-4:** Re-graded Site Surface Cover and Institutional Controls
- **RA-5:** Targeted Excavation and Off-Site Treatment and/or Disposal, Site Cover, and Institutional Controls
  - **5a:** Excavation SCOs: 47 mg/kg Mercury, 25 mg/kg PCBs, and 89 mg/kg Benzene
  - **5b:** Excavation SCOs: 220 mg/kg Mercury, 25 mg/kg PCBs, and 89 mg/kg Benzene
- **RA-6:** Targeted Excavation and On-Site Ex-Situ Treatment and/or Disposal, Site Cover, and Institutional Controls
  - **6a:** Targeted Excavation (SCOs: 47 mg/kg Mercury, 25 mg/kg PCBs, and 89 mg/kg Benzene) and On-Site Ex-Situ Treatment
  - **6b:** Targeted Excavation (SCOs: 47 mg/kg Mercury, 25 mg/kg PCBs, and 89 mg/kg Benzene) and On-Site Consolidation
  - **6c:** Targeted Excavation (SCOs: 220 mg/kg Mercury, 25 mg/kg PCBs, and 89 mg/kg Benzene) and On-Site Ex-Situ Treatment
  - **6d:** Targeted Excavation (SCOs: 220 mg/kg Mercury, 25 mg/kg PCBs, and 89 mg/kg Benzene) and On-Site Consolidation
- **RA-7:** Targeted In-Situ Treatment, Site Cover, and Institutional Controls
  - **7a:** In-Situ Treatment SCOs: 47 mg/kg Mercury, 25 mg/kg PCBs, and 89 mg/kg Benzene
  - **7b:** In-Situ Treatment SCOs: 220 mg/kg Mercury, 25 mg/kg PCBs, and 89 mg/kg Benzene

Conceptual plans of the proposed RAs are included in Appendix D. Preliminary estimates of remediation areas and volumes are noted on the figures. These estimates will be updated and refined following completion of the Supplemental RI.

Separate RAs were not developed using the commercial use SCOs. Those criteria fall in between the residential and industrial use criteria. Thus, the areas and volumes of media to be addressed also fall within the range bracketed by the residential and industrial use scenarios.

It is anticipated that demolition of the Site buildings will be conducted during the Supplemental RI phase prior to implementation of the selected remedial alternative. Building demolition is assumed to include removal of above-grade buildings/structures such that building slabs would remain. Depending on the selected RA, selective building slab demolition and removal may be required to facilitate remedy implementation (i.e., excavation or in-situ treatment of underlying soils).

RA-1: No Action

Refer to Figure C-1 in Attachment A for a conceptual plan of RA-1.

The No Action RA would not include implementation of any institutional or engineering controls and will be evaluated to serve as a baseline for comparison of other RAs. The No Action RA will consider the remedial measures required by and being implemented under the 1997 ROD, which were summarized in Section 2.2.2, as well as the 1998 Consent Decree, and/or the Stipulation and Order.

RA-2: Excavation and Off-Site Treatment and/or Disposal

Refer to Figures C-2a, C-2b, and C-2c in Appendix D for conceptual plans of RA-2a, 2b, and 2c, respectively.

RA-2 would include excavation of unsaturated zone soil within the remediation area to meet a range of SCOs. As indicated above, sub-alternatives (i.e., RA-2a, 2b, and 2c) will be developed to evaluate excavation scenarios to meet Unrestricted-Use, Residential-Use, and Industrial-Use SCOs identified in 6 NYCRR Subpart 375.6, which is consistent with DEC's September 11, 2008 letter.

Excavation scenarios that leave soil above residential use SCOs would require institutional controls to place limitations on site use and future construction activities. The 1997 ROD remedy requires institutional controls to restrict groundwater use and additional institutional controls may be implemented for areas being addressed under the 1997 ROD, the 1998 Consent Decree, and/or the Stipulation and Order, which would be coordinated with any institutional controls required by the RA. In addition, a Site Management Plan (SMP) would also be implemented to specify the methods necessary to ensure compliance with all engineering/institutional controls implemented at the Site and establish procedures for soil management during potential future construction activities.

RA-2 would support a range of future Site uses, depending on the selected SCO. Through excavation and in combination with institutional controls (installed as a component of the RA or to address other Site-related environmental issues, e.g. vapor intrusion), RA-2 would achieve the RAOs.

Excavation would be combined with proper soil handling, waste characterization, transportation and off-site treatment/disposal (e.g., landfill disposal, thermal desorption, thermal retorting, ex-situ stabilization, and incineration). Soil would be segregated, characterized, and staged or direct-loaded for transportation to an off-site, permitted treatment or disposal facility. Soil confirmed to meet the selected SCO would be re-used as backfill. Waste materials would be dewatered/stabilized, as necessary, to remove free liquids prior to transportation. Clean fill would be imported for backfilling to replace the volume of soil sent off site.

Excavation scenarios would require demolition of building slabs in areas identified for excavation. Excavation areas abutting structures (e.g., roadways, railroads) would require structural considerations. Prior to excavation, as part of remedial design activities, an engineering evaluation of structures would be required to evaluate their condition and develop a shoring plan to protect (as necessary) the structures during the course of excavation activities.

Utilities (electrical, telecommunication, water, sewer, and gas) would be identified and located prior to excavation. Coordination with the utility purveyor would be required to identify requirements and limitations associated with excavation in the vicinity of the utilities.

Dewatering is not anticipated to be a significant component of any excavation scenario, since the excavation component would target the unsaturated zone.

The estimated volumes of soil to be excavated under the RA-2 sub-alternatives will be calculated following completion of the Supplemental RI.

Due to the substantial volume of soil that would require excavation in order to achieve SCOs identified in 6 NYCRR Subpart 375.6, alternatives that rely on engineering and institutional controls potentially in combination with targeted excavation and/or treatment to control potential exposure pathways have been developed for evaluation in the FS. RA-3 through RA-7 have been identified to evaluate a range of alternatives that employ institutional and engineering controls potentially in combination with targeted excavation and/or treatment.

RA-3: Site Cover and Institutional Controls

Refer to Figure C-3 in Appendix D for a conceptual plan of RA-3.

RA-3 would include placement of cover materials (e.g., soil, asphalt, geotextile/stone) in areas where COC concentrations in surface soil exceed commercial or industrial use SCOs. In other areas, existing building slabs, paved areas, and un-impacted soil may be incorporated in the cover (with appropriate sampling and analysis to demonstrate compliance with DER-10). Building slabs or paved areas would be repaired as needed to create a suitable cover.

Since RA-3 would leave soil above residential use SCOs and relies on engineering controls, RA-3 would require institutional controls to place limitations on site use and future construction activities and require maintenance of the cover as an engineering control. Any institutional controls implemented under the 1997 ROD, the 1998 Consent Decree, and/or the Stipulation and Order would be coordinated with institutional controls required by the RA. In addition, an SMP would also be implemented to specify the methods necessary ensure compliance with all engineering/ institutional controls implemented at the Site and establish procedures for soil management during potential future construction activities.

RA-3 would provide site cover, which in combination with institutional controls, would achieve the RAOs. RA-3 would make use of existing cover materials to the extent practical and would likely not provide cover materials that could readily be incorporated into potential future re-use plans. Site development would likely require re-grading and would also include installation of alternate cover materials (e.g., soil/grassed areas, pavement, buildings, etc.). Therefore, if Site development were performed, upon completion of Site development, the re-developed Site cover would become the final cover materials that would be maintained as an engineering control and allow for continued achievement of the RAOs. An array of suitable cover materials would be specified that could be implemented during Site development and incorporated into the final Site cover.

RA-4: Re-graded Site Surface Cover and Institutional Controls

Refer to Figure C-4 in Appendix D for a conceptual plan of RA-4.

RA-4 is similar to RA-3; however, RA-4 would include placement of cover materials (e.g., soil, asphalt, or other) over the entire remediation area. This alternative would also include Site re-grading to improve site drainage and provide a suitable subgrade for future Site re-use.

Since RA-4 would leave soil above residential use SCOs and relies on engineering controls, RA-4 would require institutional controls to place limitations on site use and future construction activities and require maintenance of the cover as an engineering control. Any institutional controls implemented under the 1997 ROD, the 1998 Consent Decree, and/or the Stipulation and Order would be coordinated with institutional controls required by the RA. In addition, an SMP would also be implemented to specify the methods necessary to ensure compliance with all engineering/ institutional controls implemented at the Site and establish procedures for soil management during potential future construction activities.

RA-4 would support a range of future Site uses and achieve the RAOs through a combination of site cover and institutional controls. Unlike RA-3, RA-4 would provide cover materials that could likely be incorporated into future re-use plans. Upon completion of Site redevelopment, surface features implemented as part of the development (e.g., soil/grassed areas, pavement, buildings, etc.) would be incorporated in the final cover and maintained as an engineering control allowing for continued achievement of the Remedial Action Objectives. An array of suitable cover materials would be specified that could be implemented during Site redevelopment and incorporated into the final Site cover.

RA5: Targeted Excavation and Off-Site Treatment and/or Disposal, Site Cover, and Institutional Controls

Refer to Figures C-5a and C-5b in Appendix D for conceptual plans of RA-5a and 5b, respectively.

RA-5 would include targeted excavation (refer to description for RA-2 for excavation considerations) of unsaturated zone soil within the remediation area to address soil exceeding the selected SCOs. RA-5 would include various degrees of targeted excavation based on use of alternate SCOs for mercury. Based on the relatively small soil volumes associated with PCBs and benzene, it is assumed that targeted excavation for PCBs and benzene would consist of removal of soil exceeding the industrial-use SCOs (i.e., 25 mg/kg for PCBs and 89 mg/kg for benzene). Sub-alternatives of RA-5 (i.e., 5a and 5b) would evaluate excavation of mercury-impacted soil to alternate SCOs (47 mg/kg and 220 mg/kg). Excavated materials would be transported off site for treatment/disposal, which may consist of landfill disposal, thermal desorption, thermal retorting, ex-situ stabilization or incineration, following waste characterization.

The alternate SCOs for mercury are based on Final Human Health-based SCOs for mercury (inorganic salts) in Table 5.6-1 of NYSDEC's document entitled "New York State Brownfield Cleanup Program Development of Soil Cleanup Objectives Technical Support Document" (TSD) dated September 2006. The TSD explains the technical basis of the methods used to develop the SCOs that were promulgated under 6 NYCRR Part 375.6. For residential, restricted-residential, commercial, and industrial use SCOs, the elemental mercury Final Human Health-based SCO represents the lower of the two values. Table 5.6-1 includes separate Final Human Health-based SCOs for mercury (elemental) and mercury (inorganic salts). Since mercury at the Site is not in elemental form, the criteria established for inorganic salts may be considered as SCOs.

In addition to the excavation component, RA-5 would also include a Site cover, which would be consistent with that described under RA-3 or RA-4.

RA-5 would remove the soil from areas exhibiting the highest concentrations of COCs; however, since RA-5 would leave soil above residential use SCOs and relies on engineering controls, the alternative would require institutional controls to place limitations on site use and future construction activities and require maintenance of the cover as an engineering control. Any institutional controls implemented under the 1997 ROD, the 1998 Consent Decree, and/or the Stipulation and Order would be coordinated with institutional controls required by the RA. In addition, an SMP would also be implemented to specify the methods necessary ensure compliance with all engineering/institutional controls implemented at the Site and establish procedures for soil management during potential future construction activities.

RA-5 would support a range of future Site uses and achieve the RAOs through a combination of removal, site cover and institutional controls. Surface features implemented as part of future re-development (e.g., soil/grassed areas, pavement, buildings, etc.) could be incorporated in the final cover and maintained as an engineering control allowing for continued achievement of the RAOs. An array of suitable cover materials would be specified that could be implemented during Site development and incorporated into the final Site cover.

RA-6: Targeted Excavation and On-Site Treatment and/or Consolidation, Site Cover, and Institutional Controls

Refer to Figures C-6a,b and C-6c,d in Appendix D for conceptual plans of RA-6a,b and 6c,d, respectively.

RA-6 would include the targeted excavation component as described for RA-5. RA-6 combines excavation with on-site treatment and/or consolidation. Excavated materials would be either treated ex-situ and used as backfill or consolidated into an on-site constructed waste management unit. RA-6

includes four sub-alternatives that include excavation of mercury-impacted soil to alternate SCOs (47 mg/kg and 220 mg/kg) in combination with either on-site ex-situ treatment or consolidation/disposal:

- **6a:** Targeted Excavation (SCOs: 47 mg/kg Mercury, 25 mg/kg PCBs, and 89 mg/kg Benzene) and On-Site Ex-Situ Treatment
- **6b:** Targeted Excavation (SCOs: 47 mg/kg Mercury, 25 mg/kg PCBs, and 89 mg/kg Benzene) and On-Site Consolidation
- **6c:** Targeted Excavation (SCOs: 220 mg/kg Mercury, 25 mg/kg PCBs, and 89 mg/kg Benzene) and On-Site Ex-Situ Treatment
- **6d:** Targeted Excavation (SCOs: 220 mg/kg Mercury, 25 mg/kg PCBs, and 89 mg/kg Benzene) and On-Site Consolidation

On-site ex-situ treatment (RA-6a and RA-6c) would involve setting up an ex-situ treatment system where excavated soil is mixed with solidification/stabilization (S/S) reagents (cement, lime, slag cement, bentonite, sodium sulfide, etc.) using mechanical mixing methods (i.e., excavator, pugmill). S/S would encapsulate impacted soil in a low-permeability matrix and certain reagents (i.e., sodium sulfide) could be used to chemically stabilize mercury by converting it to low solubility mercury sulfides. Noteworthy is that based on the results from the RI and RFI, mercury at the Site is already in a relatively immobile form. Post-treatment confirmatory sampling would be conducted to document achievement of treatment criteria (e.g., leachable mercury, hydraulic conductivity, unconfined compressive strength). Treated materials meeting treatment criteria would be used for backfilling excavated areas.

On-site consolidation (RA-6b and RA-6d) would involve construction of a waste management unit on site. This alternative could potentially make use of the existing lagoon, which has an approximate 30,000-cy capacity within its perimeter berms, or a waste management unit could be constructed at another location. It is assumed that the waste management unit would consist of perimeter berms, a composite bottom liner system, and a composite cover system. Following construction of the perimeter berm and bottom liner system, it is assumed that excavated materials would be deposited in the unit. During waste placement, water management systems would be in place to collect stormwater that falls on the active loading areas for subsequent on-site or off-site treatment. Following waste placement, the cover system would be installed and the management unit would transition to long-term maintenance and monitoring.

RA-6 would also include a Site cover, which would be consistent with that described under RA-3 or RA-4.

RA-6 would remove the soil from areas exhibiting the highest concentrations of COCs and treat or consolidate the waste materials on site. Since RA-6 would leave soil above residential use SCOs and relies on engineering controls, the alternative would require institutional controls to place limitations on site use and future construction activities and require maintenance of the cover as an engineering control. For RA-6b and RA-6d, the waste management unit would also be maintained as an engineering control. Any institutional controls implemented under the 1997 ROD, the 1998 Consent Decree, and/or the Stipulation and Order would be coordinated with institutional controls required by the RA. In addition, an SMP would also be implemented to specify the methods necessary to ensure compliance with all engineering/institutional controls implemented at the Site and establish procedures for soil management during potential future construction activities.

RA-6 would support a range of future Site uses. RA-6 would achieve the RAOs through a combination of treatment or consolidation, site cover and institutional controls. Surface features implemented as part of re-development (e.g., soil/grassed areas, pavement, buildings, etc.) could be incorporated in the final cover and maintained as an engineering control allowing for continued achievement of the RAOs. An array of suitable cover materials would be specified, which may be implemented during Site development and could be incorporated into the final Site cover.

RA-7: Targeted In-Situ Treatment, Site Cover, and Institutional Controls

Refer to Figures C-7a and C-7b in Appendix D for conceptual plans of RA-7a and 7b, respectively.

RA-7 would include targeted in-situ treatment of unsaturated zone soil within the FS area to target soil exceeding the selected SCOs. RA-7 would include various degrees of targeted in-situ treatment based on use of alternate SCOs for mercury. Based on the relatively small soil volumes associated with PCBs and benzene, it is assumed that in-situ treatment for PCBs and benzene would target soil exceeding the industrial-use SCOs (i.e., 25 mg/kg for PCBs and 89 mg/kg for benzene). Sub-alternatives of RA-7 (i.e., 7a and 7b) would evaluate in-situ treatment of mercury-impacted soil to alternate SCOs (47 mg/kg and 220 mg/kg). Refer to the description of RA-5 for the basis of alternate SCOs.

In-situ treatment may consist of various approaches depending on the COC being targeted:

- For mercury, the only potential viable technology is in-situ solidification/stabilization (ISS), which would involve mixing impacted soil with reagents (cement, lime, slag cement, bentonite, sodium sulfide, etc.) using large diameter augers or an excavator bucket. ISS would encapsulate mercury-impacted soil in a low-permeability matrix and certain reagents (i.e., sodium sulfide) could chemically stabilize mercury by converting it to low solubility mercury sulfides. However, based on the results from the RI and RFI, mercury is already in a relatively immobile form.
- For PCBs, in-situ treatment may consist of ISS or in-situ thermal treatment.
- For benzene, a wider range of in-situ treatment technologies may be effective, including ISS, in-situ aerobic bioremediation, in-situ chemical oxidation, and in-situ thermal treatment. The findings of the on-site SVE pilot testing conducted under the 1997 ROD would be considered in evaluating in-situ treatment options for benzene.

ISS application can be performed using a variety of technologies. For shallow zone applications, such as this (e.g., from approximately 0 to 30 feet bgs), S/S agent injection and mixing is generally achieved using a method termed shallow-zone soil mixing (SSM), where large diameter augers (e.g., 6- to 12-foot diameter) are employed and S/S agents are injected through the auger shafts and mixed into the soil using the augers. To achieve continuous coverage, the columns would be overlapped. Prior to applying ISS, the areas to be treated are typically pre-excavated to remove subsurface obstacles, isolate or re-route utilities, as necessary, and accommodate swelling of the treated material (typically 20 to 40% volume increase). Alternatively, shallow soil mixing may be performed using an excavator bucket. Considering that the target interval is shallow and extends from the surface, pre-excavation over the entire treatment area would remove the majority of the target material, which at that point would be more efficiently managed ex-situ. Therefore, in lieu of large-scale pre-excavation, it is assumed for RA-7 that utilities would be located prior to application of ISS (via review of historic facility drawings, coordination with the utility purveyors, and on-site utility locating) and surgically removed. In addition, prior to ISS application, it is assumed that concrete slabs would be demolished and removed for subsequent crushing and use as backfill material.

Given that multiple in-situ treatment technologies may be applicable for PCB and benzene-impacted soils it is anticipated that all treatment options would remain available under RA-7. If RA-7 were selected, the specific in-situ treatment technology(ies) would be selected during the pre-design stage when further evaluation of in-situ treatment alternative would be conducted, potentially followed by bench-scale and pilot-scale testing to evaluate treatment effectiveness and serve as the basis for full-scale design.

In addition to the in-situ treatment component, RA-7 would also include a Site cover, which would be consistent with that described under RA-3 or RA-4.

RA-7 would treat soil in areas exhibiting the highest concentrations of COCs; however, since RA-7 would leave soil above residential use SCOs and relies on engineering controls, the alternative would require institutional controls to place limitations on site use and future construction activities and require

maintenance of the cover as an engineering control. Any institutional controls implemented under the 1997 ROD, the 1998 Consent Decree, and/or the Stipulation and Order would be coordinated with institutional controls required by the RA. In addition, an SMP would also be implemented to specify the methods necessary ensure compliance with all engineering/ institutional controls implemented at the Site and establish procedures for soil management during potential future construction activities.

RA-7 would support a range of future Site uses and achieve the RAOs through a combination of in-situ treatment, site cover and institutional controls. Areas receiving ISS treatment would leave solidified soil within the interval likely to be disturbed during redevelopment; however, the mix design could be designed to accommodate excavation/handling of ISS-treated soil. Surface features implemented as part of the redevelopment (e.g., soil/grassed areas, pavement, buildings, etc.) could be incorporated in the final cover and maintained as an engineering control allowing for continued achievement of the RAOs. The SMP would specify an array of suitable cover materials, which may be implemented during Site development and could be incorporated into the final Site cover.

4.7.5 Evaluation of Remedial Alternatives

The proposed RAs have been developed based on the RAOs, technologies retained after screening, guidance provided by the Department in the September 11, 2008 letter, and DER-10 (Section 4.1). The RAs provide a range of alternatives that consider attainment of unrestricted and residential SCOs, commercial and industrial use SCOs, and alternate SCOs as well as use of engineering and institutional controls to manage risks associated with constituents that may remain on site under various future site use scenarios.

The RAs identified herein will be evaluated in accordance with 6 NYCRR 375-1.8(f) and the guidance provided in DER-10 (Section 4.2). The evaluation criteria are as follows:

- Overall protectiveness of the public health and the environment;
- Standards, criteria and guidance;
- Reduction of toxicity, mobility or volume of contamination through treatment;
- Long-term effectiveness and permanence;
- Short-term impact and effectiveness;
- Implementability;
- Cost effectiveness; and
- Land use.

In performing the evaluation, the first two evaluation criteria are considered threshold criteria and must be satisfied in order for an alternative to be considered for selection. The next six evaluation criteria are primary balancing criteria which are used to compare the positive and negative aspects of each of the remedial alternatives.

An FS report will be prepared to present the evaluation of RAs and will include recommendations for an appropriate final remedy. The FS report will include the following sections consistent with DER-10, Section 4.4(b)(4):

- Introduction;
- Site description and history;
- Summary of RI and exposure assessment;
- Remedial goals and remedial action objectives;
- General response actions;
- Identification and screening of technologies;

- Development and analysis of alternatives; and
- Recommended remedy.

Figures and tables will be included to depict the alternatives and summarize the evaluation. Some of the above information has been presented in the previous sections of this RI/FS Work Plan, including RAOs, screening of technologies, and development of alternatives. These items will be updated and refined to incorporate the results of the Supplemental RI, comments received from the Department, new or revised SCGs, and other new or additional information that may become available.

Section 5

Proposed Investigation Activities and Procedures

The investigation will include the collection of soil samples at each of the target locations as part of the implementation of this Supplemental RI/FS Work Plan. Various methodologies may be employed to facilitate soil-sample collection. It is expected that these methods will consist of GeoProbe® (macro core) and/or the use of 2-inch stainless steel split-spoons. Each method will be selected based upon access, subsurface material and sampling objective. It is possible that additional methods may be required for specialized conditions, not yet foreseen. Any such methods will be discussed with the DEC prior to use and, if necessary, detailed in a supplemental submittal to this Supplemental RI/FS Work Plan. Details of the expected methods are provided in the following sections.

5.1 Sample Collection Procedures

Details regarding the procedures for the collection of soil and sediment samples are provided in the following sections. Individual standard operating procedures for the following activities are presented in Appendix E.

5.1.1 Soil

Soil samples will be collected using one of two methods: GeoProbe® (macro core), or 2-inch stainless steel split-spoons.

If soil samples are collected via GeoProbe®, a new acetate liner will be used for each sample. If sampling is performed using a 2-inch stainless steel split-spoon, the split-spoons will be field decontaminated prior to each use.

The volatile organic compounds (VOCs) samples will be collected directly from the sample device first. If additional sample volume is needed for analyses other than VOCs, additional macro-core or split-spoon samples will be collected directly adjacent to the original sample location. Soil to be analyzed for VOCs will not be homogenized. Soil for other analyses will be homogenized and containerized in the sample jars. A photoionization detector (PID) will be used to field screen the soil. Details of the field screening process are provided below and in Appendix E.

After the completion of sample collection, any excess soil will be carefully placed back in the borehole. The remainder of the borehole will be restored to grade with additional soil. If the sampling is conducted through a slab/pad or asphalt pavement, the surface will be restored using concrete, cold patch asphalt or bentonite, as appropriate to the location.

Target Intervals

At each of the SWMU sample location, a minimum of two soil samples will be collected except as otherwise noted. A coring device will be used as necessary to allow for sampling beneath the concrete slab/pad or asphalt pavement. A soil sample will be collected from the 0-1 foot interval beneath the slab/pad or pavement sub base material. The deeper sample will be collected from the interval

demonstrating the greatest impact (whether through visual inspection or field screening). If the soils do not demonstrate any evidence of impact then a sample will be collected from the next change in lithology or from immediately above the water table.

Additional lateral (step-out) or vertical sampling may be performed to further investigate areas based on observations during the soil sampling activities. Field decisions regarding the collection of additional samples will be based on observed staining or impacts, changes in lithology, depth to groundwater and screening results. The resulting data will be useful for characterizing the subsurface, detailing areas and magnitude of impact, and/or to provide horizontal and vertical delineation of impacts.

A deeper sample may not be collected where the depth to groundwater is shallow (<5 feet) and there is no significant change in soil characteristics or screening results of concern from the shallow interval. Also, a boring may be terminated without collecting a deeper sample if non-aqueous phase liquid (NAPL) or heavily contaminated soil is encountered in the shallow sample and continued drilling, probing or digging could provide a vertical pathway for the material. Noteworthy is that NAPL was not encountered in any of the samples previously collected for the RFI.

Field Screening

Each soil sample will be field screened for VOCs using a PID. When sampling with a macro core or split spoon, the sample will be screened immediately upon opening the sampling device. The PID will be utilized to monitor for VOCs within "pockets" of the soil which will be burrowed with a clean sampling spoon or the gloved hand of the sampler. The PID sampling tip will be placed within the pocket and the enclosed by the cupped hand of the sampler. Conditions will be allowed to stabilize and a reading will be taken and recorded. This process will be repeated at each observed change in material or evidence of impact. At a minimum, four scans will be performed across each 2-foot interval. The portion of the soil core sampled for analysis will be biased toward the portion demonstrating the highest PID reading. Additional details regarding the PID screening are provided in Appendix E.

5.1.2 Soil Vapor

Soil vapor samples will be collected from temporary sample points utilizing pre-evacuated stainless steel Summa Canisters. Sampling points will installed with via GeoProbe® to four (4) feet below the slab of the building. A 1.875" polyethylene vapor implant will be attached to the end of the 0.25" tubing at 4' below grade. This implant acts as a filter of 40-60 microns. Following installation of the vapor implant, the sample point will be sealed at the ground surface using bentonite, and allowed to equilibrate for a period of several hours to one day. Prior to sampling the sample points will be purged for at least three sample line volumes at a rate no greater than 200 ml/min. Additionally a helium leak test will be performed to assure the integrity of the sample point and minimize short circuiting of ambient air into the soil vapor sample line. Samples will be collected over a period of 2 hours.

5.1.3 Sediment

Sediment samples will be collected using one of two methods: sediment coring device or petit ponar dredge. Sampling methodology may be modified in the field depending on the conditions and accessibility at each catch basin and sample location. Sediment intended for VOC analysis will be placed into the appropriate sample jars immediately upon retrieval. The remaining volume, from each sample, will be homogenized and placed within the appropriate sample jars. Sediment samples to be analyzed for VOCs will not be homogenized.

5.2 Sample Containerization and Shipping

The subject soils or sediment will be transferred into the sample jar using a laboratory decontaminated plastic trowel or spoon or directly by gloved hand. The sample containers will be placed in a cooler that will be maintained at 4°C. The samples will be packaged so as to minimize the potential for breakage. Glass jars will be wrapped with protective packaging prior to placement in the cooler for transport. Plastic bags filled with ice and sealed, or blue ice containers will be placed inside each cooler with the samples to ensure that the preservation temperature is maintained. The sample coolers will be transferred, in accordance with the chain of custody procedures, to a courier for same day delivery to the analytical laboratory.

5.3 Chain-of-Custody Procedures

Custody requirements address sample custody and handling in the field and during laboratory receipt, analysis and disposition. All samples will be subject to complete custody documentation.

In the field, samples will be in physical possession or in view of the sampler/custody holder (typically the field sampling team leader). The sample may also be placed in a (designated) secure area by the custody holder.

Before sending samples to the analytical laboratory (typically by lab courier pick up), appropriate sections of the Chain-of-Custody (COC) will be filled out. A copy of a sample COC to be used by is provided in Appendix F. Sample containers will be labeled and must contain at least the following information: sample ID, sample date and time, and requested analysis. The COC will accompany the samples to the analytical laboratory; a copy of the COC stays in custody of the sampler.

The laboratory personnel will be responsible for the care and custody of samples from the time of receipt until the sample is exhausted or disposed. Custody rules will apply throughout the life of the sample in the laboratory. All documentation of sample custody within the laboratory will become a permanent part of the laboratory project files. The laboratory will submit an analytical report, including custody documentation.

5.4 Sample Analyses

Laboratory analytical services will be performed by a New York State certified laboratory. Soil samples will be analyzed for the following analyte groups, using the methods listed below:

- VOCs - 8260B
- SVOCs - 8270C (to include pyridine and alpha- and beta- and beta-picoline)
- TAL Metals – 7000/7471A/6020 (includes lead and mercury)
- PCBs - 8082
- Ammonia - MCAW 350.2M

Where feasible, and when holding times are not in jeopardy, a tiered analysis program may be employed where the deeper samples are analyzed only following the receipt and review of the analytical results from the shallower samples from the same borehole. The shallower sample data would be used to determine the need for the analysis of the deeper samples, submitting and analyzing the deeper samples only if concentrations of target analytes are detected above the soil cleanup objectives given in 6 NYCRR Part 375, and only for those analytes that are detected above the criteria.

Table 5-1 provides a summary of each sample type, quantity, analyte, container, holding time and preservation method.

5.5 Survey

Upon completion of the sampling activities, each of the soil sample locations will be surveyed by a New York-certified land surveyor. The survey will utilize the New York State Plane coordinate system (NAD'83, East Zone, Feet). Vertical elevations will be references to NAVD '88.

Section 6

Project Management

The management approach for the execution of the Supplemental RI is detailed in the following sections. Included is a discussion of the qualifications and management approach for completion of the Supplemental RI.

6.1 Management Approach

Brown and Caldwell Associates, under contract to ELT will coordinate, execute and report the results of the Supplemental RI/FS. The Supplemental RI/FS will be conducted in accordance with the Order on Consent and applicable regulations and guidance, including DER-10. Regular updates on progress will be provided to ELT and DEC. Any significant variations from the Supplemental RI/FS Work Plan will be reported and discussed accordingly.

6.2 Personnel and Contractors

Brown and Caldwell is a 66-year old national firm with a staff of over 1,400 including experts in environmental consulting, engineering and construction management. The firm does business in New York State through its wholly owned affiliate, Brown and Caldwell Associates. Personnel with the appropriate qualifications, training and experience will be assigned to each project task. Documentation of each individual's qualifications and experience can be provided upon request.

Subcontractors may be employed for specific tasks such as drilling, laboratory analysis, data validation and surveying. Only subcontractors possessing the required licenses and certifications that are prequalified with regards to health and safety, insurance and other considerations will be used for the project. Documentation of subcontractor's qualifications and experience can be provided upon request.

Section 7

Schedule

The Supplemental RI will be conducted in accordance with the schedule provided in Figure 7-1. The DEC will be notified in advance of all sampling activities and provided the opportunity to collect split samples. A minimum of five business days notice shall be provided.

The review and comment periods by regulatory agencies and other parties are estimates and may be subject to revision, and activities dependent upon such approvals, such as demolition, will be subject to receiving necessary approvals (i.e. any modification to the SPDES Permit for the Site required to address demolition). Similarly, field conditions, unforeseen events beyond the reasonable control of ELT and other factors may affect the schedule of the Supplemental RI. The DEC will be notified if any schedule revisions are necessary.

As discussed in Section 4.2, the investigation activities will be conducted prior to demolition to expedite the schedule for completing the Supplemental RI and FS. As such, it may not be possible to safely access some of the planned sample locations. It is expected that sample collection will be completed at a majority of the planned locations, that the data obtained will be sufficient to proceed with the FS. It is also anticipated that any additional sampling the Department may seek pursuant to its authority under the Order on Consent would be identified and completed no later than at this time. Work on the FS will commence following the Department's approval of the Supplemental RI Report and its concurrence that any sampling that was unable to be completed prior to demolition is not required for the purposes of preparing the FS.

Section 8

Data Management Plan

This investigation will generate a large quantity of analytical data. Proper management of these data begins in the field with sample nomenclature and continues with the use of a database, to the endpoint of using the data for decision making.

8.1 Sample Nomenclature

Each sample collected will receive a distinct sample identifier. The sample identifier will consist of three parts; the first part will identify the area the sample was collected from within; the second part will identify the sample matrix; the third part will identify the specific sample. A complete list below identifies the different area and matrix identifiers. As an example, a soil sample collected using a split spoon or a macro core in Area A from Boring 1 would be designated A-B-001. The "A" designates the area, "B" identifies the sample as a soil boring, and "001" identifies the specific boring number. Each boring identifier will additionally have the depth interval added to the end of the identifier. In the example above, if the sample was collected from the 1-2 foot interval the sample identifier would be "A-B-001-01-02".

The Quality Assurance/Quality Control (QA/QC) samples will also be identified in three parts; sample type, date, and a unique number if more than one type is collected in a single day. For example, a duplicate would be identified as "DUP-mmddyy" and a second duplicate collected on the same day would be "DUP-mmddyy-1".

Below are the matrix/sample codes:

- "B" indicates a soil boring
- "SV" indicates a soil vapor sample
- "SD" indicates a sediment sample
- "FB" indicates a field blank
- "TB" indicates a trip blank
- "DUP" indicates a duplicate

8.2 Data Record

Data will be received from the laboratory as both a hard copy and as an electronic data deliverable. Data will be imported and stored in a database, which will include a minimum of three data tables. These three main data tables will be a results table, a parameter table, and a sample table. The results table will have each of the sample results stored; the parameter table will contain details regarding the analysis; and the sample table will contain information about the sample.

Data collected in the field, including PID data, will be stored electronically with the soil boring log data.

8.3 Tabular and Graphical Displays

Data will be presented in tables generated using the database and spreadsheets. Graphical displays, maps, figures, and boring logs will be generated using survey data from the database and GIS or CAD depending on the application. Boring logs will be presented using Gint© or other similar logging software.

Section 9

Project Quality Assurance

Project-quality assurance will be achieved through the establishment of clearly defined data quality objectives (DQO), collection of field QA/QC samples, selection of test methods to fit the DQO, and the use of independent, third party data validation.

9.1 Data Quality Objectives

Method analyses that are selected must, at a minimum, have detection limits that meet the Part 375 soil cleanup objective criteria.

9.2 Quality Assurance/Quality Control Samples

The field QA/QC samples to be collected are as follows:

9.2.1 Field Duplicates

Field duplicates are a second aliquot of a field sample. Variations in the sample and duplicate can be indicative of possible inaccuracy or imprecision of laboratory methodologies. One Field Duplicate will be collected for every 20 samples.

Field duplicates will be collected in one of two ways, depending on the analysis to be performed. For each analyte, with the exception of VOCs, the sample volume will be homogenized in plastic bowls with plastic spoons, or by kneading the material in a plastic bag (e.g. Ziploc© bag). Once homogenized, the material will be evenly distributed into the sample containers. Sample collection materials (bowls, spoons, plastic bags, gloves) will be laboratory decontaminated or single use.

Homogenization of sample material that will be analyzed for VOCs is inappropriate given the volatile nature of these constituents; homogenization would only provide a greater opportunity for constituent loss due to exposure to the atmosphere.

9.2.2 Field Blanks

Field blanks, also referred to as equipment blanks, are used to determine if the sampling equipment used in the field might contribute appreciable concentrations of constituents to the samples. Laboratory grade deionized water is run over, or through, the sampling equipment and collected in the same type of sample jars as other samples. Ideally, the results for this analysis will show non-detects for the constituents analyzed. One field blank will be collected every day that samples are collected, or one per 20 samples, which ever is greater.

Field blanks are not collected for soil vapor samples.

9.2.3 Trip Blanks

Trip blanks are used to determine if cross contamination may have occurred during the transport of the samples. Trip blanks will be analyzed for VOCs only. The trip blanks are prepared in the laboratory with laboratory grade de-ionized water and are shipped with the cooler containing the VOC sample jars. Trip blanks always remain with the sample jars. One Trip Blank will be present with each shipment of VOC sample jars to and from the laboratory.

Trip blanks are not collected for soil vapor samples.

9.3 Test Methods

The following methods will be used for analysis:

- VOCs - 8260B, TO-15
- SVOCs - 8270C (to include pyridine and alpha- and beta-picoline)
- TAL Metals – 7000/7471A/6020 (includes lead and mercury)
- PCBs - 8082
- Ammonia - MCAW 350.2M

Soil samples will be reported on a dry weight basis. Soil Vapor results will be reported in ug/m^3. Data will be reported in Category B format along with the required quality assurance data on the required forms and with all raw data including calibration data, blank data, chromatograms, quant reports, sample prep logs, sample run logs and percent moisture work sheets and will be provided in electronic format.

9.4 Data Validation

9.4.1 Qualitative Data Validation

Data validation services will be performed by a qualified independent subcontracted validator. The qualifications of the validator will be provided to the DEC once they are contracted. For each data package a Data Usability Summary Report (DUSR) will be produced.

The validation will be conducted on each of the samples reported by the primary laboratory. The constituents validated will include: VOCs, SVOCs, Pest/PCBs, Mercury, Lead, pyridine, alpha- and beta picoline and ammonia.

The criteria for qualitative data validation include the following:

- Data Completeness,
- Sample Temperatures,
- Holding Times,
- Analytical Detection Limits and Sample Quantitation,
- Surrogate Recovery,
- MS/MSD Review,
- Laboratory Control Sample (LCS),
- Review of QA/QC Samples,
- Overall Evaluation of Data,
- Gas chromatograph/mass spectrometer/GC/Electron Capture Detector (GC\MS\GC\ECD) Instrument Performance,
- Initial Calibration,
- Continuing Calibration,
- Internal Standards,
- Target Compound Identification,
- System Performance, and
- Serial Dilution.

Target compound identification and GC/MS/GC/ECD instrument performance are both for organic analyses only.

9.4.2 Qualitative Data Validation Criteria

Data Completeness

The data completeness criterion incorporates a checklist of what should be found in a data package. It also identifies the types of forms used for certain analyses. A complete data set is considered to have the following: case narrative, data summary, surrogate recovery summary, MS/MSD summary, and LCS summary. In addition to identifying missing components of the data package, the data completeness check also includes verifying the following criteria: proper analytical method selection and documentation, use of the proper analytical data sheets, appropriate EPH/VPH report formats, sample preservation documentation, and documentation clarity.

Sample Temperatures

Most environmental samples are required to be held within a temperature range of 2-6°C. The rationale for this range is that temperature affects various chemical and biological degradation processes, including solubility. Freezing of samples should be avoided as well.

Holding Times

Various parameter groups have different allowable holding times. Holding times are a function of solubility, rates of decay, evaporation, and other factors that are function of time and potentially affect the concentrations of contaminants. The following lists the holding times for the constituents included in the various levels of data validation.

- VOCs – 14 days until extraction/+48 hours until analysis
- SVOCs – 14 days until extraction/+40 days until analysis
- PCBs – 14 days until extraction/+40 days until analysis
- Metals (except mercury) – 6 months
- Mercury – 28 days

The results of samples that are tested outside of the holding time ranges are considered estimates, since there may have been sufficient time for a constituent loss or a reduction in concentration to have occurred.

Analytical Detection Limits

Various analytes and various concentrations require different detection limits. This review focuses on whether or not the detection limits are sufficiently low to detect relevant concentrations of the samples by comparison to DQOs or project action limits, and examines diluted samples. As a sample is diluted to bring the concentration within the calibration curve the detection limit changes as a multiple of the dilution factor. This elevated detection limit will be avoided to the extent practical; however, in some cases the elevated detection limit may not impact the DQOs (e.g., NAPL impacted soil, may make the issue of DQO compliance moot as the soil would clearly be impacted.)

Surrogate Recovery

Surrogate recoveries are performed on each organic sample. Surrogate recoveries are one of several ways to examine the potential for matrix interference. Chemicals that are not specifically analyzed for are added (spiked) to the sample matrix in a known quantity, and the laboratory analyzes the sample.

The result is weighed against the known quantity added, and the percent difference between the spiked concentration and the analytical result provides a measure of possible matrix interference. Surrogate recovery data are reported as a percentage. The Relative Percent Difference (RPD) may be reported if a surrogate recovery duplicate is performed.

In general, if a lab has recoveries that are too low, then the results for that analysis are considered to be biased low, and if too high, the results are considered to be biased high. In each case the results should be considered an estimate and are qualified as such. In extreme cases where the recoveries are poor, in that they have a zero recovery, the data should be considered for rejection.

MS/MSD

MS/MSDs are similar to the surrogate recovery in that they are spiked samples performed in the sample matrix. There are several distinct differences, however. One difference is that the chemicals added are the same chemicals that are being analyzed for; moreover, MS/MSDs are performed on each constituent group analyzed in the samples, not just organic compounds. MS/MSDs also address whether or not the matrix interferes with the analysis.

As with surrogate recoveries, low MS/MSD recoveries indicate that the results may be biased low, and high recoveries indicate results that may be biased high. As with surrogate recoveries, MS/MSD data are reported in the form of percentages.

Laboratory Control Sample

Laboratory control samples examine the laboratory's accuracy and precision, where the focus is on the laboratory equipment and procedures. Unlike the MS/MSDs and the surrogate recovery analyses, the LCS analysis is performed with laboratory grade de-ionized water. The LCS results are reported in percentages, with low results indicating that the results may be biased low, while high results indicate the results may be biased high.

Laboratory Case Narrative

The laboratory case narrative describes inconsistencies observed by the laboratory during analysis. The case narrative states what was done differently, if anything, from prescribed methods, identifies holding time violations if any, and outlines other difficulties the lab may have encountered.

Analytical Detection Limits and Sample Quantitation

For organic compounds, the accuracy of the contract required quantitation limits (CRQL) and the reported quantitation results are calculated through a series of equations. Quantitation results are a function of the mass and area of internal standard ion added, the amount of dilution, the volume of water purged during the process and the relative response factor (RRF). The RRF is a ratio of the internal standard concentration and ion area to the target ion's concentration and ion area. The CRQL is adjusted simply by multiplying by the dilution factor.

For inorganic data, detection limit results are evaluated using a simple guideline. For those results less than twice the instrument detection limit (IDL) a "J" qualifier is added. For those results greater than twice the contract required detection limit (CRDL), no flags are added.

Overall Evaluation of Data

The overall evaluation of the data is a holistic assessment of all the data. The entire data package and data review results are reviewed, and a narrative is prepared outlining concerns and comments about the quality of the data. Rarely are additional qualifications or rejections made based on the overall evaluation.

GC/MS/GC/ECD Instrument Performance

GC/MS/GC/ECD instrument performance, also referred to as "tuning", is designed to demonstrate accurate mass resolution, identification, and sensitivity of the equipment. Instrument performance is evaluated using standard solutions and rarely results in rejections.

Initial Calibration/Continuing Calibration

Initial and continuing calibrations are standards for instrument calibration ensuring that the instruments are detecting the appropriate concentration ranges and produce a linear calibration curve. The initial calibration demonstrates that the equipment is capable of detecting the appropriate ranges and is producing the proper calibration curve. The continuing calibration produces 12 hour relative response factors (RRF) and checks the instrument daily throughout its use on the SDGs. The RRF is used to calculate quantitation and must be greater than 0.05, and produce percent differences within a range of plus or minus 25%.

Internal Standards

Internal standards evaluate GC/MS sensitivity and responses for stability. The internal standard areas must not vary by greater than a factor of two from the calibration standard, and the retention time within the columns must not vary by more than thirty seconds.

Target Compound Identification

Target compound identification examines the GC/MS results for false readings. The ions are scrutinized for concentration variances; the ions present within the standard mass spectrum with a relative percent intensity greater than 10% must also appear in the sample spectrum. If the ions that have a relative percent intensity greater than 10% are not in the sample spectrum they must be accounted for. Ions that are in both the standard and sample spectrum must have a relative percent intensity that is within 20% of each other.

System Performance

System performance examines the accuracy of the instrumentation. As samples are analyzed, changes may occur that will impair the various instruments ability to accurately analyze data. Sudden, severe shifts in the Reconstructed Ion Chromatogram (RIC) baseline can indicate decreasing resolution of the calibrated zero concentration. Inexplicable peaks, split peaks, or unusually high background readings can all also indicate problems with the instruments, and may lead to inaccurate readings.

Serial Dilution

The serial dilution examines matrix interference from physical or chemical sources. One serial dilution must be performed for each type of sample matrix, concentration level, or SDG, depending on what would be more frequent. Field Blanks must not be used. The dilution must be within 10% of the original concentration if that concentration is greater than 50 times the instrument detection limit (IDL).

A complete copy of the DUSR, signed by the reviewing validator, will be provided to the DEC.

Section 10

Health and Safety

A HASP will be prepared in accordance with the standards set by the Occupational Safety and Health Administration as stated in 29 CFR with emphasis on the following subsections, as well as other applicable federal and state statutes and regulations:

- 1910.120 Hazardous Waste Operations and Emergency Response
- 1910.1000 Toxic and Hazardous Air Contaminants
- 1910.1200 Hazard Communication, Employee Right-to-Know Law
- 1904 Recording and Reporting Occupational Injuries and Illnesses
- 1990 Identification and Regulation of Potential Occupational Carcinogens
- 1926 Safety and Health Regulations for Construction)

The Site specific Health and Safety Plan is presented in Appendix G.

10.1 Community Air Monitoring Plan

Community air monitoring will be performed in accordance with the New York State Department of Health (DOH) Generic Community Air Monitoring Plan, included in Appendix H. Air monitoring readings will be recorded in a logbook and will be provided as an appendix to the Supplemental RI Report. Real-time air monitoring will be conducted during work activities for VOCs and particulates (i.e., dust). Air monitoring will be performed continuously for ground intrusive activities.

This Community Air Monitoring Plan (CAMP) is not intended for use in establishing action levels for worker respiratory protection. Furthermore, this CAMP is intended to address only the Supplemental RI sampling activities following demolition of Site buildings and structures.

10.1.1 CAMP VOC Action Levels

The following action levels for VOCs are in accordance with the Generic CAMP:

Action Level	Response
Below 5 ppm above background for the 15-minute average	Continue and/or resume work activities
> 5 ppm above background for the 15-minute average	Temporarily halt work and continue monitoring
5 to < 25 ppm	Work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions and continue monitoring
> 25 ppm	Cease operations. Contact PM and BC Director of Health and Safety or designee immediately.

10.1.2 CAMP Particulate Action Levels

The following action levels for particulates are in accordance with the Generic CAMP:

Action Level	Response
> 0.1 mg/m^3 above background for the 15-minute average or if airborne dust is observed leaving the work area	Employ dust suppression techniques
0.1 to 0.15 mg/m^3	Work may continue with dust suppression techniques provided downwind PM-10 particulate levels do not exceed 0.15 mg/m^3 above background for the 15-minute average and airborne dust is not observed leaving the work area
> 0.15 mg/m^3 with dust suppression techniques implemented	Cease operations. Contact PM and BC Director of Health and Safety or designee immediately.

Section 11

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Tables

TABLE 2-1
SITE CHRONOLOGY
FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

Year	Month	CERCLA Activities	RCRA Activities	SPDES Activities	Description
1942					Nepera plant begins operations. Operated by Pyridium Corporation. Manufactures bulk and fine pharmaceutical chemicals, hydrogels, and pyridine-based chemical intermediates.
1942					Begin spreading of solidified process wastes (neutralized with lime) in location of present-day parking lot.
1945	September				Incineration of waste products in burn pits commences.
1947-1948					Land spreading of solidified process wastes ceases.
1953					On-site disposal of calcium sulfate sludge ceases.
1956					Pyridium Corporation and its affiliate, Nepera Chemical Company, purchased by Warner-Lambert Company. Nepera, Inc. formed as a wholly owned subsidiary in 1957 of Warner-Lambert Company.
1957	May				Incineration of waste products in burn pits ceases.
Mid 1960s					Wastewater lagoon constructed.
1976					In 1976, Nepera, Inc. becomes a wholly owned subsidiary of Schering, A.G. of Berlin, Germany.
Mid 1980s					Buried drums removed from areas near Buildings 67 and 75 and southern boundary of Site.
1986					Schering, A.G. sells Nepera to Cambrex.
1986	March	X			Plant Wide Hydrogeologic Investigation report issued.
1988	March	X			Nepera, Inc. and Warner Lambert enter into Stipulation Agreement with NYSDEC.
1989	July	X			Phase I Hydrogeologic Investigation/Interim Remedial Measures report issued.
1989	December	X			Remedial Investigation/Feasibility Study (RI/FS) Work Plan submitted to NYSDEC.
1990	July	X			NYSDEC conditionally approves RI/FS Work Plan.
1990		X			IRM groundwater extraction system installed and begins operating.
1991	March	X			Revised RI/FS Work Plan Addendum and QAPP submitted to NYSDEC.
1991	April	X			Commence RI field investigations.
1992	June	X			RI field investigations completed.
1992	July	X			RI Report submitted to NYSDEC.
1994	April	X			NYSDEC provides comments on RI Report.
1994	June		X		NYSDEC completes RCRA Facility Assessment (RFA).
1994	November	X			FS Report submitted to NYSDEC. (NYSDEC did not review the report and requested submission of a Phase I FS report.)

TABLE 2-1
SITE CHRONOLOGY
FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

Year	Month	CERCLA Activities	RCRA Activities	SPDES Activities	Description
1994	December	X			NYSDEC provides additional comments on RI Report.
1995	1st half	X			Additional RI activities performed.
1995	June	X			Phase I FS Report submitted to NYSDEC. (NYSDEC provided comments that were incorporated into a revised FS report.)
1995	July	X			Revised RI Report submitted to NYSDEC.
1995	September	X			NYSDEC provides comments on revised RI Report. Response to comments submitted to NYSDEC.
1995	September	X			Revised FS Report submitted to NYSDEC.
1995	November	X			Final RI Report submitted to NYSDEC.
1995	November	X			NYSDEC provides comments on revised FS Report.
1995	November	X			NYSDEC conducts surface water sampling in West Branch of Ramapo River.
1996	January	X			FS Report Addendum submitted to NYSDEC.
1997	March	X			NYSDEC issues Record of Decision (ROD).
1998	May	X			Trust enters into Consent Decree to implement the remedy selected in the ROD.
1999	July		X		Part 373 Hazardous Waste Management Permit issued to Nepera Inc. Permit subsequently transferred to Rutherford Chemicals, LLC.
1999		X			Additional sentry wells installed to complete array of down-gradient monitoring; additional wells installed in vicinity of Building 53.
1999-2001		X			Drum and contaminated soil removal from Area F and Building 53 performed. Excavation Summary Report submitted to NYSDEC in March 2001.
2001		X			Sediment excavation from Area K completed.
2001		X			Soil vapor extraction tested and found to be ineffective. SVE/VER Test Report submitted to NYSDEC.
2001-2002		X			Building 13 seep investigation and IRM completed. Building 13 Seep Investigation Report submitted to NYSDEC in October 2002.
2001-2005				X	Pollutant Minimization Plan developed and implemented under SPDES permit to identify/control plant sources of mercury.
2001	June/July	X			NYSDEC conducts a fish study for West Branch of Ramapo River and issues a fact sheet.
2002		X			Groundwater remediation by biosparging commences.
2002-2005		X			Activities performed in MW-1S area. MW-1 Groundwater Evaluation Work Plan developed and implemented. Biosparge system installed and operated for two years. MW-1 Groundwater Evaluation Report submitted to NYSDEC in February 2004.
2003	November				Nepera, Inc. purchased by Rutherford Chemicals, LLC.
2004	September	X			Groundwater extraction wells taken off line.
2005	May	X			Riverbank Capping Work Plan submitted to NYSDEC.

TABLE 2-1
SITE CHRONOLOGY
FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

Year	Month	CERCLA Activities	RCRA Activities	SPDES Activities	Description
2005	May				All manufacturing operations ceased.
2005	May	X			Erosion control IRM implemented along the stream bank.
2005	July		X		Equipment shutdown, cleanout and decontamination begun.
2005	August		X		Incinerator shut down.
2005	September		X		NYSDEC issues Documentation of Environmental Indicator (EI) Determination; concludes current human exposures are under control.
2005	September				Last product shipped off site.
2005	November	X			Conceptual Plan for Riverbank Stabilization submitted to NYSDEC.
2005			X		Above-ground portions of all TSD units closed pursuant to permit and approved RCRA Closure Plan
2006	May		X		NYSDEC requires Rutherford Chemicals to prepare RCRA Facility Investigation (RFI) Work Plan.
2006	July		X		Meeting with NYSDEC on 7/26/06 to review scope of RFI and proposed sampling approach.
2006	August		X		Draft RFI Work Plan submitted to NYSDEC.
2006	October		X		Equipment shutdown, cleanout and decontamination completed.
2006	October		X		NYSDEC conditional approval of RFI Work Plan. RFI field investigation begun.
2006	November		X		Final RFI Work Plan submitted to NYSDEC.
2007	January		X		RFI field activities completed.
2007	January		X		NYSDEC site visit to observe RCRA Closure activities; letter issued 1/11/07 regarding sampling requirements.
2007	April		X		RFI Report submitted to NYSDEC.
2007	April		X		Meeting with NYSDEC on 4/25/07 to review findings of RFI.
2007	April	X			Stream bank IRM repaired and enhanced following a flooding event that caused minor damage.
2007	July		X		NYSDEC comments on RFI Report; requires Phase II RFI Work Plan and CMS Plan.
2007	August		X		Draft responses to comments on RFI Report submitted to NYSDEC for review and discussion.
2007	September		X		Meeting with NYSDEC and NYSDOH to discuss comments on RFI Report.
2007	October		X		Addendum to RFI Report submitted to NYSDEC.
2007	November		X		Phase II RFI Work Plan, CMS Plan and Task I Report submitted to NYSDEC.
2007	November				ELT Harriman, LLC purchases the site.
2007	December			X	ELT Harriman submits application for transfer of existing SPDES permit.
2008	February		X		NYSDEC approves Phase II RFI Work Plan.
2008	May	X			Conceptual Site Model and Supplemental Remedial Action Work Plan submitted to NYSDEC.

TABLE 2-1
SITE CHRONOLOGY
FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

Year	Month	CERCLA Activities	RCRA Activities	SPDES Activities	Description
2008	August		X		Phase II (Supplemental) RFI Technical Memo submitted to NYSDEC.
2008	September	X			Biosparge system taken off line.
2008	September		X		NYSDEC comments on CMS Plan and Task I Report. States that parking lot must be included in CMS.
2008	November	X	X		Letter from West Firm to NYSDEC in response to NYSDEC comment to include parking lot in CMS.
2008-present		X			Semiannual groundwater sampling and analysis performed at on-site monitoring wells in accordance with Supplemental Remedial Action Work Plan.
2009	February		X		NYSDEC letter re CMS scope and schedule clarifies that parking lot is not to be included in CMS, requests interim CMS Report by March 16, 2009 and CMS Report by April 30, 2009.
2009	March		X		Interim CMS Report submitted to NYSDEC on March 16, 2009.
2009	May		X		NYSDEC comments on Interim CMS report; requires additional mercury speciation analysis.
2009	June		X		Letter from ELT to NYSDEC regarding schedule for responding to comments in Interim CMS report.
2009	July		X		Letter from BC to NYSDEC responding to comments on Interim CMS Report.
2009	September		X		Supplemental Mercury Speciation Work Plan submitted to NYSDEC.
2009	November		X		NYSDEC comments on Supplemental Mercury Speciation Work Plan and requests a conference call to further discuss the issues.
2009	November	X			Letter from NYSDEC OGC to multiple parties requesting delineation sampling of parking lot area.
2009	November	X	X		Letter from West Firm to NYSDEC OGC regarding responsibilities under regulatory programs.
2009	December	X	X		Letter from NYSDEC OGC to West Firm regarding responsibilities under regulatory programs.
2010	April	X			Parking Lot investigation completed and report submitted to NYSDEC.
2010	April			X	SPDES permit expires after DEC elects not to transfer the existing permit to ELT Harriman.
2010	June			X	Closure Plan submitted to NYSDEC for SPDES Lagoon.
2010	August			X	ELT Harriman submits application for new SPDES permit.
2010	August		X		Conference call with NYSDEC on 8/6/11 to discuss supplemental mercury speciation study and CMS.
2010	August				NYSDEC site visit on 8/11/11 to observe condition of parking lot area and fencing.
2010	August				Letter from West Firm to NYSDEC regarding condition of parking lot and fencing.
2010	August				Letter from NYSDEC regarding fencing around parking lot area.
2010	October				NYSDEC letter to ELT regarding condition of parking lot and fencing.
2010	October				Work plan for fence installation submitted to NYSDEC by Environmental Operations, Inc.
2010	November				NYSDEC approves work plan for fence installation; work completed (documented in 2/18/11 memo prepared by BC).

TABLE 2-1
SITE CHRONOLOGY
FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

Year	Month	CERCLA Activities	RCRA Activities	SPDES Activities	Description
2010	December	X	X		ELT/Trust meet with NYSDEC to provide site technical orientation and update.
2010	December	X	X		NYSDEC provides draft Scope of Work requiring additional investigation to address alleged data gaps.
2011	January	X	X		Response to draft Scope of Work submitted to NYSDEC.
2011	February	X	X		NYSDEC issues letter requesting submission of a Sitewide Characterization Summary Report within 30 days.
2011	March	X	X		Site-Wide Characterization Summary Report submitted jointly by ELT and Trust to NYSDEC.
2011	August			X	NYSDEC issues new SPDES Permit to ELT.
2011	August	X	X		Meeting with NYSDEC at Site to discuss Summary Report and draft SOW.
2011	September	X	X		ELT and Trust provide comments on draft SOW to NYSDEC.
2012	September	X	X		NYSDEC provides draft Consent Order with SOW to ELT and Trust for review.
2012	October	X	X		Meeting with NYSDEC to discuss draft Consent Order and SOW.
2012	November	X	X		ELT and Trust provide comments on draft SOW to NYSDEC.
2012	December	X	X		Additional correspondence with NYSDEC regarding draft SOW; ELT and Trust submit proposed revisions.
2013	January	X	X		NYSDEC indicates that proposed revisions to draft SOW are acceptable.
2013	October	X	X	X	NYSDEC issues letter dated October 28, 2013, revised October 29, 2013, setting forth outstanding liability for remediation and the parties responsible for various aspects of the remediation ("DEC Determination").

TABLE 2-2
PEAK FLOW RATES
FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

Design Point	Description	Area (acres)	Tc (Minutes)	Curve Number	Peak Flow Rate (cfs)				
					$Q_{1\text{-year}}$	$Q_{2\text{-year}}$	$Q_{10\text{-year}}$	$Q_{25\text{-year}}$	$Q_{100\text{-year}}$
DP 1	Lagoon Influent Sump	11.905	11.7	86	18.13	24.11	44.54	54.8	70.12
DP 2	Admin Building CB	1.36	6.3	89	2.8	3.62	6.36	7.72	9.74
DP 3	Grass Swale	3.441	6.8	82	4.99	6.89	13.58	17	22.15
DP 4	Discharge to Field	1.738	5	83	2.78	3.79	7.38	9.19	11.92

TABLE 2-3
RUNOFF VOLUMES
FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

Design Point	Description	Area (acres)	Curve Number	Runoff Volume (acre-feet)				
				$V_{1\text{-year}}$	$V_{2\text{-year}}$	$V_{10\text{-year}}$	$V_{25\text{-year}}$	$V_{100\text{-year}}$
DP 1	Lagoon Influent Sump	11.905	86	1.455	1.944	3.674	4.57	5.929
	Lagoon Direct	2.95	92	0.479	0.612	1.063	1.29	1.631
	Total Entering Lagoon	14.855		1.934	2.556	4.737	5.86	7.56
DP 2	Admin Building CB	1.36	89	0.192	0.251	0.455	0.559	0.716
DP 3	Grass Swale	3.441	82	0.345	0.475	0.949	1.2	1.585
DP 4	Discharge to Field	1.738	83	0.183	0.251	0.494	0.622	0.817

TABLE 4-1
SAMPLING AND ANALYSIS SUMMARY
FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

Location	Sample ID	Rationale	Sample Depths (see notes)	Analytes (see notes)
Soil Samples				
Area A	01-B-003	Inaccessible SWMU listed in RCRA Permit	2 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
	01-B-004	Inaccessible SWMU listed in RCRA Permit	2 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
	02-B-003	Inaccessible SWMU listed in RCRA Permit	2 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
	02-B-004	Delineation of Source Material	1 Sample/Boring	Total Mercury
	05-B-002	Inaccessible SWMU listed in RCRA Permit / Delineation of Source Material	3 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
	13-B-003	Inaccessible SWMU listed in RCRA Permit	2 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
	13-B-004	Inaccessible SWMU listed in RCRA Permit	2 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
	20-B-002	Inaccessible SWMU listed in RCRA Permit	2 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
	20-B-003	Inaccessible SWMU listed in RCRA Permit	2 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
	28-B-003	Inaccessible SWMU listed in RCRA Permit	2 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
	28-B-004	Inaccessible SWMU listed in RCRA Permit	2 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
	29-B-004	Delineation of Source Material	1 Sample/Boring	Total Mercury
	37-B-002	Delineation of Source Material	1 Sample/Boring	Total Mercury
	70-B-002	Delineation of Source Material	1 Sample/Boring	Total Mercury
	A-B-125	Non-SWMU Soil Characterization	2 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
	A-B-126	Non-SWMU Soil Characterization	2 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
	A-B-127	Non-SWMU Delineation of Source Material	2 Samples/Boring	Total Mercury
	A-B-128	Non-SWMU Delineation of Source Material	2 Samples/Boring	Total Mercury
	A-B-129	Non-SWMU Delineation of Source Material	2 Samples/Boring	Total Mercury
	A-B-130	Non-SWMU Delineation of Source Material	2 Samples/Boring	Total Mercury
	A-B-131	Non-SWMU Delineation of Source Material	2 Samples/Boring	Total Mercury
Area B	38-B-002	Inaccessible SWMU listed in RCRA Permit	2 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
	38-B-003	Inaccessible SWMU listed in RCRA Permit	2 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
Area E	E-B-006	Delineation of Source Material	2 Samples/Boring	Total Mercury
	E-B-007	Delineation of Source Material	2 Samples/Boring	Total Mercury
	E-B-008	Non-SWMU Soil Characterization	2 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
Area G	57-B-001	Inaccessible SWMU listed in RCRA Permit	2 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
	67-B-003	Inaccessible SWMU listed in RCRA Permit	2 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
	67-B-004	Inaccessible SWMU listed in RCRA Permit	2 Samples/Boring	VOC, SVOC, Metals, Ammonia, PCBs
Soil Vapor Samples				
Area A	01-SV-001	Vapor Intrusion Investigation	4 ft	VOCs
	18-SV-001	Vapor Intrusion Investigation	4 ft	VOCs
	28-SV-001	Vapor Intrusion Investigation	4 ft	VOCs
Area G	67-SV-001	Vapor Intrusion Investigation	4 ft	VOCs
Lagoon Sediment Samples				
Area C	C-SD-006	Lagoon Evaluation	1 ft Interval composites - up to 3 per location	VOC, SVOC, Metals, Ammonia, PCBs, Grain Size
	C-SD-007	Lagoon Evaluation	1 ft Interval composites - up to 3 per location	VOC, SVOC, Metals, Ammonia, PCBs, Grain Size
	C-SD-008	Lagoon Evaluation	1 ft Interval composites - up to 3 per location	VOC, SVOC, Metals, Ammonia, PCBs, Grain Size
	C-SD-009	Lagoon Evaluation	1 ft Interval composites - up to 3 per location	VOC, SVOC, Metals, Ammonia, PCBs, Grain Size
Stormwater Sediment Samples				
	Drain-SD-001	Stormwater Evaluation	0-6" within catch basin	VOC, SVOC, Metals, Ammonia, PCBs
	Drain-SD-002	Stormwater Evaluation	0-6" within catch basin	VOC, SVOC, Metals, Ammonia, PCBs
	Drain-SD-003	Stormwater Evaluation	0-6" within catch basin	VOC, SVOC, Metals, Ammonia, PCBs
	Drain-SD-004	Stormwater Evaluation	0-6" within catch basin	VOC, SVOC, Metals, Ammonia, PCBs
	Drain-SD-005	Stormwater Evaluation	0-6" within catch basin	VOC, SVOC, Metals, Ammonia, PCBs
	Drain-SD-006	Stormwater Evaluation	0-6" within catch basin	VOC, SVOC, Metals, Ammonia, PCBs

TABLE 4-1
SAMPLING AND ANALYSIS SUMMARY
FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

Location	Sample ID	Rationale	Sample Depths (see notes)	Analytes (see notes)
	Drain-SD-007	Stormwater Evaluation	0-6" within catch basin	VOC, SVOC, Metals, Ammonia, PCBs
	Drain-SD-008	Stormwater Evaluation	0-6" within catch basin	VOC, SVOC, Metals, Ammonia, PCBs
	Drain-SD-009	Stormwater Evaluation	0-6" within catch basin	VOC, SVOC, Metals, Ammonia, PCBs
	Drain-SD-010	Stormwater Evaluation	0-6" within catch basin	VOC, SVOC, Metals, Ammonia, PCBs
	Drain-SD-011	Stormwater Evaluation	0-6" within catch basin	VOC, SVOC, Metals, Ammonia, PCBs
	Drain-SD-012	Stormwater Evaluation	0-6" within catch basin	VOC, SVOC, Metals, Ammonia, PCBs
	Drain-SD-013	Stormwater Evaluation	0-6" within catch basin	VOC, SVOC, Metals, Ammonia, PCBs
	Drain-SD-014	Stormwater Evaluation	0-6" within catch basin	VOC, SVOC, Metals, Ammonia, PCBs

NOTES - SAMPLE DEPTHS:
Inacessible SWMUs - Two samples will be collected per location (where feasible). Sample will be collected from 0-1 ft below the slab, pad, pavement or sub-base material (when present) and when a change in lithology is observed or immediately above the water table.
Delineation of Source Material - One sample below the depth of prior samples.

NOTES - ANALYTES:
- VOCs to be analyzed by Method 8260B for soils, Method TO-15 for Soil Vapor.
- SVOCs to be analyzed by Method 8270C and to include pyridine and alpha-picoline.
- Metals to be analyzed by Method 7000/7471A/6020 and to include lead and total mercury.
- PCBs to be analyzed by Method 8082.
- Ammonia to be analyzed by MCAW 350.2M.

TABLE 5-1
ANALYTICAL METHODS AND HOLDING TIMES
FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

Matrix	Number of Samples	Parameters	Analytical Method	Container Type	Preservative	Holding Time
Soil	55	VO+15	USEPA SW846 8260B	Encore	Preserve w/in 48 hrs	14 days
Soil	55	BNA+25	USEPA SW846 8270C	4 oz Glass Jar	Cool, 4 deg C	Extraction - 14 days; Analysis - 40 days
Soil	55	PCB's	USEPA SW846 8082	4 oz Glass Jar	Cool, 4 deg C	Extraction - 14 days; Analysis - 40 days
Soil	55	PP-Metals & TAL Metal	USEPA SW846 7000/6020	2 oz Glass Jar	Cool, 4 deg C	Analysis - 6 months
Soil	55	Total Mercury	USEPA SW846 7471A	2 oz Glass Jar	Cool, 4 deg C	Analysis - 28 days
Soil	55	Ammonia	USEPA 350.2M	2 oz Glass Jar	Cool, 4 deg C	Analysis - 28 days
Soil Vapor	4	VO+15	USEPA TO-15	6L Summa Canister	None Required	30 Days
Sediment	9 - 27	VO+15	USEPA SW846 8260B	Encore	Preserve w/in 48 hrs	14 days
Sediment	9 - 27	BNA+25	USEPA SW846 8270C	4 oz Glass Jar	Cool, 4 deg C	Extraction - 14 days; Analysis - 40 days
Sediment	9 - 27	PCB's	USEPA SW846 8082	4 oz Glass Jar	Cool, 4 deg C	Extraction - 14 days; Analysis - 40 days
Sediment	9 - 27	PP-Metals & TAL Metal	USEPA SW846 7000/6020	2 oz Glass Jar	Cool, 4 deg C	Analysis - 6 months
Sediment	9 - 27	Total Mercury	USEPA SW846 7471A	2 oz Glass Jar	Cool, 4 deg C	Analysis - 28 days
Sediment	4-12	Grain Size	ASTM D422-63	1 L Glass Jar	Cool, 4 deg C	N/A
Sediment	9-27	Ammonia	USEPA 350.2M	2 oz Glass Jar	Cool, 4 deg C	Analysis - 28 days

Figures

12/16/2013

Author: PThorn Path: P:\GIS\Nepera\Supp_RFI_WP\Site_Location.mxd

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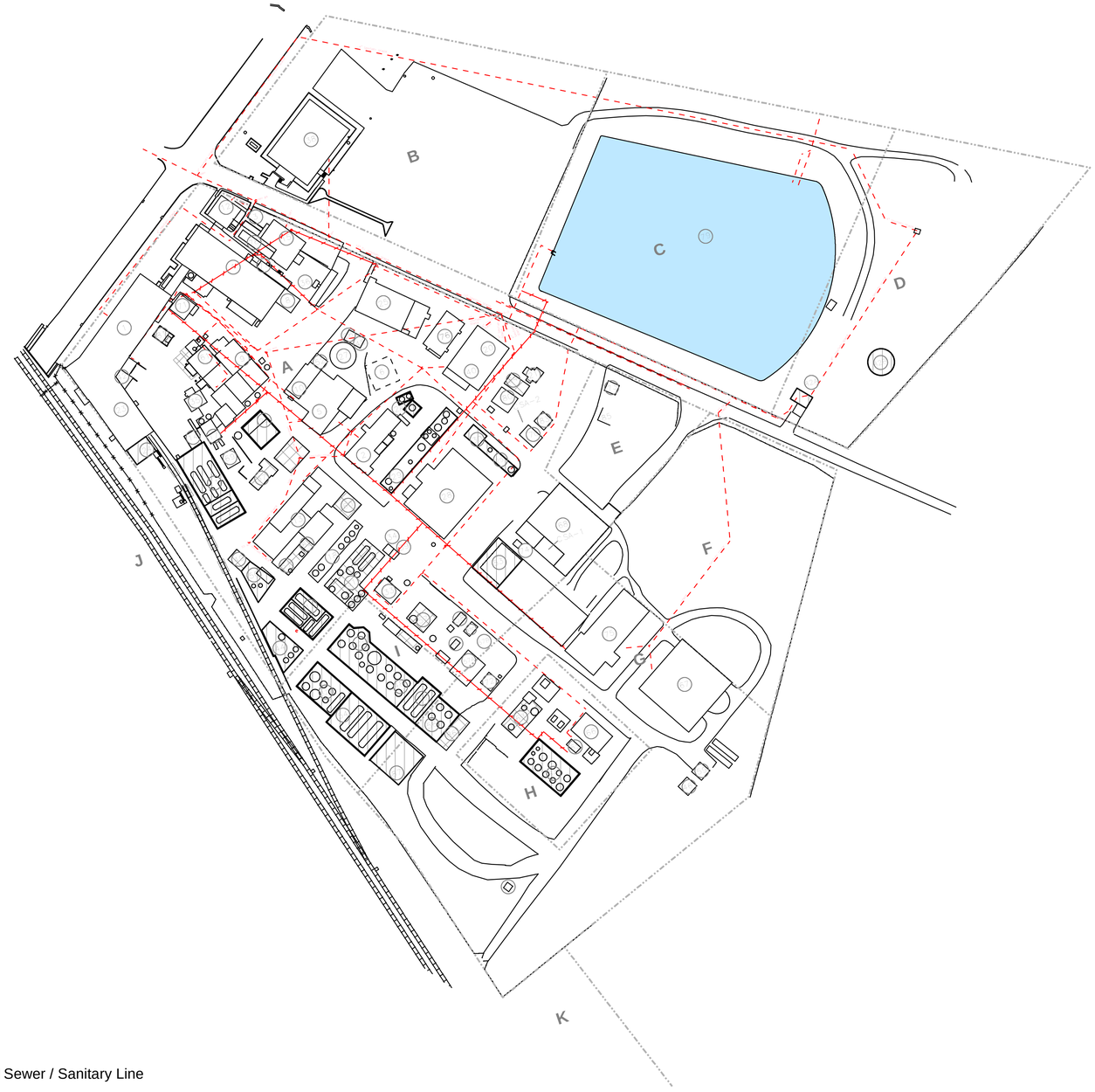
FIGURE 1-1
SITE LOCATION
FORMER NEPERA PLANT SITE, HARRIMAN, NEW YORK

0 1,000 2,000
Feet

12/16/2013

N



Legend

- Site Area Boundary
- Building
- Containment Pad
- Tank Farm
- Lagoon
- Abandoned Industrial Sewer / Sanitary Line
- Industrial Sewer / Sanitary Line

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85 IRM BLDG
86 TRUCK LOADING STATION
87 ACS PYRIDINE TANK FARM

Author: PThorn Path: P:\GIS\Nepera\Supp_RFI_WP\Site_Plan.mxd

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FIGURE 2-1
SITE PLAN
FORMER NEPERA PLANT SITE, HARRIMAN, NEW YORK

Source Citation

0 100 200

Feet

12/20/2013

N

Legend

- Site Area Boundary
- Building
- Containment Pad
- Tank Farm
- SWMU Location
- TSD Location
- Lagoon
- Abandoned Industrial Sewer / Sanitary Line
- Industrial Sewer / Sanitary Line

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87 ACS PYRIDINE TANK FARM

Author: PThorn Path: P:\GIS\Nepera\Supp_RFI_WP\SWMU_Locations.mxd

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FIGURE 2-2
SWMU AND TSD LOCATION PLAN
FORMER NEPERA PLANT SITE, HARRIMAN, NEW YORK

Source Citation

0 100 200

Feet

2/27/2014

Legend

- Proposed SWMU Soil Boring Location
- Proposed Non-SWMU Soil Boring Location
- Proposed Soil Vapor Sample Location
- Prior Soil Boring Location
- Site Area Boundary
- Building
- Lagoon

Author: pthorn Path: P:\GIS\Nepera\Supp_RFI_WP\Proposed_Supp_RFI_Sample_Locations.mxd

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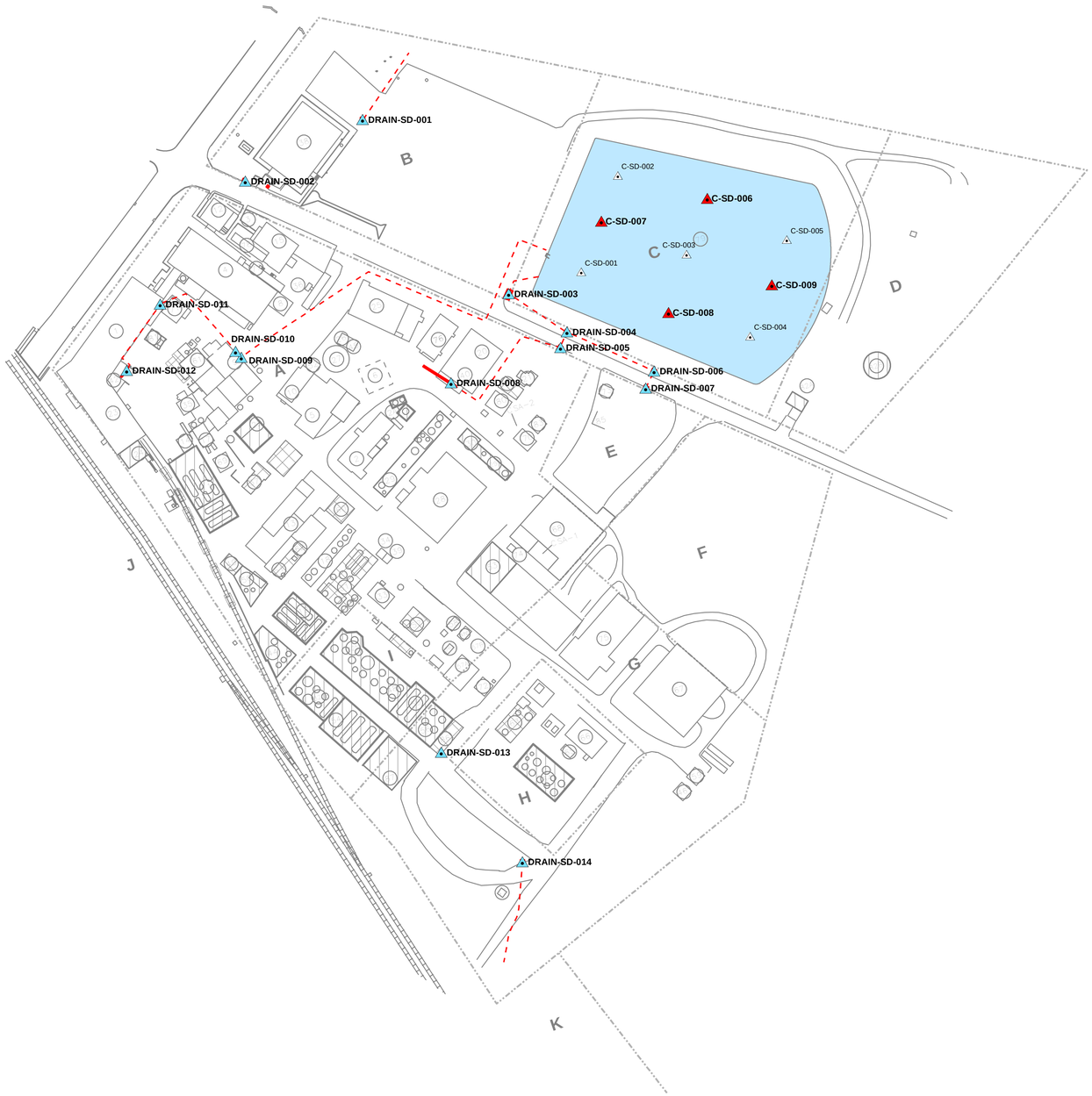
FIGURE 4-1
SUPPLEMENTAL RI SAMPLE LOCATION PLAN
FORMER NEPERA PLANT SITE, HARRIMAN, NEW YORK

0 100 200
Feet

2/27/2014

N



Legend

- Proposed Stormwater Sediment Sample Location
- Proposed Lagoon Sediment Sample Location
- Prior RFI Sediment Sample Location
- Stormwater Drain Line
- Site Area Boundary
- Building
- Lagoon

Author: pthorn Path: P:\GIS\Nepera\Supp_RFI_WP\Proposed_Supp_RFI_Sediment_Locations.mxd

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FIGURE 4-2
SUPPLEMENTAL RI SEDIMENT SAMPLE LOCATION PLAN
FORMER NEPERA PLANT SITE, HARRIMAN, NEW YORK

0 100 200
Feet

P:\DRAFTING\NEPERA\135954(CMS)\MARCH09_MEMO\RA_PLANS\FIG-4-3 (REMEDIATION AREA).DWG 03/06/2014 10:24:01AM By:Blomes XREFS: BASE_M-3 Layout: 34X22

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85 IRM BLDG
86 TRUCK LOADING STATION
87 ACS PYRIDINE TANK FARM

NYS ROUTE 17 (AVERILL AVENUE)
ARDEN HOUSE ROAD
VILLAGE OF HARRIMAN
TOWN OF WOODBURY
(ABAND.)
A
B
PARKING LOT
C
LAGOON
D
E
F
G
H
I
J
K
CSA-1
CSA-2

LEGEND:
- PROPERTY LINE
- FENCE LINE
- RAIL ROAD
- BUILDING
- TANK FARM
- CONTAINMENT PAD
- LAGOON
- STUDY AREA BOUNDARY
- REMEDIATION AREA
- SWMU LOCATION
- TSD LOCATION

SOURCE NOTES:

1. BASE MAP AND BUILDING/STRUCTURE INDEX FROM NEPERA, INC. MAP (REVISED FROM LOCH SURVEYOR'S MAPS AND FILES OF SITE PLAN) ENTITLED "NEPERA SITE PLAN" DATED 4/19/94 (DRAWING NO.4-43-360).

0 80 160
SCALE IN FEET

Brown AND Caldwell
ASSOCIATES
UPPER SADDLE RIVER, NEW JERSEY

SUBMITTED: ADAM SHERMAN, PROJECT MANAGER DATE: 3/09
APPROVED: JEFF CAPUTI, BROWN AND CALDWELL DATE: 3/09

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)
DESIGNED:
DRAWN:
CHECKED:
CHECKED:
APPROVED:

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

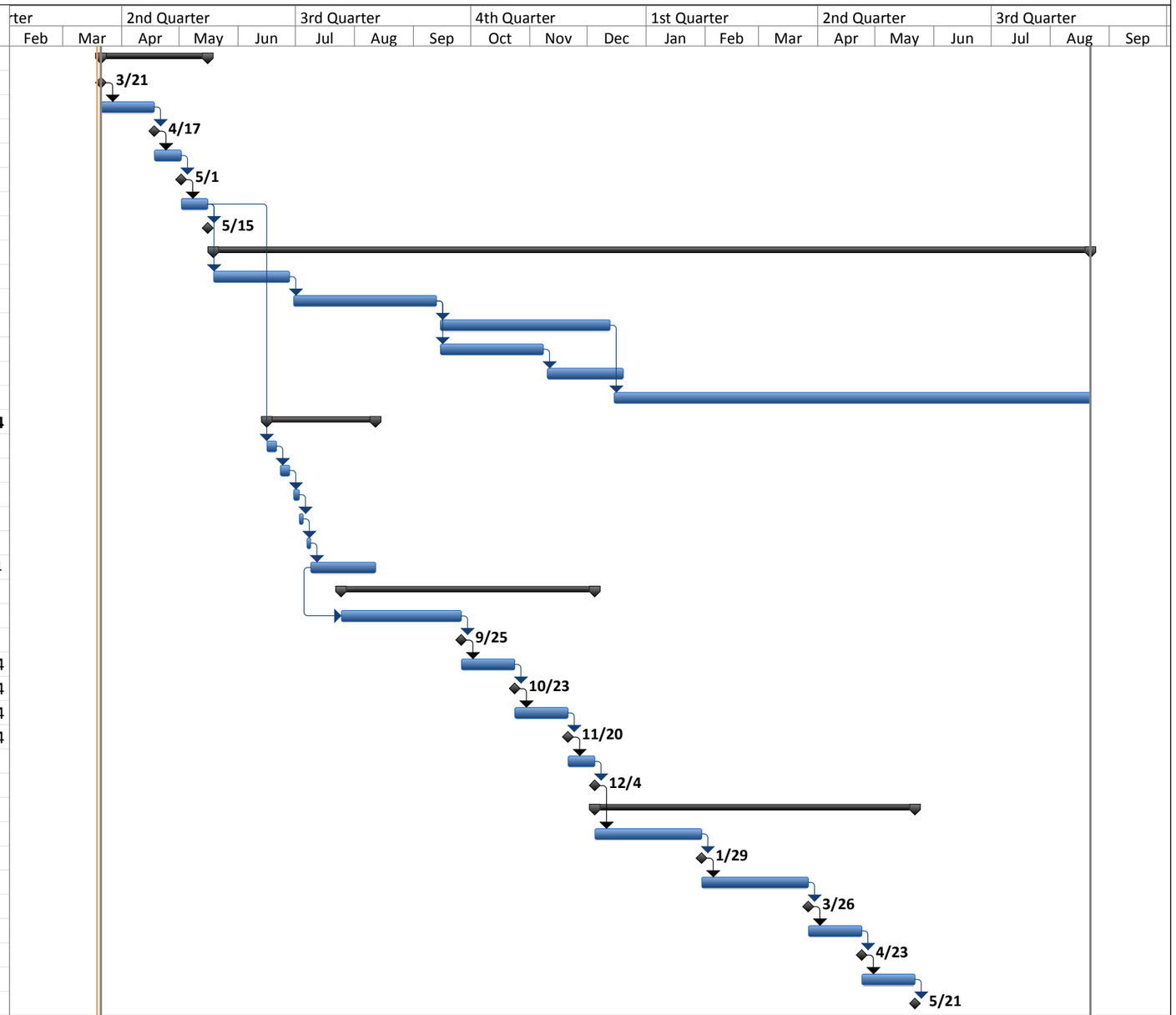
FIGURE 4-3
REMEDIATION AREAS

FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

FILENAME: FIGURE 2
BC PROJECT NUMBER: 135954.002
CLIENT PROJECT NUMBER: NA
DRAWING NUMBER: NA
SHEET NUMBER:

FIGURE 7-1
SUPPLEMENTAL RI/FS SCHEDULE
FORMER NEPERA PLANT SITE, HARRIMAN, NEW YORK

ID	Task Name	Duration	Start	Finish
1	**Work Plan**	**40 days**	**Fri 3/21/14**	**Thu 5/15/14**
2	Submit Revised Work Plan to DEC	0 days	Fri 3/21/14	Fri 3/21/14
3	DEC Review	20 days	Fri 3/21/14	Thu 4/17/14
4	Receipt of DEC Comments	0 days	Thu 4/17/14	Thu 4/17/14
5	Incorporate DEC Comments	10 days	Fri 4/18/14	Thu 5/1/14
6	Submit Final Supplemental RFI Work Plan to DEC	0 days	Thu 5/1/14	Thu 5/1/14
7	DEC Review of Final Work Plan	10 days	Fri 5/2/14	Thu 5/15/14
8	Approval of Final Work Plan from DEC	0 days	Thu 5/15/14	Thu 5/15/14
9	**Demolition**	**330 days**	**Mon 5/19/14**	**Fri 8/21/15**
10	Pre-Demolition Survey Contractor Procurement	30 days	Mon 5/19/14	Fri 6/27/14
11	Pre-Demolition Survey and Sampling	55 days	Mon 6/30/14	Fri 9/12/14
12	SHPO Review and Permits Acquisition	65 days	Mon 9/15/14	Fri 12/12/14
13	Preparation of Demolition Plans and Specifications	40 days	Mon 9/15/14	Fri 11/7/14
14	Demolition Contractor Procurement	30 days	Mon 11/10/14	Fri 12/19/14
15	Pre-Demolition Abatement and Demolition	180 days	Mon 12/15/14	Fri 8/21/15
16	**Field Investigation**	**41 days**	**Mon 6/16/14**	**Mon 8/11/14**
17	Inspection and survey of sample locations	5 days	Mon 6/16/14	Fri 6/20/14
18	SWMU Soil Borings	5 days	Mon 6/23/14	Fri 6/27/14
19	Soil Vapor Samples	3 days	Mon 6/30/14	Wed 7/2/14
20	Lagoon Sediment Samples	2 days	Thu 7/3/14	Fri 7/4/14
21	Stormwater Sediment Samples	2 days	Mon 7/7/14	Tue 7/8/14
22	Laboratory Sample Analysis	24 days	Wed 7/9/14	Mon 8/11/14
23	**Supplemental RI Report**	**95 days**	**Fri 7/25/14**	**Thu 12/4/14**
24	Prepare Supplemental RI (SRI) Report	45 days	Fri 7/25/14	Thu 9/25/14
25	Submit SRI Report to DEC	0 days	Thu 9/25/14	Thu 9/25/14
26	DEC Review	20 days	Fri 9/26/14	Thu 10/23/14
27	Receipt of DEC Comments	0 days	Thu 10/23/14	Thu 10/23/14
28	Incorporate DEC Comments	20 days	Fri 10/24/14	Thu 11/20/14
29	Submit Final SRI Report to DEC	0 days	Thu 11/20/14	Thu 11/20/14
30	DEC Review	10 days	Fri 11/21/14	Thu 12/4/14
31	Approval of Final SRI Report from DEC	0 days	Thu 12/4/14	Thu 12/4/14
32	**Feasibility Study**	**120 days**	**Fri 12/5/14**	**Thu 5/21/15**
33	Conduct Feasibility Study (FS) of Prepare FS Report	40 days	Fri 12/5/14	Thu 1/29/15
34	Submit FS Report to DEC	0 days	Thu 1/29/15	Thu 1/29/15
35	DEC Review	40 days	Fri 1/30/15	Thu 3/26/15
36	Receipt of DEC Comments	0 days	Thu 3/26/15	Thu 3/26/15
37	Incorporate DEC Comments	20 days	Fri 3/27/15	Thu 4/23/15
38	Submit Final FS Report to DEC	0 days	Thu 4/23/15	Thu 4/23/15
39	DEC Review	20 days	Fri 4/24/15	Thu 5/21/15
40	Approval of Final FS Report from DEC	0 days	Thu 5/21/15	Thu 5/21/15



Project: Figue 7-1_Supplemental_
Date: Wed 3/19/14

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Progress
Milestone	External Milestone	Manual Task	Start-only	
Summary	Inactive Task	Duration-only	Finish-only	

Appendix A: DEC Determination

New York State Department of Environmental Conservation
Office of General Counsel, 14th Floor
625 Broadway, Albany, New York 12233-1500
Phone: (518) 402-9185 **Fax:** (518) 402-9018
Website: www.dec.ny.gov

Joe Martens
Commissioner

VIA EMAIL ONLY

October 29, 2013

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Keane & Beane, PC
455 Hamilton Avenue
White Plains, New York 10601

Re: Nepera-Harriman, Site No. 336006
Site-wide investigation
Harriman, Orange County

Dear Counsel:

I am the Bureau Chief of the Remediation Bureau for the Office of General Counsel in the New York State Department of Environmental Conservation (DEC or Department). I write concerning the former Nepera-Harriman facility in the town of Harriman, Orange County (Site No. 336006) (the "Site").

The Department has attempted for nearly five years to obtain the participation of all of the potentially responsible parties for the comprehensive investigation and clean up of the Site. This has included multiple meetings, phone calls, correspondence, and negotiations. Unfortunately progress in remediating the Site has stalled. Most recently the responsible parties rejected the Department's comprehensive approach as embodied in the proposed order sent on August 22, 2013.

In light of the responsible parties failure to engage in a comprehensive investigation and clean up of the Site this letter seeks to establish a clear path forward in remediating and closing the Site as required under the 1997 Record of Decision (ROD), the 1998 CERCLA Consent Decree (Consent Decree), and the permit issued to Nepera, Inc. (formerly), Rutherford/Vertellus, and ELT Harriman, LLC, pursuant to RCRA, Title 9 of Article 27 of the ECL, and other applicable laws (the RCRA permit). This letter specifically delineates the work that the responsible parties must complete at the Site.

A. Work To Address the Historic Contamination Pursuant to the Consent Decree

Nepera, Inc. (Nepera), Warner Lambert Company (Warner-Lambert), and the Harriman Trust (Trust) must perform the work delineated in this Section A of this Letter pursuant to the Consent Decree. This work is necessary to protect public health and the environment.

Section A of this letter constitutes an administrative determination by the Department under the Consent Decree, including Paragraphs 30, 32 and 46 thereof. To the extent that Nepera, Warner-Lambert, and/or the Trust wish to challenge this determination, they must do so within 30 days pursuant to Paragraphs 45-49 (Section IX) of the Consent Decree.

1. The Parking Lot Area (Area B)

In 2005, Nepera, Warner-Lambert, and the Trust submitted a design for stabilizing the bank of the West Branch of the Ramapo River, a drinking water supply, along the area of the Site on which the parking lot and waste lagoon area are located. The parking lot area of the Site is contaminated with a calcium sulfate material that contains elevated mercury levels. The Department has determined that the current design of the parking lot and associated erosional controls are inadequate to protect public health and the environment from the migration of mercury into the river from this area.

The ROD requires the design and construction of a remedy to mitigate mercury loading into the West Branch of the Ramapo River. Additional work is required to design and construct erosional controls or other appropriate remedies to mitigate such loading from this area (see ROD § 7). The former parking lot, as currently designed with an interim erosion control cover, is not preventing potential mercury loading into the river. The parking lot has numerous holes that allow for water infiltration, and it is clear that a simple asphalt cap on top of the type of waste material buried there is not part of a viable remedy. Since the issuance of the ROD the parking lot has been subject to major flooding events, including the catastrophic inundation caused by Tropical Storm Irene in 2011 – the type of extreme precipitation event that scientific consensus indicates will be increasingly common. Site characterization work performed in January 2010

revealed that the parking lot, which was in active use at the time the ROD was developed, is underlain by approximately 22,000 cubic yards of mercury-containing waste, with a maximum depth of approximately 8.5 feet, which waste laterally extends up to the banks of the river. Given the parking lot's proximity to the banks of the Ramapo River, significant additional erosional controls or alternative remedial measures must be undertaken to fully contain the contamination beneath it, and prevent the contaminants, on a permanent basis, from entering the river.

Based on the inadequacy of the use of the parking lot as a cap and inadequate riverbank erosional controls, the Department requires that Nepera, Warner-Lambert, and the Trust submit a supplemental work plan, pursuant to paragraphs 30 and 32 of the Consent Decree, that will include an investigation and feasibility study in order to design a permanent remedial measure or measures for the parking lot area. This investigation and feasibility study must assess the efficacy of a properly capped landfill with appropriate containment (e.g., sheet pile containment wall), excavation and removal of the material underneath the parking lot, and other alternatives. The investigation and feasibility study must also characterize the riverbank, with sampling required in both surface and subsurface soils along the riverbank and in the river.

2. <u>The Lagoon Area</u>

The Lagoon Area of the Site has been used to hold stormwater and effluent from a groundwater treatment system for many years. The clay liner at the bottom of the lagoon has never fully been characterized to determine if it is effective in containing contamination in the lagoon. Additionally, the lagoon area is directly adjacent to the banks of the Ramapo River, and under the ROD and Consent Decree, the Department requires additional investigation and feasibility study work to determine whether the lagoon is adequately preventing mercury contamination from entering the Ramapo River. Specifically, the Department requires soil borings to be conducted on a minimum 50 foot grid, from the Ramapo River inward to the lagoon, to completely delineate the contamination in the lagoon sediments and determine the extent and condition of the clay barrier. These issues should also be addressed in the supplemental work plan.

3. <u>Other areas of the Site</u>

Other areas of the Site require further investigation and characterization and should be included in the work plan. These areas have previously been identified by the Department, and are more fully described in the Scope of Work that was attached to my August 22, 2013 letter.

* * *

Unless Nepera, Warner-Lambert, and the Trust challenge, within 30 days, the Department's determination that the parking lot area and associated erosional controls are inadequate (pursuant to Section IX of the Consent Decree), the Department and the State expect that they will be submitting a supplemental investigation and feasibility study work plan pursuant to the Consent Decree. The Department requires submission of an approvable work plan by December 31, 2013. The Department reserves all of its rights under Titles 9 and 13 of Article 27, CERCLA, RCRA, the State Finance Law, and other applicable law, in the event that the parties to the Consent Decree do not act in accordance with the aforementioned schedule,

including the expenditure of state monies to perform the remedial work required to protect human health and the environment, and the right to seek recovery of these costs from the responsible parties.

Please note that the Department considers all of the aforementioned work to be required and necessary under the Consent Decree and ROD. However, if the Court determines that any aspect of it exceeds the scope of what is currently required, the State will seek to reopen the ROD - which was developed and issued when the Nepera facility was in active production - based on additional information the Department has discovered or received since the Consent Decree's effective date, which together with other relevant information, indicates that the remedial action selected for the Harriman Site is not protective of human health or the environment.

B. Corrective Action and Closure Work to be Done under the RCRA Permit

In 2005, Nepera, Inc. notified the Department that it would cease operation of the facility. Nepera, Inc. and subsequent owners of the facility, Rutherford/Vertellus, as well as the current owner, ELT Harriman LLC, have failed to perform the necessary investigatory, corrective, and closure actions under RCRA, Title 9 of Article 27 of the ECL, and their implementing regulations. Specifically, Module III of the RCRA permit requires these parties to complete all necessary corrective action requirements. Additionally, RCRA requires that the parties to the permit maintain financial assurance for corrective action (which the Department determined should be in the amount of $18,600,000), maintain financial assurance for closure, and complete all necessary remaining closure actions. These requirements have not been addressed and the Site remains in violation at this time.

Additionally, the Site's current owner ELT Harriman LLC, violated Article 17 of the ECL by releasing mercury-contaminated water from the lagoon into the Ramapo River in violation of SPDES permit limits established by the Department. ELT Harriman LLC has taken no affirmative steps to address the lagoon area to prevent future discharges, and it has taken no affirmative steps as the Site owner to properly address and manage the contamination on its Site.

ELT Harriman LLC, Rutherford/Vertellus, and Nepera, Inc. have not performed various work items required under the RCRA permit, despite repeated requests by the Department. There is no reason this work should have been held up based on the existence of unrelated remedial obligations under other programs at the Site. This work must proceed expeditiously.

ELT Harriman LLC, Rutherford/Vertellus, and Nepera, Inc. must indicate within 30 days of this letter whether they will submit a work plan to the Department to correct and address all outstanding RCRA and SPDES violations at the Site. These parties will then need to submit an approvable work plan by December 31, 2013. The Department reserves all of its rights under Titles 9 and 13 of Article 27, CERCLA, RCRA, the State Finance Law, and other applicable law, in the event that the parties to the Consent Decree do not act in accordance with the aforementioned schedule, including the expenditure of state monies to perform the RCRA work required to protect human health and the environment, and the right to seek recovery of these costs from the responsible parties.

In the unlikely event a court ultimately determines that the work described in Section A above is outside the scope of the ROD and Consent Decree, the Department reserves its rights to pursue additional investigatory, remedial, corrective, or closure actions at the parking lot area, the lagoon area, and any other relevant area as an aspect of the RCRA corrective action and closure. Additionally, the Department reserves its rights to use its own authority under Title 9 of Article 27 of the ECL to perform such work and seek compensation, should the responsible parties fail to perform such work.

Future Enforcement Actions By the State

DEC fully expects the parties will cooperate in complying with the directives in this letter as required by the ROD, Consent Decree and RCRA permit. However, if necessary, with respect to the work delineated in Section A above, the State will pursue all available remedies under the CD to compel completion of that work. The Department reserves all rights to compel, or, if necessary, perform and seek compensation for, the work enumerated in Section A to the extent a court rules that it is outside the scope of the Consent Decree and ROD.

The Department will similarly take whatever enforcement actions are necessary to compel the RCRA work delineated in Section B, including administrative and/or court enforcement, or undertaking the necessary work and thereafter pursuing compensation.

Nothing in this letter in any way affects the Department's rights against the parties to which this letter is addressed, or any other party under applicable law.

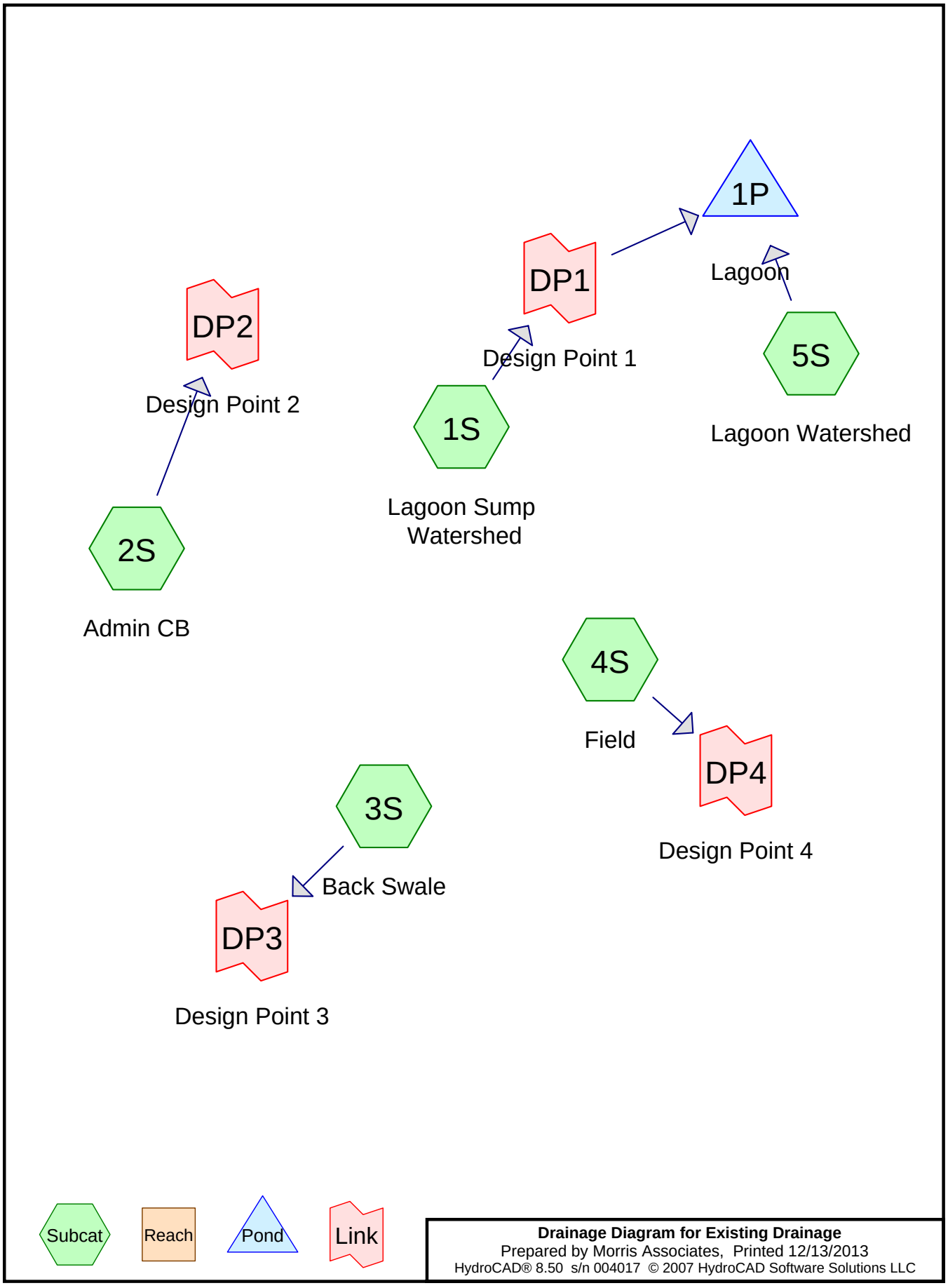
Thank you for your consideration.

Sincerely,

Benjamin Conlon, Esq.
Bureau Chief
Remediation Bureau

ec: A. Guglielmi
P. Patel
D. Crosby

Appendix B: Drainage Analysis



Drainage Diagram for Existing Drainage
Prepared by Morris Associates, Printed 12/13/2013

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.387	39	>75% Grass cover, Good, HSG A (5S)
7.758	68	<50% Grass cover, Poor, HSG A (1S,2S,3S,4S)
10.686	98	Paved parking & roofs (1S,2S,3S,4S)
2.563	100	Water (5S)
21.394		**TOTAL AREA**

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lagoon Sump Runoff Area=11.905 ac 61.60% Impervious Runoff Depth>1.47"
Flow Length=1,154' Tc=11.7 min CN=86 Runoff=18.13 cfs 1.455 af

Subcatchment 2S: Admin CB Runoff Area=1.360 ac 69.26% Impervious Runoff Depth>1.70"
Flow Length=131' Tc=6.3 min CN=89 Runoff=2.80 cfs 0.192 af

Subcatchment 3S: Back Swale Runoff Area=3.441 ac 45.57% Impervious Runoff Depth>1.20"
Flow Length=902' Tc=6.8 min CN=82 Runoff=4.99 cfs 0.345 af

Subcatchment 4S: Field Runoff Area=1.738 ac 48.50% Impervious Runoff Depth>1.27"
Flow Length=410' Tc=5.0 min CN=83 Runoff=2.78 cfs 0.183 af

Subcatchment 5S: Lagoon Watershed Runoff Area=2.950 ac 86.88% Impervious Runoff Depth>1.95"
Tc=6.0 min CN=92 Runoff=6.87 cfs 0.479 af

Pond 1P: Lagoon Peak Elev=524.03' Storage=84,193 cf Inflow=23.48 cfs 1.934 af
Outflow=0.00 cfs 0.000 af

Link DP1: Design Point 1 Inflow=18.13 cfs 1.455 af
Primary=18.13 cfs 1.455 af

Link DP2: Design Point 2 Inflow=2.80 cfs 0.192 af
Primary=2.80 cfs 0.192 af

Link DP3: Design Point 3 Inflow=4.99 cfs 0.345 af
Primary=4.99 cfs 0.345 af

Link DP4: Design Point 4 Inflow=2.78 cfs 0.183 af
Primary=2.78 cfs 0.183 af

Total Runoff Area = 21.394 ac Runoff Volume = 2.654 af Average Runoff Depth = 1.49"
38.07% Pervious = 8.145 ac 61.93% Impervious = 13.249 ac

Summary for Subcatchment 1S: Lagoon Sump Watershed

Runoff = 18.13 cfs @ 12.16 hrs, Volume= 1.455 af, Depth> 1.47"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-YR Rainfall=2.90"

Area (ac)	CN	Description
7.333	98	Paved parking & roofs
4.572	68	<50% Grass cover, Poor, HSG A
11.905	86	Weighted Average
4.572		Pervious Area
7.333		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.0150	1.28		**Sheet Flow, 1-a** Smooth surfaces n= 0.011 P2= 3.50"
0.4	81	0.0432	3.35		**Shallow Concentrated Flow, 1-b** Unpaved Kv= 16.1 fps
9.1	848	0.0059	1.56		**Shallow Concentrated Flow, 1-c** Paved Kv= 20.3 fps
0.9	125	0.0100	2.36	1.85	**Circular Channel (pipe), 1-d** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
11.7	1,154	Total			

Summary for Subcatchment 2S: Admin CB

Runoff = 2.80 cfs @ 12.09 hrs, Volume= 0.192 af, Depth> 1.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-YR Rainfall=2.90"

Area (ac)	CN	Description
0.942	98	Paved parking & roofs
0.418	68	<50% Grass cover, Poor, HSG A
1.360	89	Weighted Average
0.418		Pervious Area
0.942		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	66	0.0303	0.19		**Sheet Flow, 2-a** Grass: Short n= 0.150 P2= 3.50"
0.6	65	0.0385	1.72		**Sheet Flow, 2-b** Smooth surfaces n= 0.011 P2= 3.50"
6.3	131	Total			

Summary for Subcatchment 3S: Back Swale

Runoff = 4.99 cfs @ 12.10 hrs, Volume= 0.345 af, Depth> 1.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-YR Rainfall=2.90"

Area (ac)	CN	Description
1.568	98	Paved parking & roofs
1.873	68	<50% Grass cover, Poor, HSG A
3.441	82	Weighted Average
1.873		Pervious Area
1.568		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0100	1.09		**Sheet Flow, 3-a** Smooth surfaces n= 0.011 P2= 3.50"
0.8	132	0.0303	2.80		**Shallow Concentrated Flow, 3-b** Unpaved Kv= 16.1 fps
3.2	497	0.0161	2.58		**Shallow Concentrated Flow, 3-c** Paved Kv= 20.3 fps
0.8	108	0.0185	2.19		**Shallow Concentrated Flow, 3-d** Unpaved Kv= 16.1 fps
0.5	65	0.0154	2.23	0.78	**Circular Channel (pipe), 3-e** Diam= 8.0" Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.025 Corrugated metal
6.8	902	Total			

Summary for Subcatchment 4S: Field

Runoff = 2.78 cfs @ 12.08 hrs, Volume= 0.183 af, Depth> 1.27"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-YR Rainfall=2.90"

Area (ac)	CN	Description
0.843	98	Paved parking & roofs
0.895	68	<50% Grass cover, Poor, HSG A
1.738	83	Weighted Average
0.895		Pervious Area
0.843		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	85	0.0118	1.13		**Sheet Flow, 4-a** Smooth surfaces n= 0.011 P2= 3.50"
0.4	67	0.0224	3.04		**Shallow Concentrated Flow, 4-b** Paved Kv= 20.3 fps
1.0	109	0.0138	1.89		**Shallow Concentrated Flow, 4-c** Unpaved Kv= 16.1 fps
0.4	50	0.0100	2.03		**Shallow Concentrated Flow, 4-d** Paved Kv= 20.3 fps
1.9	99	0.0150	0.86		**Shallow Concentrated Flow, 4-e** Short Grass Pasture Kv= 7.0 fps
5.0	410	Total			

Summary for Subcatchment 5S: Lagoon Watershed

Runoff = 6.87 cfs @ 12.09 hrs, Volume= 0.479 af, Depth> 1.95"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-YR Rainfall=2.90"

	Area (ac)	CN	Description
*	2.563	100	Water
	0.387	39	>75% Grass cover, Good, HSG A
	2.950	92	Weighted Average
	0.387		Pervious Area
	2.563		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Pond 1P: Lagoon

Inflow Area = 14.855 ac, 66.62% Impervious, Inflow Depth > 1.56" for 1-YR event
Inflow = 23.48 cfs @ 12.14 hrs, Volume= 1.934 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 524.03' @ 20.00 hrs Surf.Area= 0 sf Storage= 84,193 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	523.50'	1,171,422 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
523.50	0
526.00	397,938
528.00	608,909
530.00	837,979
532.00	1,171,422

Summary for Link DP1: Design Point 1

Inflow Area = 11.905 ac, 61.60% Impervious, Inflow Depth > 1.47" for 1-YR event
Inflow = 18.13 cfs @ 12.16 hrs, Volume= 1.455 af
Primary = 18.13 cfs @ 12.16 hrs, Volume= 1.455 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP2: Design Point 2

Inflow Area = 1.360 ac, 69.26% Impervious, Inflow Depth > 1.70" for 1-YR event
Inflow = 2.80 cfs @ 12.09 hrs, Volume= 0.192 af
Primary = 2.80 cfs @ 12.09 hrs, Volume= 0.192 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP3: Design Point 3

Inflow Area = 3.441 ac, 45.57% Impervious, Inflow Depth > 1.20" for 1-YR event
Inflow = 4.99 cfs @ 12.10 hrs, Volume= 0.345 af
Primary = 4.99 cfs @ 12.10 hrs, Volume= 0.345 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP4: Design Point 4

Inflow Area = 1.738 ac, 48.50% Impervious, Inflow Depth > 1.27" for 1-YR event
Inflow = 2.78 cfs @ 12.08 hrs, Volume= 0.183 af
Primary = 2.78 cfs @ 12.08 hrs, Volume= 0.183 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lagoon Sump Runoff Area=11.905 ac 61.60% Impervious Runoff Depth>1.96"
Flow Length=1,154' Tc=11.7 min CN=86 Runoff=24.11 cfs 1.944 af

Subcatchment 2S: Admin CB Runoff Area=1.360 ac 69.26% Impervious Runoff Depth>2.22"
Flow Length=131' Tc=6.3 min CN=89 Runoff=3.62 cfs 0.251 af

Subcatchment 3S: Back Swale Runoff Area=3.441 ac 45.57% Impervious Runoff Depth>1.66"
Flow Length=902' Tc=6.8 min CN=82 Runoff=6.89 cfs 0.475 af

Subcatchment 4S: Field Runoff Area=1.738 ac 48.50% Impervious Runoff Depth>1.73"
Flow Length=410' Tc=5.0 min CN=83 Runoff=3.79 cfs 0.251 af

Subcatchment 5S: Lagoon Watershed Runoff Area=2.950 ac 86.88% Impervious Runoff Depth>2.49"
Tc=6.0 min CN=92 Runoff=8.66 cfs 0.612 af

Pond 1P: Lagoon Peak Elev=524.20' Storage=111,280 cf Inflow=30.87 cfs 2.556 af
Outflow=0.00 cfs 0.000 af

Link DP1: Design Point 1 Inflow=24.11 cfs 1.944 af
Primary=24.11 cfs 1.944 af

Link DP2: Design Point 2 Inflow=3.62 cfs 0.251 af
Primary=3.62 cfs 0.251 af

Link DP3: Design Point 3 Inflow=6.89 cfs 0.475 af
Primary=6.89 cfs 0.475 af

Link DP4: Design Point 4 Inflow=3.79 cfs 0.251 af
Primary=3.79 cfs 0.251 af

Total Runoff Area = 21.394 ac Runoff Volume = 3.533 af Average Runoff Depth = 1.98"
38.07% Pervious = 8.145 ac 61.93% Impervious = 13.249 ac

Summary for Subcatchment 1S: Lagoon Sump Watershed

Runoff = 24.11 cfs @ 12.16 hrs, Volume= 1.944 af, Depth> 1.96"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.50"

Area (ac)	CN	Description
7.333	98	Paved parking & roofs
4.572	68	<50% Grass cover, Poor, HSG A
11.905	86	Weighted Average
4.572		Pervious Area
7.333		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.0150	1.28		**Sheet Flow, 1-a** Smooth surfaces n= 0.011 P2= 3.50"
0.4	81	0.0432	3.35		**Shallow Concentrated Flow, 1-b** Unpaved Kv= 16.1 fps
9.1	848	0.0059	1.56		**Shallow Concentrated Flow, 1-c** Paved Kv= 20.3 fps
0.9	125	0.0100	2.36	1.85	**Circular Channel (pipe), 1-d** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
11.7	1,154	Total			

Summary for Subcatchment 2S: Admin CB

Runoff = 3.62 cfs @ 12.09 hrs, Volume= 0.251 af, Depth> 2.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.50"

Area (ac)	CN	Description
0.942	98	Paved parking & roofs
0.418	68	<50% Grass cover, Poor, HSG A
1.360	89	Weighted Average
0.418		Pervious Area
0.942		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	66	0.0303	0.19		**Sheet Flow, 2-a** Grass: Short n= 0.150 P2= 3.50"
0.6	65	0.0385	1.72		**Sheet Flow, 2-b** Smooth surfaces n= 0.011 P2= 3.50"
6.3	131	Total			

Summary for Subcatchment 3S: Back Swale

Runoff = 6.89 cfs @ 12.10 hrs, Volume= 0.475 af, Depth> 1.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.50"

Area (ac)	CN	Description
1.568	98	Paved parking & roofs
1.873	68	<50% Grass cover, Poor, HSG A
3.441	82	Weighted Average
1.873		Pervious Area
1.568		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0100	1.09		**Sheet Flow, 3-a** Smooth surfaces n= 0.011 P2= 3.50"
0.8	132	0.0303	2.80		**Shallow Concentrated Flow, 3-b** Unpaved Kv= 16.1 fps
3.2	497	0.0161	2.58		**Shallow Concentrated Flow, 3-c** Paved Kv= 20.3 fps
0.8	108	0.0185	2.19		**Shallow Concentrated Flow, 3-d** Unpaved Kv= 16.1 fps
0.5	65	0.0154	2.23	0.78	**Circular Channel (pipe), 3-e** Diam= 8.0" Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.025 Corrugated metal
6.8	902	Total			

Summary for Subcatchment 4S: Field

Runoff = 3.79 cfs @ 12.08 hrs, Volume= 0.251 af, Depth> 1.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.50"

Area (ac)	CN	Description
0.843	98	Paved parking & roofs
0.895	68	<50% Grass cover, Poor, HSG A
1.738	83	Weighted Average
0.895		Pervious Area
0.843		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	85	0.0118	1.13		**Sheet Flow, 4-a** Smooth surfaces n= 0.011 P2= 3.50"
0.4	67	0.0224	3.04		**Shallow Concentrated Flow, 4-b** Paved Kv= 20.3 fps
1.0	109	0.0138	1.89		**Shallow Concentrated Flow, 4-c** Unpaved Kv= 16.1 fps
0.4	50	0.0100	2.03		**Shallow Concentrated Flow, 4-d** Paved Kv= 20.3 fps
1.9	99	0.0150	0.86		**Shallow Concentrated Flow, 4-e** Short Grass Pasture Kv= 7.0 fps
5.0	410	Total			

Summary for Subcatchment 5S: Lagoon Watershed

Runoff = 8.66 cfs @ 12.09 hrs, Volume= 0.612 af, Depth> 2.49"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YR Rainfall=3.50"

	Area (ac)	CN	Description
*	2.563	100	Water
	0.387	39	>75% Grass cover, Good, HSG A
	2.950	92	Weighted Average
	0.387		Pervious Area
	2.563		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Pond 1P: Lagoon

Inflow Area = 14.855 ac, 66.62% Impervious, Inflow Depth > 2.06" for 2-YR event
Inflow = 30.87 cfs @ 12.14 hrs, Volume= 2.556 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 524.20' @ 20.00 hrs Surf.Area= 0 sf Storage= 111,280 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	523.50'	1,171,422 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
523.50	0
526.00	397,938
528.00	608,909
530.00	837,979
532.00	1,171,422

Summary for Link DP1: Design Point 1

Inflow Area = 11.905 ac, 61.60% Impervious, Inflow Depth > 1.96" for 2-YR event
Inflow = 24.11 cfs @ 12.16 hrs, Volume= 1.944 af
Primary = 24.11 cfs @ 12.16 hrs, Volume= 1.944 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP2: Design Point 2

Inflow Area = 1.360 ac, 69.26% Impervious, Inflow Depth > 2.22" for 2-YR event
Inflow = 3.62 cfs @ 12.09 hrs, Volume= 0.251 af
Primary = 3.62 cfs @ 12.09 hrs, Volume= 0.251 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP3: Design Point 3

Inflow Area = 3.441 ac, 45.57% Impervious, Inflow Depth > 1.66" for 2-YR event
Inflow = 6.89 cfs @ 12.10 hrs, Volume= 0.475 af
Primary = 6.89 cfs @ 12.10 hrs, Volume= 0.475 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP4: Design Point 4

Inflow Area = 1.738 ac, 48.50% Impervious, Inflow Depth > 1.73" for 2-YR event
Inflow = 3.79 cfs @ 12.08 hrs, Volume= 0.251 af
Primary = 3.79 cfs @ 12.08 hrs, Volume= 0.251 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lagoon Sump Runoff Area=11.905 ac 61.60% Impervious Runoff Depth>3.70"
Flow Length=1,154' Tc=11.7 min CN=86 Runoff=44.54 cfs 3.674 af

Subcatchment 2S: Admin CB Runoff Area=1.360 ac 69.26% Impervious Runoff Depth>4.02"
Flow Length=131' Tc=6.3 min CN=89 Runoff=6.36 cfs 0.455 af

Subcatchment 3S: Back Swale Runoff Area=3.441 ac 45.57% Impervious Runoff Depth>3.31"
Flow Length=902' Tc=6.8 min CN=82 Runoff=13.58 cfs 0.949 af

Subcatchment 4S: Field Runoff Area=1.738 ac 48.50% Impervious Runoff Depth>3.41"
Flow Length=410' Tc=5.0 min CN=83 Runoff=7.38 cfs 0.494 af

Subcatchment 5S: Lagoon Watershed Runoff Area=2.950 ac 86.88% Impervious Runoff Depth>4.33"
Tc=6.0 min CN=92 Runoff=14.59 cfs 1.063 af

Pond 1P: Lagoon Peak Elev=524.80' Storage=206,255 cf Inflow=55.97 cfs 4.737 af
Outflow=0.00 cfs 0.000 af

Link DP1: Design Point 1 Inflow=44.54 cfs 3.674 af
Primary=44.54 cfs 3.674 af

Link DP2: Design Point 2 Inflow=6.36 cfs 0.455 af
Primary=6.36 cfs 0.455 af

Link DP3: Design Point 3 Inflow=13.58 cfs 0.949 af
Primary=13.58 cfs 0.949 af

Link DP4: Design Point 4 Inflow=7.38 cfs 0.494 af
Primary=7.38 cfs 0.494 af

Total Runoff Area = 21.394 ac Runoff Volume = 6.636 af Average Runoff Depth = 3.72"
38.07% Pervious = 8.145 ac 61.93% Impervious = 13.249 ac

Summary for Subcatchment 1S: Lagoon Sump Watershed

Runoff = 44.54 cfs @ 12.16 hrs, Volume= 3.674 af, Depth> 3.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.50"

Area (ac)	CN	Description
7.333	98	Paved parking & roofs
4.572	68	<50% Grass cover, Poor, HSG A
11.905	86	Weighted Average
4.572		Pervious Area
7.333		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.0150	1.28		**Sheet Flow, 1-a** Smooth surfaces n= 0.011 P2= 3.50"
0.4	81	0.0432	3.35		**Shallow Concentrated Flow, 1-b** Unpaved Kv= 16.1 fps
9.1	848	0.0059	1.56		**Shallow Concentrated Flow, 1-c** Paved Kv= 20.3 fps
0.9	125	0.0100	2.36	1.85	**Circular Channel (pipe), 1-d** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
11.7	1,154	Total			

Summary for Subcatchment 2S: Admin CB

Runoff = 6.36 cfs @ 12.09 hrs, Volume= 0.455 af, Depth> 4.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.50"

Area (ac)	CN	Description
0.942	98	Paved parking & roofs
0.418	68	<50% Grass cover, Poor, HSG A
1.360	89	Weighted Average
0.418		Pervious Area
0.942		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	66	0.0303	0.19		**Sheet Flow, 2-a** Grass: Short n= 0.150 P2= 3.50"
0.6	65	0.0385	1.72		**Sheet Flow, 2-b** Smooth surfaces n= 0.011 P2= 3.50"
6.3	131	Total			

Summary for Subcatchment 3S: Back Swale

Runoff = 13.58 cfs @ 12.10 hrs, Volume= 0.949 af, Depth> 3.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.50"

Area (ac)	CN	Description
1.568	98	Paved parking & roofs
1.873	68	<50% Grass cover, Poor, HSG A
3.441	82	Weighted Average
1.873		Pervious Area
1.568		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0100	1.09		**Sheet Flow, 3-a** Smooth surfaces n= 0.011 P2= 3.50"
0.8	132	0.0303	2.80		**Shallow Concentrated Flow, 3-b** Unpaved Kv= 16.1 fps
3.2	497	0.0161	2.58		**Shallow Concentrated Flow, 3-c** Paved Kv= 20.3 fps
0.8	108	0.0185	2.19		**Shallow Concentrated Flow, 3-d** Unpaved Kv= 16.1 fps
0.5	65	0.0154	2.23	0.78	**Circular Channel (pipe), 3-e** Diam= 8.0" Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.025 Corrugated metal
6.8	902	Total			

Summary for Subcatchment 4S: Field

Runoff = 7.38 cfs @ 12.07 hrs, Volume= 0.494 af, Depth> 3.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.50"

Area (ac)	CN	Description
0.843	98	Paved parking & roofs
0.895	68	<50% Grass cover, Poor, HSG A
1.738	83	Weighted Average
0.895		Pervious Area
0.843		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	85	0.0118	1.13		**Sheet Flow, 4-a** Smooth surfaces n= 0.011 P2= 3.50"
0.4	67	0.0224	3.04		**Shallow Concentrated Flow, 4-b** Paved Kv= 20.3 fps
1.0	109	0.0138	1.89		**Shallow Concentrated Flow, 4-c** Unpaved Kv= 16.1 fps
0.4	50	0.0100	2.03		**Shallow Concentrated Flow, 4-d** Paved Kv= 20.3 fps
1.9	99	0.0150	0.86		**Shallow Concentrated Flow, 4-e** Short Grass Pasture Kv= 7.0 fps
5.0	410	Total			

Summary for Subcatchment 5S: Lagoon Watershed

Runoff = 14.59 cfs @ 12.09 hrs, Volume= 1.063 af, Depth> 4.33"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YR Rainfall=5.50"

	Area (ac)	CN	Description
*	2.563	100	Water
	0.387	39	>75% Grass cover, Good, HSG A
	2.950	92	Weighted Average
	0.387		Pervious Area
	2.563		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Pond 1P: Lagoon

Inflow Area = 14.855 ac, 66.62% Impervious, Inflow Depth > 3.83" for 10-YR event
Inflow = 55.97 cfs @ 12.14 hrs, Volume= 4.737 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 524.80' @ 20.00 hrs Surf.Area= 0 sf Storage= 206,255 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	523.50'	1,171,422 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
523.50	0
526.00	397,938
528.00	608,909
530.00	837,979
532.00	1,171,422

Summary for Link DP1: Design Point 1

Inflow Area = 11.905 ac, 61.60% Impervious, Inflow Depth > 3.70" for 10-YR event
Inflow = 44.54 cfs @ 12.16 hrs, Volume= 3.674 af
Primary = 44.54 cfs @ 12.16 hrs, Volume= 3.674 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP2: Design Point 2

Inflow Area = 1.360 ac, 69.26% Impervious, Inflow Depth > 4.02" for 10-YR event
Inflow = 6.36 cfs @ 12.09 hrs, Volume= 0.455 af
Primary = 6.36 cfs @ 12.09 hrs, Volume= 0.455 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP3: Design Point 3

Inflow Area = 3.441 ac, 45.57% Impervious, Inflow Depth > 3.31" for 10-YR event
Inflow = 13.58 cfs @ 12.10 hrs, Volume= 0.949 af
Primary = 13.58 cfs @ 12.10 hrs, Volume= 0.949 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP4: Design Point 4

Inflow Area = 1.738 ac, 48.50% Impervious, Inflow Depth > 3.41" for 10-YR event
Inflow = 7.38 cfs @ 12.07 hrs, Volume= 0.494 af
Primary = 7.38 cfs @ 12.07 hrs, Volume= 0.494 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lagoon Sump Runoff Area=11.905 ac 61.60% Impervious Runoff Depth>4.61"
Flow Length=1,154' Tc=11.7 min CN=86 Runoff=54.80 cfs 4.570 af

Subcatchment 2S: Admin CB Runoff Area=1.360 ac 69.26% Impervious Runoff Depth>4.93"
Flow Length=131' Tc=6.3 min CN=89 Runoff=7.72 cfs 0.559 af

Subcatchment 3S: Back Swale Runoff Area=3.441 ac 45.57% Impervious Runoff Depth>4.18"
Flow Length=902' Tc=6.8 min CN=82 Runoff=17.00 cfs 1.200 af

Subcatchment 4S: Field Runoff Area=1.738 ac 48.50% Impervious Runoff Depth>4.29"
Flow Length=410' Tc=5.0 min CN=83 Runoff=9.19 cfs 0.622 af

Subcatchment 5S: Lagoon Watershed Runoff Area=2.950 ac 86.88% Impervious Runoff Depth>5.25"
Tc=6.0 min CN=92 Runoff=17.52 cfs 1.290 af

Pond 1P: Lagoon Peak Elev=525.10' Storage=255,150 cf Inflow=68.54 cfs 5.860 af
Outflow=0.00 cfs 0.000 af

Link DP1: Design Point 1 Inflow=54.80 cfs 4.570 af
Primary=54.80 cfs 4.570 af

Link DP2: Design Point 2 Inflow=7.72 cfs 0.559 af
Primary=7.72 cfs 0.559 af

Link DP3: Design Point 3 Inflow=17.00 cfs 1.200 af
Primary=17.00 cfs 1.200 af

Link DP4: Design Point 4 Inflow=9.19 cfs 0.622 af
Primary=9.19 cfs 0.622 af

Total Runoff Area = 21.394 ac Runoff Volume = 8.241 af Average Runoff Depth = 4.62"
38.07% Pervious = 8.145 ac 61.93% Impervious = 13.249 ac

Summary for Subcatchment 1S: Lagoon Sump Watershed

Runoff = 54.80 cfs @ 12.16 hrs, Volume= 4.570 af, Depth> 4.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.50"

Area (ac)	CN	Description
7.333	98	Paved parking & roofs
4.572	68	<50% Grass cover, Poor, HSG A
11.905	86	Weighted Average
4.572		Pervious Area
7.333		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.0150	1.28		**Sheet Flow, 1-a** Smooth surfaces n= 0.011 P2= 3.50"
0.4	81	0.0432	3.35		**Shallow Concentrated Flow, 1-b** Unpaved Kv= 16.1 fps
9.1	848	0.0059	1.56		**Shallow Concentrated Flow, 1-c** Paved Kv= 20.3 fps
0.9	125	0.0100	2.36	1.85	**Circular Channel (pipe), 1-d** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
11.7	1,154	Total			

Summary for Subcatchment 2S: Admin CB

Runoff = 7.72 cfs @ 12.09 hrs, Volume= 0.559 af, Depth> 4.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.50"

Area (ac)	CN	Description
0.942	98	Paved parking & roofs
0.418	68	<50% Grass cover, Poor, HSG A
1.360	89	Weighted Average
0.418		Pervious Area
0.942		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	66	0.0303	0.19		**Sheet Flow, 2-a** Grass: Short n= 0.150 P2= 3.50"
0.6	65	0.0385	1.72		**Sheet Flow, 2-b** Smooth surfaces n= 0.011 P2= 3.50"
6.3	131	Total			

Summary for Subcatchment 3S: Back Swale

Runoff = 17.00 cfs @ 12.10 hrs, Volume= 1.200 af, Depth> 4.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.50"

Area (ac)	CN	Description
1.568	98	Paved parking & roofs
1.873	68	<50% Grass cover, Poor, HSG A
3.441	82	Weighted Average
1.873		Pervious Area
1.568		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0100	1.09		**Sheet Flow, 3-a** Smooth surfaces n= 0.011 P2= 3.50"
0.8	132	0.0303	2.80		**Shallow Concentrated Flow, 3-b** Unpaved Kv= 16.1 fps
3.2	497	0.0161	2.58		**Shallow Concentrated Flow, 3-c** Paved Kv= 20.3 fps
0.8	108	0.0185	2.19		**Shallow Concentrated Flow, 3-d** Unpaved Kv= 16.1 fps
0.5	65	0.0154	2.23	0.78	**Circular Channel (pipe), 3-e** Diam= 8.0" Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.025 Corrugated metal
6.8	902	Total			

Summary for Subcatchment 4S: Field

Runoff = 9.19 cfs @ 12.07 hrs, Volume= 0.622 af, Depth> 4.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.50"

Area (ac)	CN	Description
0.843	98	Paved parking & roofs
0.895	68	<50% Grass cover, Poor, HSG A
1.738	83	Weighted Average
0.895		Pervious Area
0.843		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	85	0.0118	1.13		**Sheet Flow, 4-a** Smooth surfaces n= 0.011 P2= 3.50"
0.4	67	0.0224	3.04		**Shallow Concentrated Flow, 4-b** Paved Kv= 20.3 fps
1.0	109	0.0138	1.89		**Shallow Concentrated Flow, 4-c** Unpaved Kv= 16.1 fps
0.4	50	0.0100	2.03		**Shallow Concentrated Flow, 4-d** Paved Kv= 20.3 fps
1.9	99	0.0150	0.86		**Shallow Concentrated Flow, 4-e** Short Grass Pasture Kv= 7.0 fps
5.0	410	Total			

Summary for Subcatchment 5S: Lagoon Watershed

Runoff = 17.52 cfs @ 12.09 hrs, Volume= 1.290 af, Depth> 5.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YR Rainfall=6.50"

	Area (ac)	CN	Description
*	2.563	100	Water
	0.387	39	>75% Grass cover, Good, HSG A
	2.950	92	Weighted Average
	0.387		Pervious Area
	2.563		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Pond 1P: Lagoon

Inflow Area = 14.855 ac, 66.62% Impervious, Inflow Depth > 4.73" for 25-YR event
Inflow = 68.54 cfs @ 12.14 hrs, Volume= 5.860 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 525.10' @ 20.00 hrs Surf.Area= 0 sf Storage= 255,150 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	523.50'	1,171,422 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
523.50	0
526.00	397,938
528.00	608,909
530.00	837,979
532.00	1,171,422

Summary for Link DP1: Design Point 1

Inflow Area = 11.905 ac, 61.60% Impervious, Inflow Depth > 4.61" for 25-YR event
Inflow = 54.80 cfs @ 12.16 hrs, Volume= 4.570 af
Primary = 54.80 cfs @ 12.16 hrs, Volume= 4.570 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP2: Design Point 2

Inflow Area = 1.360 ac, 69.26% Impervious, Inflow Depth > 4.93" for 25-YR event
Inflow = 7.72 cfs @ 12.09 hrs, Volume= 0.559 af
Primary = 7.72 cfs @ 12.09 hrs, Volume= 0.559 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP3: Design Point 3

Inflow Area = 3.441 ac, 45.57% Impervious, Inflow Depth > 4.18" for 25-YR event
Inflow = 17.00 cfs @ 12.10 hrs, Volume= 1.200 af
Primary = 17.00 cfs @ 12.10 hrs, Volume= 1.200 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP4: Design Point 4

Inflow Area = 1.738 ac, 48.50% Impervious, Inflow Depth > 4.29" for 25-YR event
Inflow = 9.19 cfs @ 12.07 hrs, Volume= 0.622 af
Primary = 9.19 cfs @ 12.07 hrs, Volume= 0.622 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lagoon Sump Runoff Area=11.905 ac 61.60% Impervious Runoff Depth>5.98"
Flow Length=1,154' Tc=11.7 min CN=86 Runoff=70.12 cfs 5.929 af

Subcatchment 2S: Admin CB Runoff Area=1.360 ac 69.26% Impervious Runoff Depth>6.32"
Flow Length=131' Tc=6.3 min CN=89 Runoff=9.74 cfs 0.716 af

Subcatchment 3S: Back Swale Runoff Area=3.441 ac 45.57% Impervious Runoff Depth>5.53"
Flow Length=902' Tc=6.8 min CN=82 Runoff=22.15 cfs 1.585 af

Subcatchment 4S: Field Runoff Area=1.738 ac 48.50% Impervious Runoff Depth>5.64"
Flow Length=410' Tc=5.0 min CN=83 Runoff=11.92 cfs 0.817 af

Subcatchment 5S: Lagoon Watershed Runoff Area=2.950 ac 86.88% Impervious Runoff Depth>6.63"
Tc=6.0 min CN=92 Runoff=21.89 cfs 1.631 af

Pond 1P: Lagoon Peak Elev=525.57' Storage=329,154 cf Inflow=87.32 cfs 7.560 af
Outflow=0.00 cfs 0.000 af

Link DP1: Design Point 1 Inflow=70.12 cfs 5.929 af
Primary=70.12 cfs 5.929 af

Link DP2: Design Point 2 Inflow=9.74 cfs 0.716 af
Primary=9.74 cfs 0.716 af

Link DP3: Design Point 3 Inflow=22.15 cfs 1.585 af
Primary=22.15 cfs 1.585 af

Link DP4: Design Point 4 Inflow=11.92 cfs 0.817 af
Primary=11.92 cfs 0.817 af

Total Runoff Area = 21.394 ac Runoff Volume = 10.677 af Average Runoff Depth = 5.99"
38.07% Pervious = 8.145 ac 61.93% Impervious = 13.249 ac

Summary for Subcatchment 1S: Lagoon Sump Watershed

Runoff = 70.12 cfs @ 12.16 hrs, Volume= 5.929 af, Depth> 5.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=8.00"

Area (ac)	CN	Description
7.333	98	Paved parking & roofs
4.572	68	<50% Grass cover, Poor, HSG A
11.905	86	Weighted Average
4.572		Pervious Area
7.333		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.0150	1.28		**Sheet Flow, 1-a** Smooth surfaces n= 0.011 P2= 3.50"
0.4	81	0.0432	3.35		**Shallow Concentrated Flow, 1-b** Unpaved Kv= 16.1 fps
9.1	848	0.0059	1.56		**Shallow Concentrated Flow, 1-c** Paved Kv= 20.3 fps
0.9	125	0.0100	2.36	1.85	**Circular Channel (pipe), 1-d** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.025 Corrugated metal
11.7	1,154	Total			

Summary for Subcatchment 2S: Admin CB

Runoff = 9.74 cfs @ 12.09 hrs, Volume= 0.716 af, Depth> 6.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=8.00"

Area (ac)	CN	Description
0.942	98	Paved parking & roofs
0.418	68	<50% Grass cover, Poor, HSG A
1.360	89	Weighted Average
0.418		Pervious Area
0.942		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	66	0.0303	0.19		**Sheet Flow, 2-a** Grass: Short n= 0.150 P2= 3.50"
0.6	65	0.0385	1.72		**Sheet Flow, 2-b** Smooth surfaces n= 0.011 P2= 3.50"
6.3	131	Total			

Summary for Subcatchment 3S: Back Swale

Runoff = 22.15 cfs @ 12.10 hrs, Volume= 1.585 af, Depth> 5.53"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=8.00"

Area (ac)	CN	Description
1.568	98	Paved parking & roofs
1.873	68	<50% Grass cover, Poor, HSG A
3.441	82	Weighted Average
1.873		Pervious Area
1.568		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0100	1.09		**Sheet Flow, 3-a** Smooth surfaces n= 0.011 P2= 3.50"
0.8	132	0.0303	2.80		**Shallow Concentrated Flow, 3-b** Unpaved Kv= 16.1 fps
3.2	497	0.0161	2.58		**Shallow Concentrated Flow, 3-c** Paved Kv= 20.3 fps
0.8	108	0.0185	2.19		**Shallow Concentrated Flow, 3-d** Unpaved Kv= 16.1 fps
0.5	65	0.0154	2.23	0.78	**Circular Channel (pipe), 3-e** Diam= 8.0" Area= 0.3 sf Perim= 2.1' r= 0.17' n= 0.025 Corrugated metal
6.8	902	Total			

Summary for Subcatchment 4S: Field

Runoff = 11.92 cfs @ 12.07 hrs, Volume= 0.817 af, Depth> 5.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=8.00"

Area (ac)	CN	Description
0.843	98	Paved parking & roofs
0.895	68	<50% Grass cover, Poor, HSG A
1.738	83	Weighted Average
0.895		Pervious Area
0.843		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	85	0.0118	1.13		**Sheet Flow, 4-a** Smooth surfaces n= 0.011 P2= 3.50"
0.4	67	0.0224	3.04		**Shallow Concentrated Flow, 4-b** Paved Kv= 20.3 fps
1.0	109	0.0138	1.89		**Shallow Concentrated Flow, 4-c** Unpaved Kv= 16.1 fps
0.4	50	0.0100	2.03		**Shallow Concentrated Flow, 4-d** Paved Kv= 20.3 fps
1.9	99	0.0150	0.86		**Shallow Concentrated Flow, 4-e** Short Grass Pasture Kv= 7.0 fps
5.0	410	Total			

Summary for Subcatchment 5S: Lagoon Watershed

Runoff = 21.89 cfs @ 12.09 hrs, Volume= 1.631 af, Depth> 6.63"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-YR Rainfall=8.00"

	Area (ac)	CN	Description
*	2.563	100	Water
	0.387	39	>75% Grass cover, Good, HSG A
	2.950	92	Weighted Average
	0.387		Pervious Area
	2.563		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Summary for Pond 1P: Lagoon

Inflow Area = 14.855 ac, 66.62% Impervious, Inflow Depth > 6.11" for 100-YR event
Inflow = 87.32 cfs @ 12.14 hrs, Volume= 7.560 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 525.57' @ 20.00 hrs Surf.Area= 0 sf Storage= 329,154 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	523.50'	1,171,422 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
523.50	0
526.00	397,938
528.00	608,909
530.00	837,979
532.00	1,171,422

Summary for Link DP1: Design Point 1

Inflow Area = 11.905 ac, 61.60% Impervious, Inflow Depth > 5.98" for 100-YR event
Inflow = 70.12 cfs @ 12.16 hrs, Volume= 5.929 af
Primary = 70.12 cfs @ 12.16 hrs, Volume= 5.929 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP2: Design Point 2

Inflow Area = 1.360 ac, 69.26% Impervious, Inflow Depth > 6.32" for 100-YR event
Inflow = 9.74 cfs @ 12.09 hrs, Volume= 0.716 af
Primary = 9.74 cfs @ 12.09 hrs, Volume= 0.716 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP3: Design Point 3

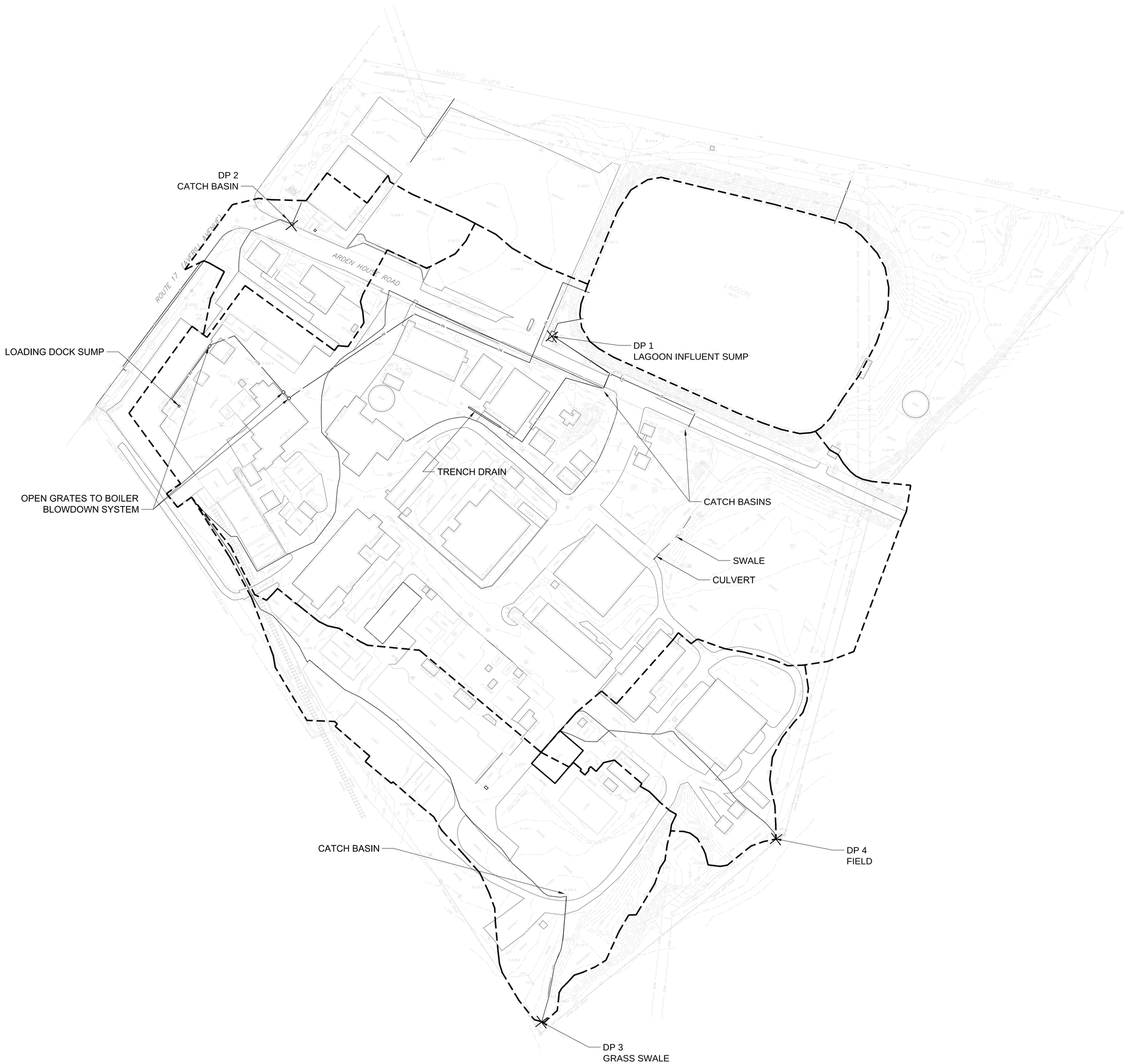
Inflow Area = 3.441 ac, 45.57% Impervious, Inflow Depth > 5.53" for 100-YR event
Inflow = 22.15 cfs @ 12.10 hrs, Volume= 1.585 af
Primary = 22.15 cfs @ 12.10 hrs, Volume= 1.585 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Link DP4: Design Point 4

Inflow Area = 1.738 ac, 48.50% Impervious, Inflow Depth > 5.64" for 100-YR event
Inflow = 11.92 cfs @ 12.07 hrs, Volume= 0.817 af
Primary = 11.92 cfs @ 12.07 hrs, Volume= 0.817 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



MAP REFERENCE:

1. SITE TOPOGRAPHY AND FEATURES TAKEN FROM TOPOGRAPHIC SURVEY PREPARED BY THE CHAZEN COMPANIES DATED APRIL 13, 2007.
2. SITE UTILITIES SHOWN HEREON TAKEN FROM DRAWING TITLED "NEPERA SITE PLAN" PREPARED BY NEPERA INC DATED APRIL 19, 1994 AND FIELD VERIFIED TO THE EXTENT POSSIBLE BY MORRIS ASSOCIATES ON DECEMBER 9, 2013.

LINE LEGEND

- EXISTING DRAINAGE SYSTEM
- EXISTING BOILER BLOWDOWN SYSTEM
- WATERSHED BOUNDARIES
- TIME OF CONCENTRATION PATH

REV. No.	DESCRIPTION	DATE	BY

ELT HARRIMAN LLC

T/WOODBURY & V/HARRIMAN — ORANGE COUNTY, NY

ON-SITE SURFACE WATER DRAINAGE MAP

MORRIS ASSOCIATES,
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DATE	SCALE		FILE No.	DRAWING NO.
12/12/2013	1"=50'	DESIGNED BY: AL DRAWN BY: AL CHECKED BY: AL	211029.132	1 OF 1

United States Department of Agriculture

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Orange County, New York

ELT Harriman

February 1, 2012

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map (ELT Harriman)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:4,310 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:15,840.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 18N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Orange County, New York
Survey Area Data: Version 12, Dec 20, 2011

Date(s) aerial images were photographed: 8/13/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (ELT Harriman)

Orange County, New York (NY071)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Ca	Canandaigua silt loam	0.5	1.0%
ErA	Erie gravelly silt loam, 0 to 3 percent slopes	2.5	4.8%
Fd	Fredon loam	9.9	19.2%
HoB	Hoosic gravelly sandy loam, 3 to 8 percent slopes	2.3	4.6%
OtB	Otisville gravelly sandy loam, 0 to 8 percent slopes	33.6	65.4%
W	Water	2.5	4.9%
Totals for Area of Interest		**51.3**	**100.0%**

Map Unit Descriptions (ELT Harriman)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic

classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Orange County, New York

Ca—Canandaigua silt loam

Map Unit Setting

Mean annual precipitation: 42 to 52 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 135 to 215 days

Map Unit Composition

Canandaigua and similar soils: 75 percent
Minor components: 25 percent

Description of Canandaigua

Setting

Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Silty and clayey glaciolacustrine deposits

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 15 percent
Available water capacity: Moderate (about 7.6 inches)

Interpretive groups

Land capability (nonirrigated): 4w

Typical profile

0 to 8 inches: Silt loam
8 to 35 inches: Silty clay loam
35 to 60 inches: Fine sand

Minor Components

Alden

Percent of map unit: 5 percent
Landform: Depressions

Halsey

Percent of map unit: 5 percent
Landform: Depressions

Madalin

Percent of map unit: 5 percent
Landform: Depressions

Palms
Percent of map unit: 5 percent
Landform: Marshes, swamps

Raynham
Percent of map unit: 5 percent

ErA—Erie gravelly silt loam, 0 to 3 percent slopes

Map Unit Setting
Mean annual precipitation: 42 to 52 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 135 to 215 days

Map Unit Composition
Erie and similar soils: 75 percent
Minor components: 25 percent

Description of Erie

Setting
Landform: Drumlinoid ridges, hills, till plains
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till derived from siltstone, sandstone, shale, and limestone

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: 10 to 21 inches to fragipan
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water capacity: Very low (about 2.5 inches)

Interpretive groups
Land capability (nonirrigated): 3w

Typical profile
0 to 10 inches: Gravelly silt loam
10 to 18 inches: Channery silt loam
18 to 56 inches: Channery silt loam
56 to 70 inches: Channery silt loam

Minor Components

Alden
Percent of map unit: 5 percent
Landform: Depressions

Bath
Percent of map unit: 5 percent

Swartswood
Percent of map unit: 5 percent
Landform: Depressions

Mardin
Percent of map unit: 5 percent

Wurtsboro
Percent of map unit: 5 percent

Fd—Fredon loam

Map Unit Setting
Elevation: 250 to 1,200 feet
Mean annual precipitation: 42 to 52 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 135 to 215 days

Map Unit Composition
Fredon, poorly drained, and similar soils: 50 percent
Fredon, somewhat poorly drained, and similar soils: 25 percent
Minor components: 25 percent

Description of Fredon, Poorly Drained

Setting
Landform: Valley trains, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy over sandy and gravelly glaciofluvial deposits

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Occasional
Frequency of ponding: None

Calcium carbonate, maximum content: 15 percent
Available water capacity: Low (about 5.3 inches)

Interpretive groups
Land capability (nonirrigated): 3w

Typical profile
0 to 6 inches: Loam
6 to 24 inches: Very fine sandy loam
24 to 60 inches: Stratified gravelly sand

Description of Fredon, Somewhat Poorly Drained

Setting
Landform: Valley trains, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy over sandy and gravelly glaciofluvial deposits

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water capacity: Low (about 5.3 inches)

Interpretive groups
Land capability (nonirrigated): 3w

Typical profile
0 to 6 inches: Loam
6 to 24 inches: Very fine sandy loam
24 to 60 inches: Stratified gravelly sand

Minor Components

Castile
Percent of map unit: 5 percent

Chenango
Percent of map unit: 5 percent

Halsey
Percent of map unit: 5 percent
Landform: Depressions

Hoosic
Percent of map unit: 5 percent

Raynham
Percent of map unit: 5 percent

HoB—Hoosic gravelly sandy loam, 3 to 8 percent slopes

Map Unit Setting

Elevation: 100 to 1,100 feet
Mean annual precipitation: 42 to 52 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 135 to 215 days

Map Unit Composition

Hoosic and similar soils: 80 percent
Minor components: 20 percent

Description of Hoosic

Setting

Landform: Deltas, outwash plains, terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly glaciofluvial deposits

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (1.98 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.3 inches)

Interpretive groups

Land capability (nonirrigated): 3s

Typical profile

0 to 6 inches: Gravelly sandy loam
6 to 28 inches: Very gravelly sandy loam
28 to 60 inches: Very gravelly sand

Minor Components

Castile

Percent of map unit: 5 percent

Chenango

Percent of map unit: 5 percent

Fredon
Percent of map unit: 5 percent

Oakville
Percent of map unit: 5 percent

OtB—Otisville gravelly sandy loam, 0 to 8 percent slopes

Map Unit Setting
Mean annual precipitation: 42 to 52 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 135 to 215 days

Map Unit Composition
Otisville and similar soils: 80 percent
Minor components: 20 percent

Description of Otisville

Setting
Landform: Deltas, outwash plains, terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly glaciofluvial deposits

Properties and qualities
Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.2 inches)

Interpretive groups
Land capability (nonirrigated): 3s

Typical profile
0 to 6 inches: Gravelly sandy loam
6 to 28 inches: Gravelly loamy sand
28 to 60 inches: Very gravelly sand

Minor Components

Oakville
Percent of map unit: 5 percent

Chenango
Percent of map unit: 5 percent

Fredon
Percent of map unit: 5 percent

Hoosic
Percent of map unit: 5 percent

W—Water

Map Unit Setting
Mean annual precipitation: 42 to 52 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 135 to 215 days

Map Unit Composition
Water: 100 percent

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

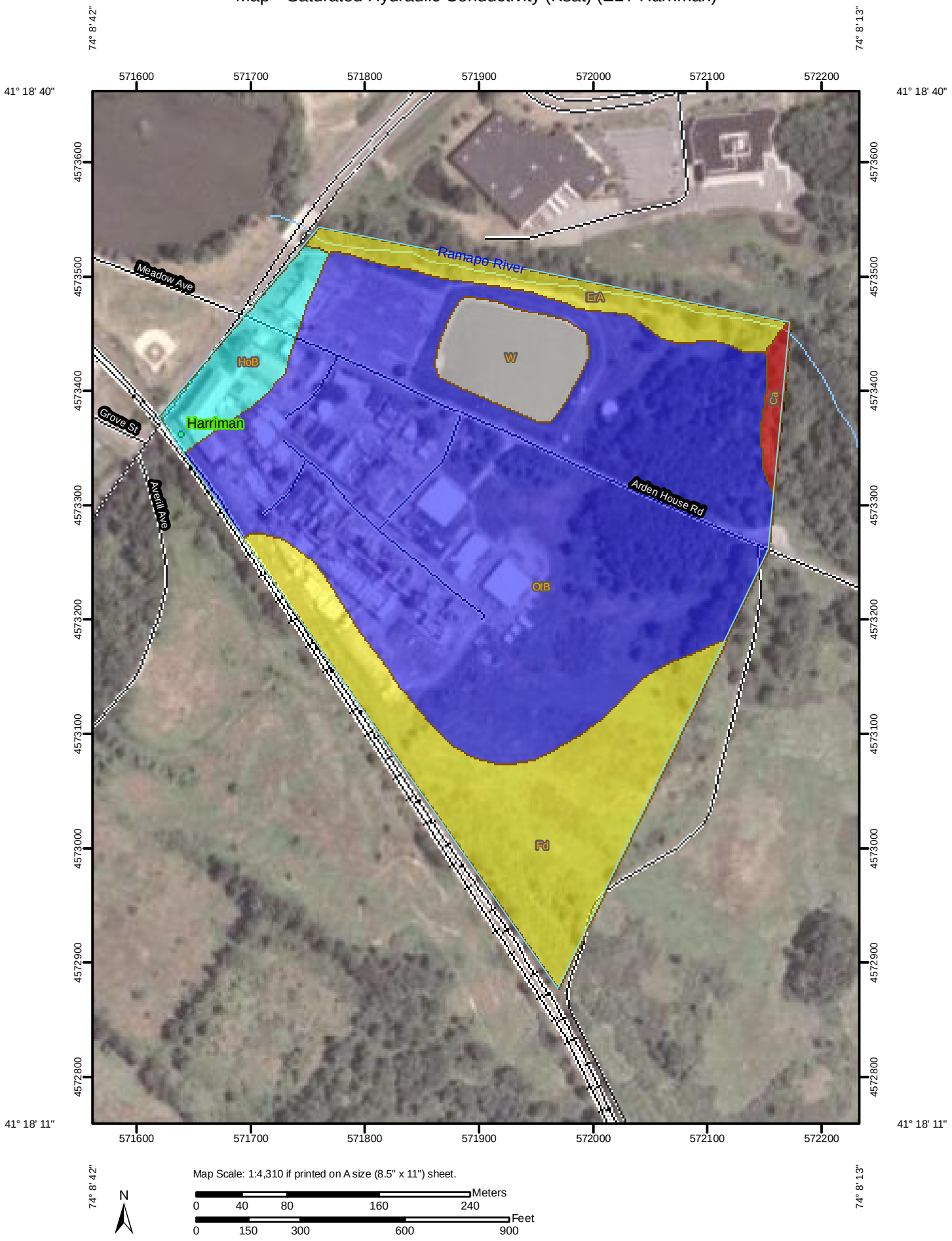
Saturated Hydraulic Conductivity (Ksat) (ELT Harriman)

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits.

Custom Soil Resource Report
Map—Saturated Hydraulic Conductivity (Ksat) (ELT Harriman)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- <= 7.7
- > 7.7 AND <= 9
- > 9 AND <= 78
- > 78 AND <= 92
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:4,310 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:15,840.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 18N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Orange County, New York
Survey Area Data: Version 12, Dec 20, 2011

Date(s) aerial images were photographed: 8/13/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Saturated Hydraulic Conductivity (Ksat) (ELT Harriman)

Saturated Hydraulic Conductivity (Ksat)— Summary by Map Unit — Orange County, New York (NY071)				
Map unit symbol	**Map unit name**	**Rating (micrometers per second)**	**Acres in AOI**	**Percent of AOI**
Ca	Canandaigua silt loam	7.7000	0.5	1.0%
ErA	Erie gravelly silt loam, 0 to 3 percent slopes	9.0000	2.5	4.8%
Fd	Fredon loam	9.0000	9.9	19.2%
HoB	Hoosic gravelly sandy loam, 3 to 8 percent slopes	78.0000	2.3	4.6%
OtB	Otisville gravelly sandy loam, 0 to 8 percent slopes	92.0000	33.6	65.4%
W	Water		2.5	4.9%
Totals for Area of Interest			**51.3**	**100.0%**

Rating Options—Saturated Hydraulic Conductivity (Ksat) (ELT Harriman)

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Slowest

Interpret Nulls as Zero: No

Layer Options: Surface Layer

Saturated Hydraulic Conductivity (Ksat), Standard Classes (ELT Harriman)

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits. The classes are:

Very low: 0.00 to 0.01

Low: 0.01 to 0.1

Moderately low: 0.1 to 1.0

Moderately high: 1 to 10

High: 10 to 100

Very high: 100 to 705

Custom Soil Resource Report
Map—Saturated Hydraulic Conductivity (Ksat), Standard Classes (ELT Harriman)

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- Very Low (0.0 - 0.01)
- Low (0.01 - 0.1)
- Moderately Low (0.1 - 1)
- Moderately High (1 - 10)
- High (10 - 100)
- Very High (100 - 705)
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:4,310 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:15,840.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 18N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Orange County, New York
Survey Area Data: Version 12, Dec 20, 2011

Date(s) aerial images were photographed: 8/13/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Saturated Hydraulic Conductivity (Ksat), Standard Classes (ELT Harriman)

Saturated Hydraulic Conductivity (Ksat), Standard Classes— Summary by Map Unit — Orange County, New York (NY071)				
Map unit symbol	**Map unit name**	**Rating (micrometers per second)**	**Acres in AOI**	**Percent of AOI**
Ca	Canandaigua silt loam	7.7000	0.5	1.0%
ErA	Erie gravelly silt loam, 0 to 3 percent slopes	9.0000	2.5	4.8%
Fd	Fredon loam	9.0000	9.9	19.2%
HoB	Hoosic gravelly sandy loam, 3 to 8 percent slopes	78.0000	2.3	4.6%
OtB	Otisville gravelly sandy loam, 0 to 8 percent slopes	92.0000	33.6	65.4%
W	Water		2.5	4.9%
Totals for Area of Interest			**51.3**	**100.0%**

Rating Options—Saturated Hydraulic Conductivity (Ksat), Standard Classes (ELT Harriman)

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Slowest

Interpret Nulls as Zero: No

Layer Options: Surface Layer

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group (ELT Harriman)

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Custom Soil Resource Report
Map—Hydrologic Soil Group (ELT Harriman)

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:4,310 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:15,840.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 18N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Orange County, New York
Survey Area Data: Version 12, Dec 20, 2011

Date(s) aerial images were photographed: 8/13/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group (ELT Harriman)

Hydrologic Soil Group— Summary by Map Unit — Orange County, New York (NY071)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
Ca	Canandaigua silt loam	B/D	0.5	1.0%
ErA	Erie gravelly silt loam, 0 to 3 percent slopes	D	2.5	4.8%
Fd	Fredon loam	B/D	9.9	19.2%
HoB	Hoosic gravelly sandy loam, 3 to 8 percent slopes	A	2.3	4.6%
OtB	Otisville gravelly sandy loam, 0 to 8 percent slopes	A	33.6	65.4%
W	Water		2.5	4.9%
Totals for Area of Interest			**51.3**	**100.0%**

Rating Options—Hydrologic Soil Group (ELT Harriman)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Water Features

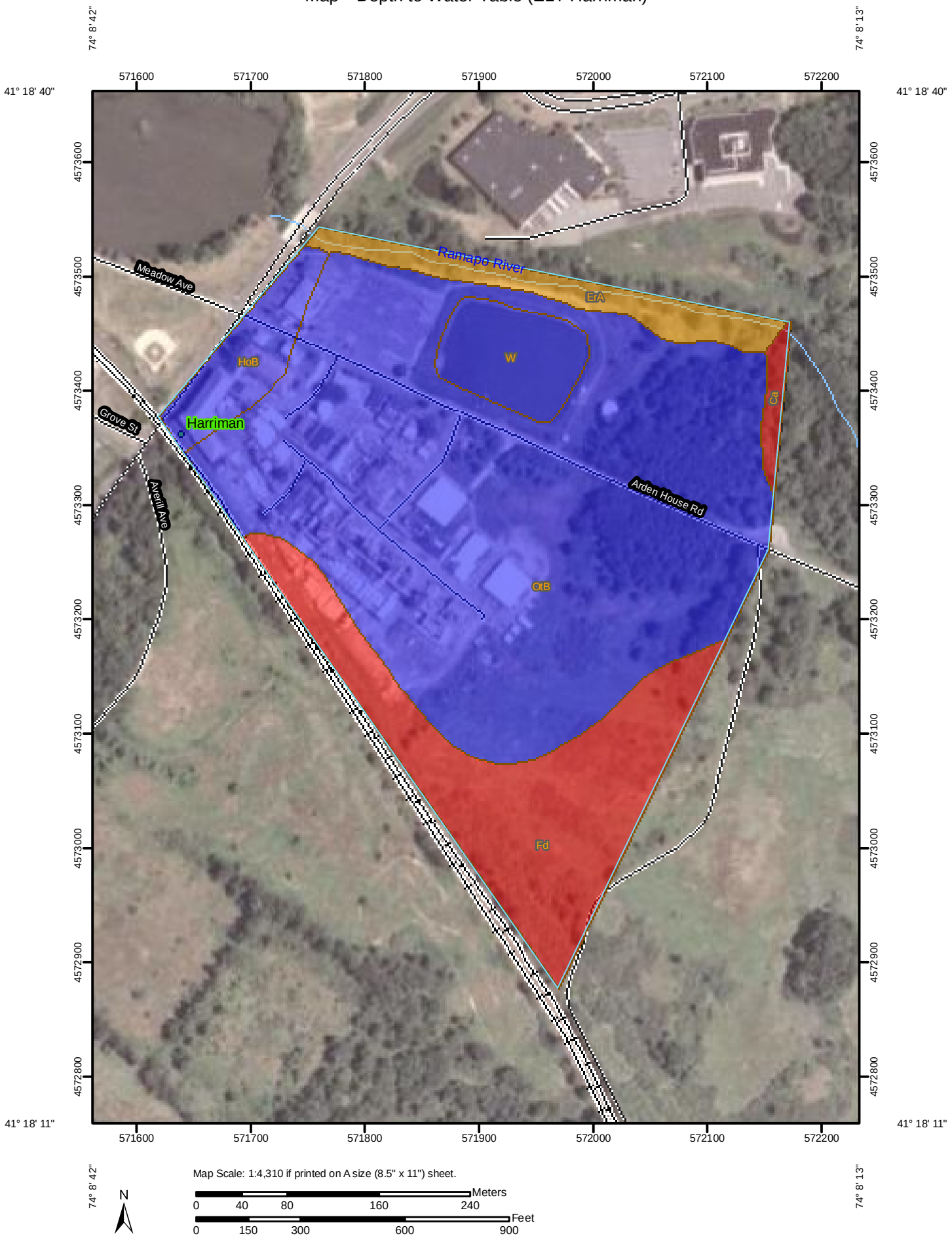
Water Features include ponding frequency, flooding frequency, and depth to water table.

Depth to Water Table (ELT Harriman)

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Custom Soil Resource Report
Map—Depth to Water Table (ELT Harriman)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Soil Ratings

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:4,310 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:15,840.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 18N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Orange County, New York
Survey Area Data: Version 12, Dec 20, 2011

Date(s) aerial images were photographed: 8/13/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Depth to Water Table (ELT Harriman)

Depth to Water Table— Summary by Map Unit — Orange County, New York (NY071)				
Map unit symbol	**Map unit name**	**Rating (centimeters)**	**Acres in AOI**	**Percent of AOI**
Ca	Canandaigua silt loam	0	0.5	1.0%
ErA	Erie gravelly silt loam, 0 to 3 percent slopes	31	2.5	4.8%
Fd	Fredon loam	15	9.9	19.2%
HoB	Hoosic gravelly sandy loam, 3 to 8 percent slopes	>200	2.3	4.6%
OtB	Otisville gravelly sandy loam, 0 to 8 percent slopes	>200	33.6	65.4%
W	Water	>200	2.5	4.9%
Totals for Area of Interest			**51.3**	**100.0%**

Rating Options—Depth to Water Table (ELT Harriman)

Units of Measure: centimeters

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Interpret Nulls as Zero: No

Beginning Month: January

Ending Month: December

References

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Appendix C: Closure Cost Estimate

Former Nepera Plant Site
Cost Estimate for Remaining RCRA Closure Activities
May 2014

Structure ID	Description	Closure Activities Remaining*
11	Tank Farm	Remove tank T-911 and demolish 2^{o} containment down to pad level.
18	Tank Farm	Remove tanks T-936, 937, and 939 and demolish 2^{o} containment down to pad level.
22	Tank Farm	Remove tank T-105 and demolish 2^{o} containment down to pad level.
61	Incinerator	Remove incinerator components (chamber, transition section, transit duct, and stack)
No ID	Haz Waste Lines	Remove hazardous waste feed lines.

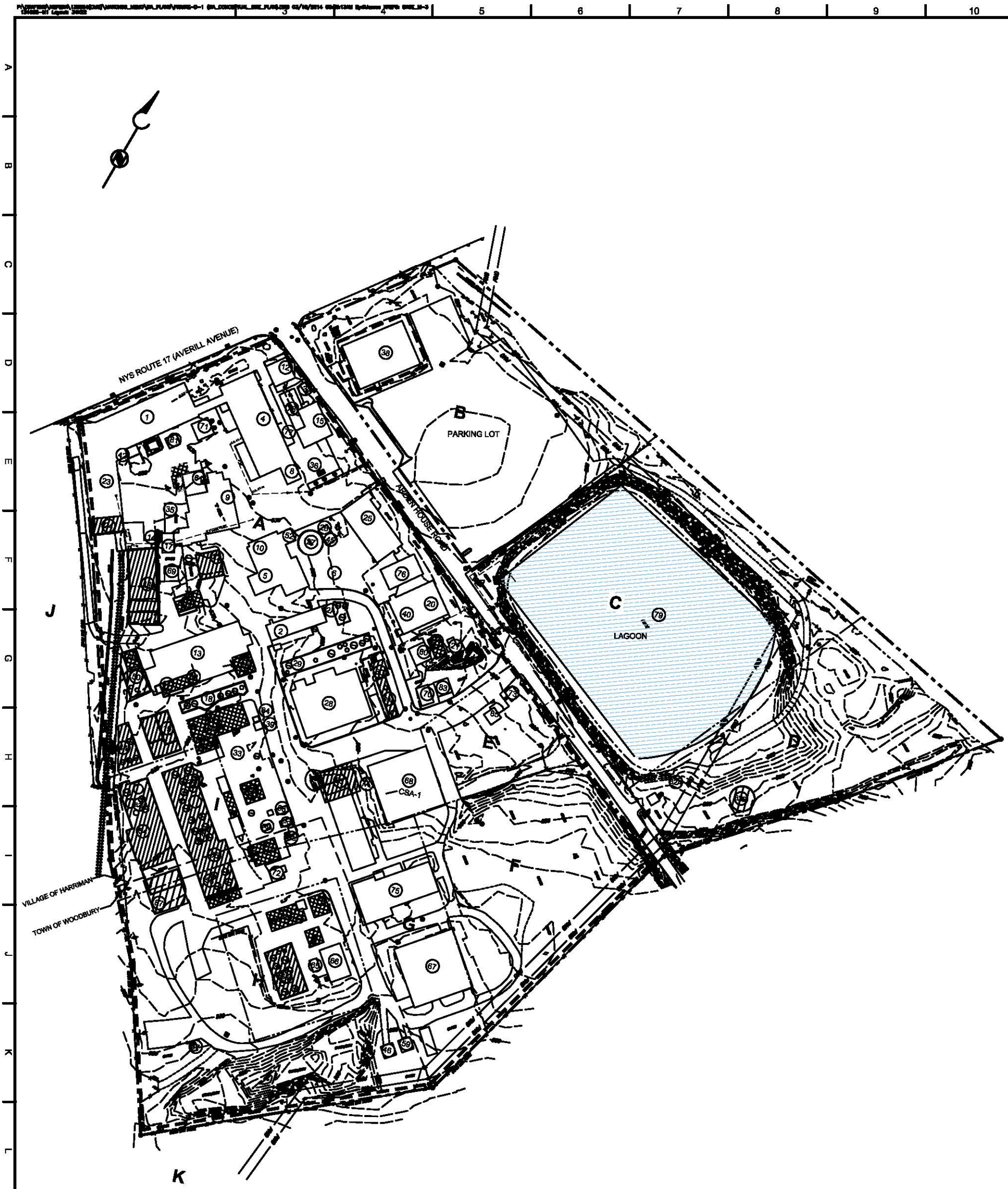
*Based on review of "RCRA Closure Report" (Shaw, April 2007) and NYSDEC's review letter dated 11/5/07.

No.	Item	Unit	Quantity	Unit Cost	Cost
1	Site Mob, Demob, and Administration	LS	1	$ 23,700.00	$ 23,700
2	Remove and Cut-up Tank T-911 (8' diameter, 12' long, 10,000-gallon)	LS	1	$ 7,800.00	$ 7,800
3	Demolish 2^{o} Containment around Tank T-911 (assume 6' high, 1' thick, 260' long)	SF	1560	$ 4.00	$ 6,200
4	Remove and Cut-up Tank T-936 (assume 8' diameter, 24' high, 20,000-gallon)	LS	1	$ 7,500.00	$ 7,500
5	Remove and Cut-up Tank T-937 (assume 8' diameter, 24' high, 20,000-gallon)	LS	1	$ 7,500.00	$ 7,500
6	Remove and Cut-up Tank T-939 (assume 8' diameter, 24' high, 20,000-gallon)	LS	1	$ 7,500.00	$ 7,500
7	Demolish 2^{o} Containment around Tanks T-936, 937, and 939 (assume 2' high, 12" thick, 250' long)	SF	500	$ 4.00	$ 2,000
8	Remove and Cut-up Tank T-105 (8' diameter, 24' long, 20,000-gallon)	LS	1	$ 7,500.00	$ 7,500
9	Demolish 2^{o} Containment around Tank T-105 (assume 3' high, 12" thick. 170' long)	SF	510	$ 4.00	$ 2,000
10	Remove and Cut-up Incinerator Components	LS	1	$ 42,900.00	$ 42,900
11	Remove and Cut-up Hazardous Waste Lines (assume: 1600 ft, 4" diameter, steel pipe)	LF	1600	$ 20.00	$ 32,000
12	On-Site Crushing and Staging of Concrete	LS	1	$ 12,000.00	$ 12,000
13	Hazardous Waste Disposal (Haz Waste Feed Lines T-105, T-939, and Cyano Residue)	TON	9	$ 300.00	$ 2,700
14	Misc. Non-Hazardous Waste Disposal	TON	100	$ 50.00	$ 5,000
				Subtotal (Contractor Cost)	$ 166,000
				25% Contingency	$ 42,000
				Total (Contractor Cost)	$ 208,000
15	Engineering, Oversight, and Documentation	%	20	$ 41,600.00	$ 41,600
				25% Contingency	$ 10,000
				Total (Engineering Cost)	$ 52,000
				TOTAL	**$ 260,000**

Notes:

1. Estimates are based on Brown and Caldwell Associates' experience, contractor cost information, and Means Cost Estimating Guides. Costs are in 2014 dollars.
2. This is a Class 5 estimate, which in accordance with the Association for the Advancement of Cost Engineering International (AACE) criteria, is defined as a Conceptual Level or Project Viability Estimate. Typically, engineering is from 0% to 2% complete. The target expected accuracy for Class 5 estimates typically ranges from -50% to +100%.
3. Assumptions include: dimensions and quantities identified above; non-union work forces; no ACM removal/disposal; and no further decontamination required. Hazardous waste disposal is limited to management of three of the hazardous waste feed lines (T-105, T-939, and cyano residues lines).

Appendix D: Conceptual Site Plans for Remedial Alternatives



NOTES:

1. REFER TO SITE PLAN FOR GENERAL LEGEND.
2. BUILDING DEMOLITION TO BE CONDUCTED INDEPENDENT OF REMEDAIL ACTION. BUILDING DEMOLITION TO OCCUR PRIOR TO RA IMPLEMENTATION AND IS ANTICIPATED TO INCLUDE REMOVAL OF ABOVE-GRADE BUILDINGS/STRUCTURES, SUCH THAT BUILDING/STRUCTURE SLABS REMAIN.
3. THE LAGOON IS PERMITTED UNDER THE NYS SPDES PROGRAM AND CLOSURE WILL BE CONDUCTED INDEPENDENT OF REMEDIAL ACTION AND IN COMPLIANCE WITH SPDES REQUIREMENTS.
4. REFER TO THE MARCH 1997 RECORD OF DECISION (ROD) FOR SITE REMEDIATION MEASURES REQUIRED BY THE ROD. IN SUMMARY THE ROD REMEDY INCLUDES: GROUNDWATER SOURCE REMEDIATION, DRUM REMOVAL, SEDIMENT EXCAVATION, GROUNDWATER PLUME CONTAINMENT, EROSION CONTROLS (AS NECESSARY), LONG-TERM GROUNDWATER AND SURFACE WATER MONITORING, AND RESTRICTION OF ON-SITE GROUNDWATER USE INCORPORATED INTO DEED NOTICE.

SOURCE:

REFER TO "SITE PLAN"

RA LEGEND:

RA AREA

0 60 180

SCALE IN FEET

Brown AND Caldwell

ASSOCIATES
UPPER SADDLE RIVER, NEW JERSEY

SUBMITTED: ADAM SHERMAN, PROJECT MANAGER DATE: 3/09

APPROVED: JEFF CAPUTI, BROWN AND CALDWELL DATE: 3/09

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED:
DRAWN:
CHECKED:
CHECKED:
APPROVED:

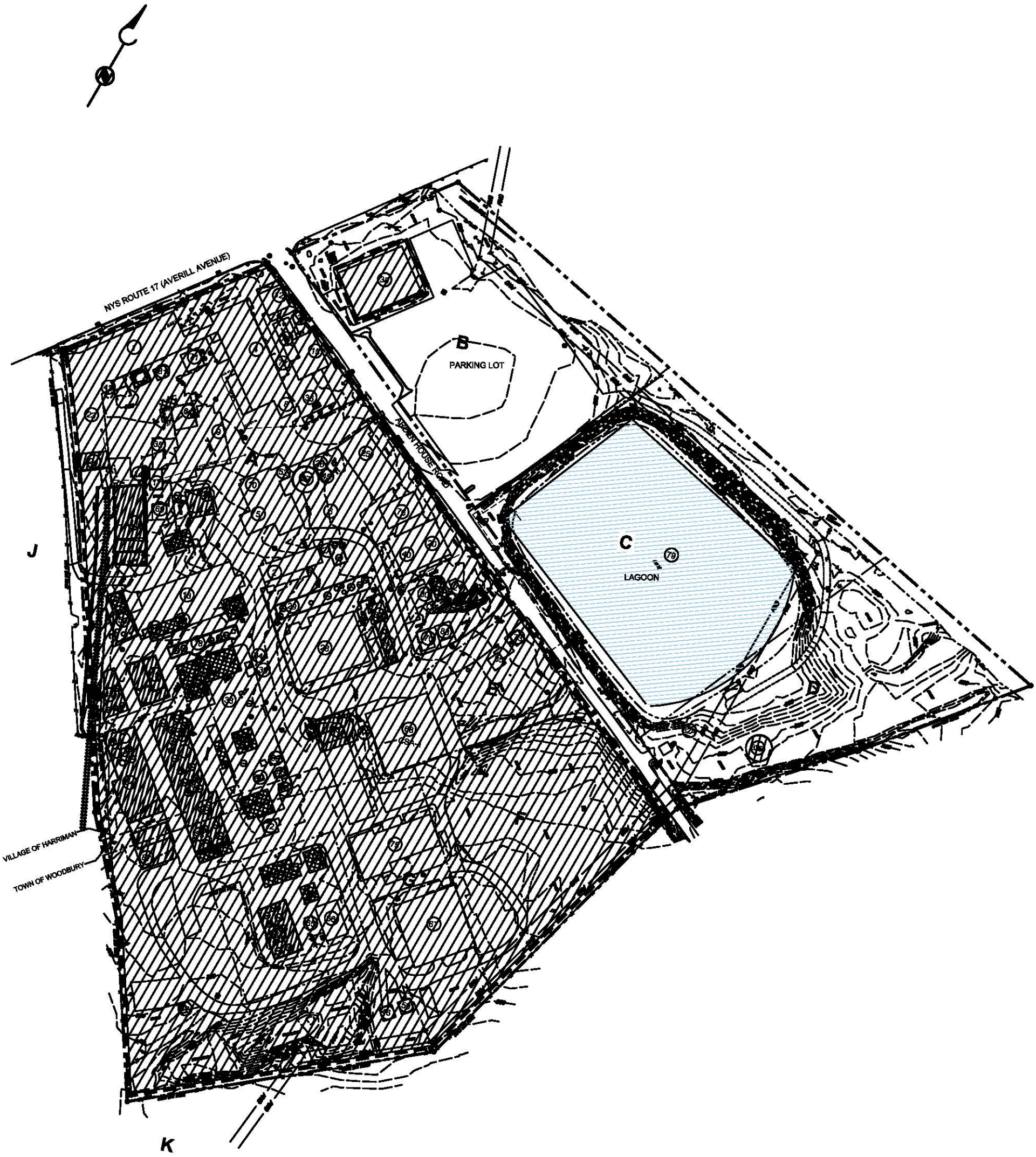
REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

FIGURE - D-1

RA-1 CONCEPTUAL SITE PLAN
NO ACTION

FORMER NEPERA SITE
HARRIMAN, NEW YORK

FILENAME: FIGURE D-1
BC PROJECT NUMBER: 135954.002
CLIENT PROJECT NUMBER: NA
DRAWING NUMBER: NA
SHEET NUMBER:



NOTES:

1. REFER TO "SITE PLAN" FOR GENERAL LEGEND.
2. REFER TO FIGURE C-1 "RA-1 CONCEPTUAL SITE PLAN" FOR NOTES REGARDING BUILDING DEMOLITION, MANAGEMENT OF SPDES LAGOON, AND ROD-REQUIRED REMEDIAL ACTIONS.

SOURCE:

REFER TO "SITE PLAN"

CMA LEGEND:

- - - - RA AREA

CONCEPTUAL EXCAVATION LIMITS
(UNRESTRICTED USE SCOs: 0.18 mg/kg MERCURY, 0.1 mg/kg PCBs, 0.06 mg/kg BENZENE)

APPROXIMATE EXCAVATION DEPTH: 4-8 FT BGS

APPROXIMATE EXCAVATION VOLUME: 183,000 CY (TOTAL), 126,000 CY (TREATMENT/DISPOSAL)

0 60 180
SCALE IN FEET

Brown AND Caldwell
ASSOCIATES
UPPER SADDLE RIVER, NEW JERSEY

SUBMITTED: ADAM SHERMAN, PROJECT MANAGER DATE: 3/09

APPROVED: JEFF CAPUTI, BROWN AND CALDWELL DATE: 3/09

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED:
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CHECKED:
CHECKED:
APPROVED:

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

FIGURE-D-2a

RA - 2a CONCEPTUAL SITE PLAN
EXCAVATION (UNRESTRICTED-USE SCOs) AND TREATMENT AND/OR DISPOSAL

FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

FILENAME: FIGURE D-2a
BC PROJECT NUMBER: 135954.002
CLIENT PROJECT NUMBER: NA
DRAWING NUMBER: NA
SHEET NUMBER:

NOTES:

1. REFER TO "SITE PLAN" FOR GENERAL LEGEND.
2. REFER TO FIGURE C-1 "RA-1 CONCEPTUAL SITE PLAN" FOR NOTES REGARDING BUILDING DEMOLITION, MANAGEMENT OF SPDES LAGOON, AND ROD-REQUIRED REMEDIAL ACTIONS.

SOURCE:

REFER TO "SITE PLAN"

RA LEGEND:

RA AREA

CONCEPTUAL EXCAVATION LIMITS
(RESIDENTIAL-USE SCOs: 0.81 mg/kg MERCURY, 1 mg/kg PCBs, 2.9 mg/kg BENZENE)

APPROXIMATE EXCAVATION DEPTH: 2-8 FT BGS

APPROXIMATE EXCAVATION VOLUME: 168,000 CY (TOTAL), 91,000 CY (TREATMENT/DISPOSAL)

0 80 160
SCALE IN FEET

Brown AND Caldwell
ASSOCIATES
UPPER SADDLE RIVER, NEW JERSEY

SUBMITTED: ADAM SHERMAN, PROJECT MANAGER DATE: 3/09

APPROVED: JEFF CAPUTI, BROWN AND CALDWELL DATE: 3/09

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED:
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CHECKED:
CHECKED:
APPROVED:

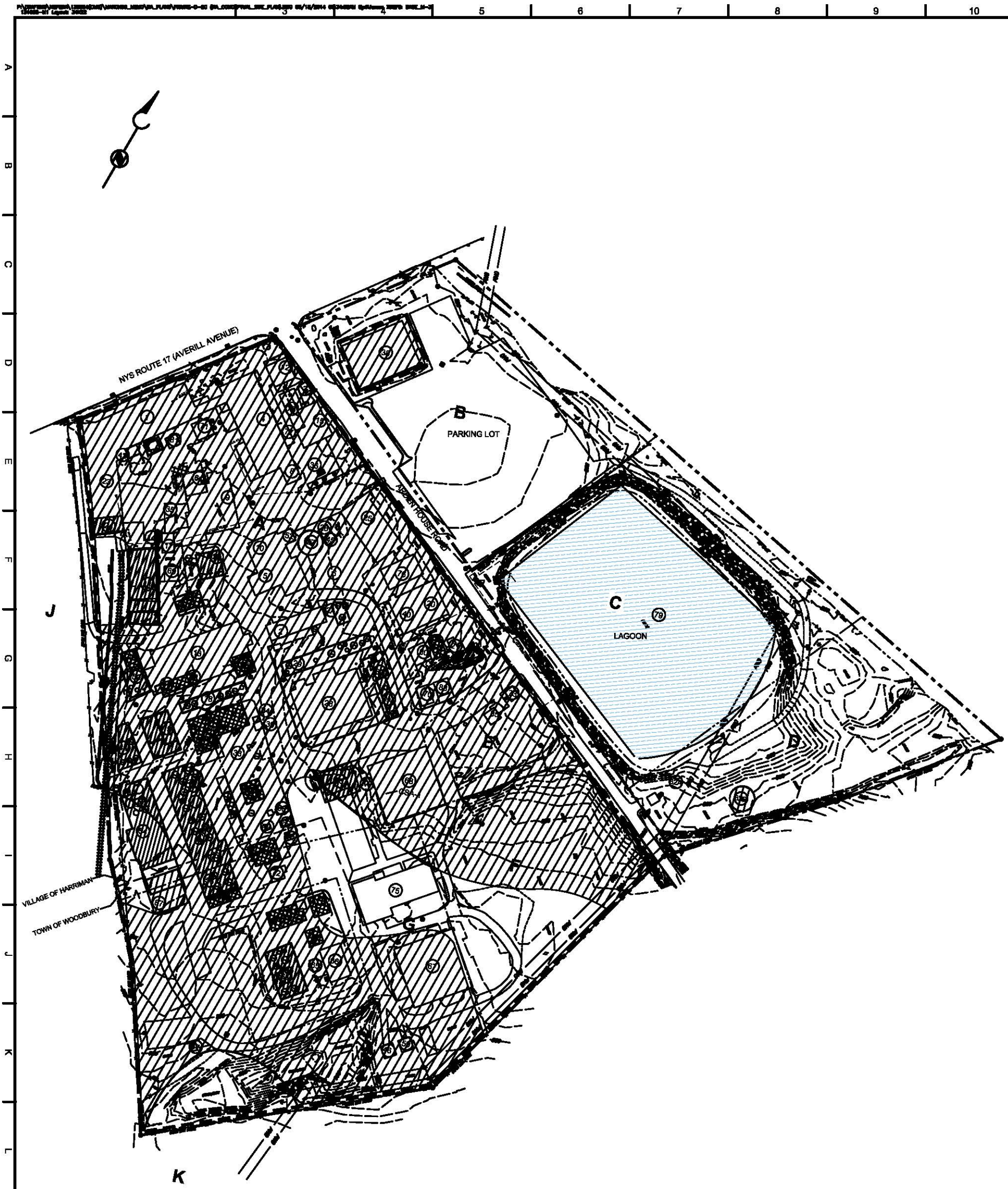
REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

FIGURE - D-2b

RA - 2b CONCEPTUAL SITE PLAN
EXCAVATION (RESIDENTAL-USE SCOs) AND OFF-SITE TREATMENT AND/OR DISPOSAL

FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

FILENAME: FIGURE D-2b
BC PROJECT NUMBER: 135954.002
CLIENT PROJECT NUMBER: NA
DRAWING NUMBER: NA
SHEET NUMBER:



NOTES:

1. REFER TO "SITE PLAN" FOR GENERAL LEGEND.
2. REFER TO FIGURE C-1 "RA-1 CONCEPTUAL SITE PLAN" FOR NOTES REGARDING BUILDING DEMOLITION, MANAGEMENT OF SPDES LAGOON, AND ROD-REQUIRED REMEDIAL ACTIONS.

SOURCE:

REFER TO "SITE PLAN"

RA LEGEND:

RA AREA

CONCEPTUAL EXCAVATION LIMITS
(INDUSTRIAL-USE SCOs: 5.7 mg/kg MERCURY, 25 mg/kg PCBs, 89 mg/kg BENZENE)

APPROXIMATE EXCAVATION DEPTH: 2-8 FT BGS

APPROXIMATE EXCAVATION VOLUME: 122,000 CY (TOTAL), 60,000 CY (TREATMENT/DISPOSAL)

RA-2C WOULD INCLUDE INSTITUTIONAL CONTROLS TO RESTRICT SITE USE AND PLACE LIMITATIONS ON FUTURE CONSTRUCTION ACTIVITIES.

0 60 120
SCALE IN FEET

BROWN AND CALDWELL ASSOCIATES
ALLENDALE, NEW JERSEY

SUBMITTED: ADAM SHERMAN, PROJECT MANAGER DATE: 3/09
APPROVED: JEFF CAPUTI, BROWN AND CALDWELL DATE: 3/09

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)
DESIGNED:
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CHECKED:
CHECKED:
APPROVED:

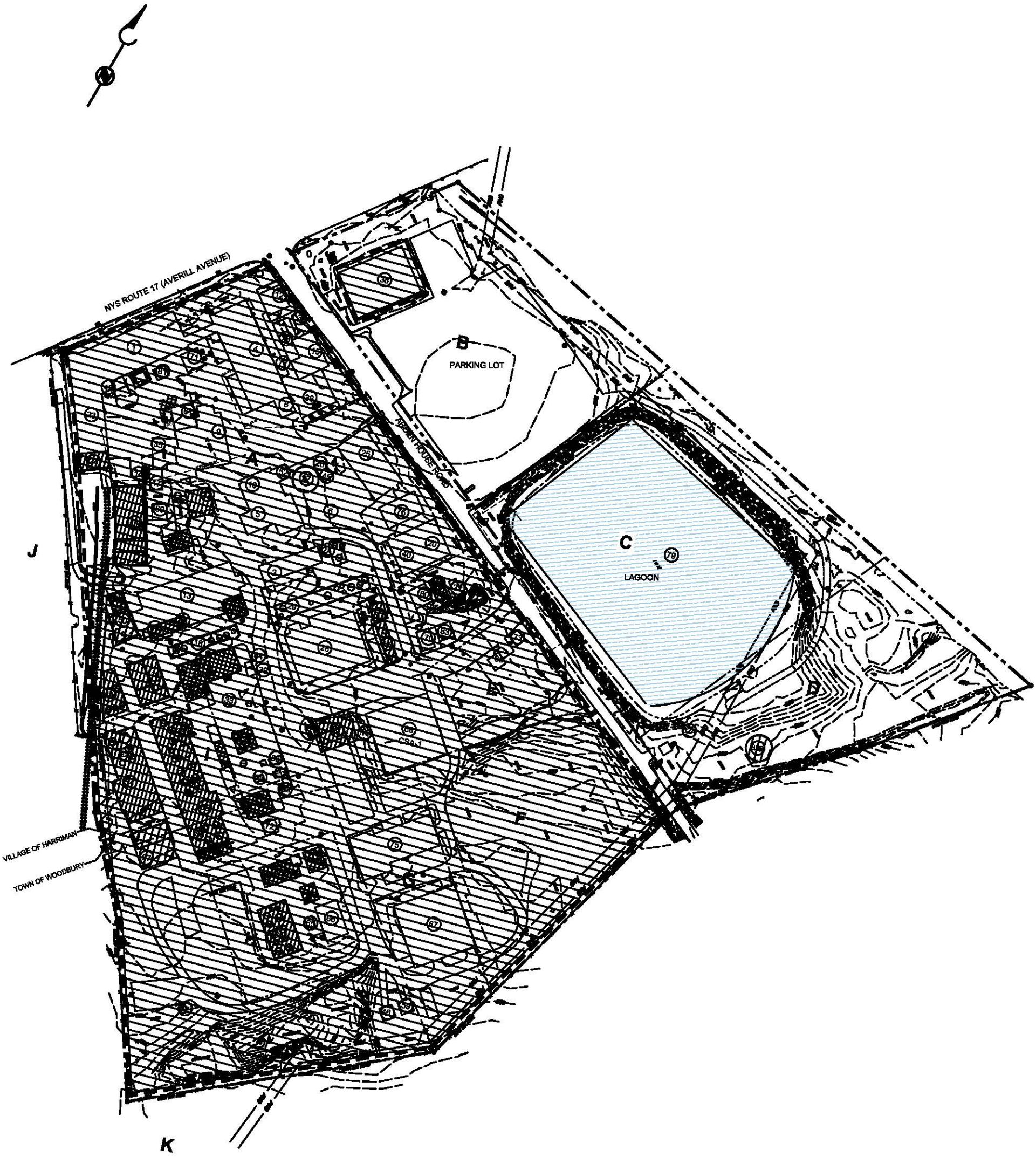
REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

FIGURE - D-2c

RA - 2c CONCEPTUAL SITE PLAN
EXCAVATION (INDUSTRIAL USE SCOs) AND OFF-SITE TREATMENT AND/OR DISPOSAL

FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

FILENAME: FIGURE D-2c
BC PROJECT NUMBER: 135954.002
CLIENT PROJECT NUMBER: NA
DRAWING NUMBER: NA
SHEET NUMBER:



NOTES:

1. REFER TO "SITE PLAN" FOR GENERAL LEGEND.
2. REFER TO FIGURE C-1 "RA-1 CONCEPTUAL SITE PLAN" FOR NOTES REGARDING BUILDING DEMOLITION, MANAGEMENT OF SPDES LAGOON, AND ROD-REQUIRED REMEDIAL ACTIONS.

SOURCE:

REFER TO "SITE PLAN"

0 60 180
SCALE IN FEET

RA LEGEND:

RA AREA

CONCEPTUAL LIMITS OF SITE COVER
(SOIL COVER, ASPHALT, EXISTING ASPHALT/BUILDING SLABS, ETC.)

APPROXIMATE COVER AREA = 17.7 ACRES

1. RA-3 WOULD INCLUDE INSTITUTIONAL CONTROLS TO RESTRICT SITE USE, PLACE LIMITATIONS ON FUTURE CONSTRUCTION ACTIVITIES AND REQUIRE MAINTENANCE OF SITE COVER AS AN ENGINEERING CONTROL.
2. SURFACE SOIL SAMPLING MAY BE PERFORMED PRIOR TO REMEDY IMPLEMENTATION TO REFINE SITE COVER AREA.

Brown AND Caldwell
ASSOCIATES
UPPER SADDLE RIVER, NEW JERSEY

SUBMITTED: ADAM SHERMAN, PROJECT MANAGER DATE: 3/09
APPROVED: JEFF CAPUTI, BROWN AND CALDWELL DATE: 3/09

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)
DESIGNED:
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CHECKED:
CHECKED:
APPROVED:

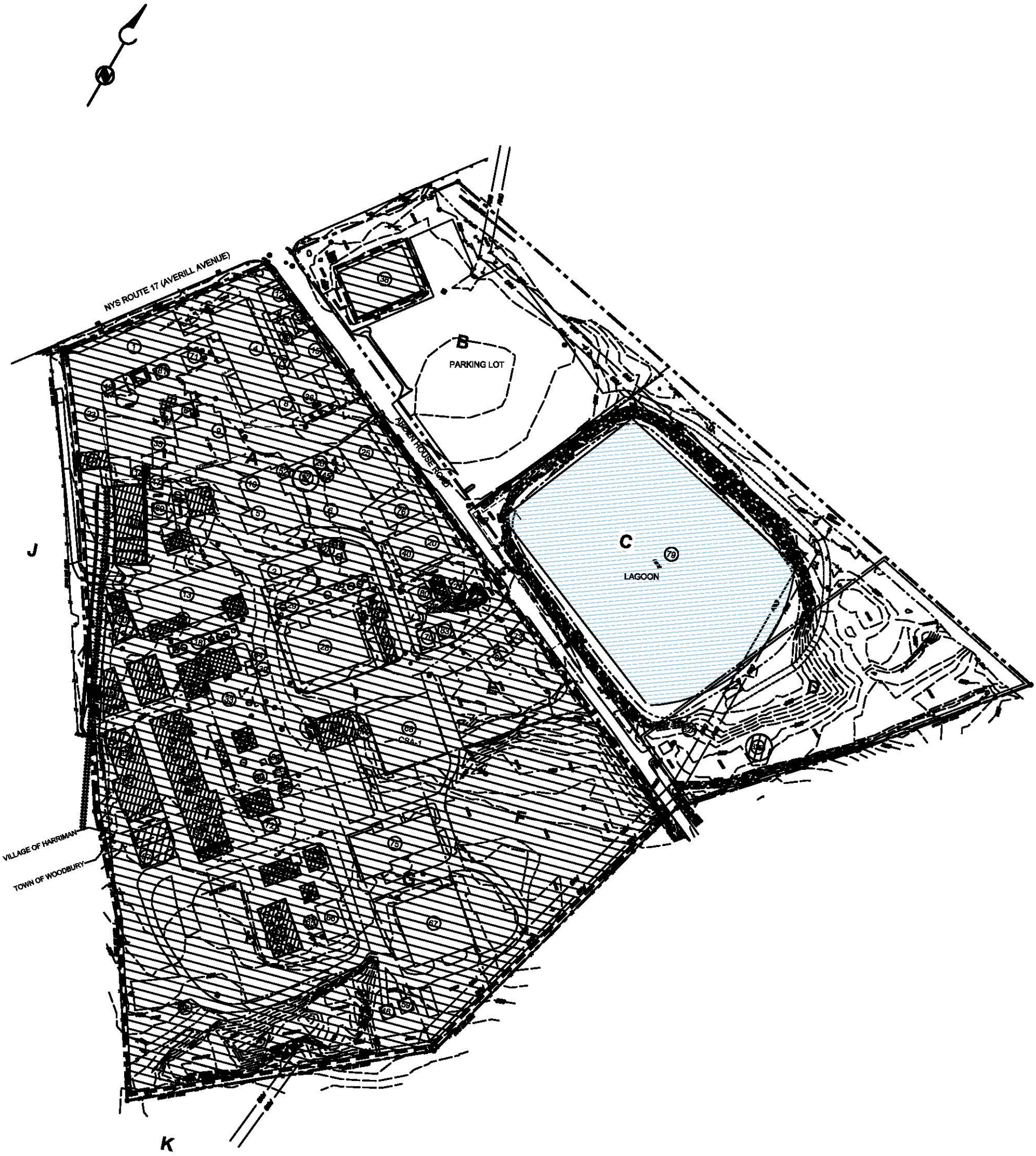
REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

FIGURE - D-3

RA - 3 CONCEPTUAL SITE PLAN
SITE COVER AND INSTITUTIONAL CONTROLS

FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

FILENAME: FIGURE D-3
BC PROJECT NUMBER: 135954.002
CLIENT PROJECT NUMBER: NA
DRAWING NUMBER: NA
SHEET NUMBER:



NOTES:

1. REFER TO "SITE PLAN" FOR GENERAL LEGEND.
2. REFER TO FIGURE C-1 "RA-1 CONCEPTUAL SITE PLAN" FOR NOTES REGARDING BUILDING DEMOLITION, MANAGEMENT OF SPDES LAGOON, AND ROD-REQUIRED REMEDIAL ACTIONS.

SOURCE:

REFER TO "SITE PLAN"

0 60 180
SCALE IN FEET

RA LEGEND:

RA AREA

CONCEPTUAL LIMITS OF SITE COVER (SOIL COVER, ASPHALT, ETC.)

APPROXIMATE COVER AREA = 17.7 ACRES

1. RA-4 WOULD INCLUDE INSTITUTIONAL CONTROLS TO RESTRICT SITE USE,PLACE LIMITATIONS ON FUTURE CONSTRUCTION ACTIVITIES, AND REQUIRE MAINTENANCE OF SITE COVER AS AN ENGINEERING CONTROL.
2. SURFACE SOIL SAMPLING MAY BE PERFORMED PRIOR TO REMEDY IMPLEMENTATION TO REFINE SITE COVER AREA.

Brown AND Caldwell
ASSOCIATES
UPPER SADDLE RIVER, NEW JERSEY

SUBMITTED: ADAM SHERMAN, PROJECT MANAGER DATE: 3/09
APPROVED: JEFF CAPUTI, BROWN AND CALDWELL DATE: 3/09

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)
DESIGNED:
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CHECKED:
CHECKED:
APPROVED:

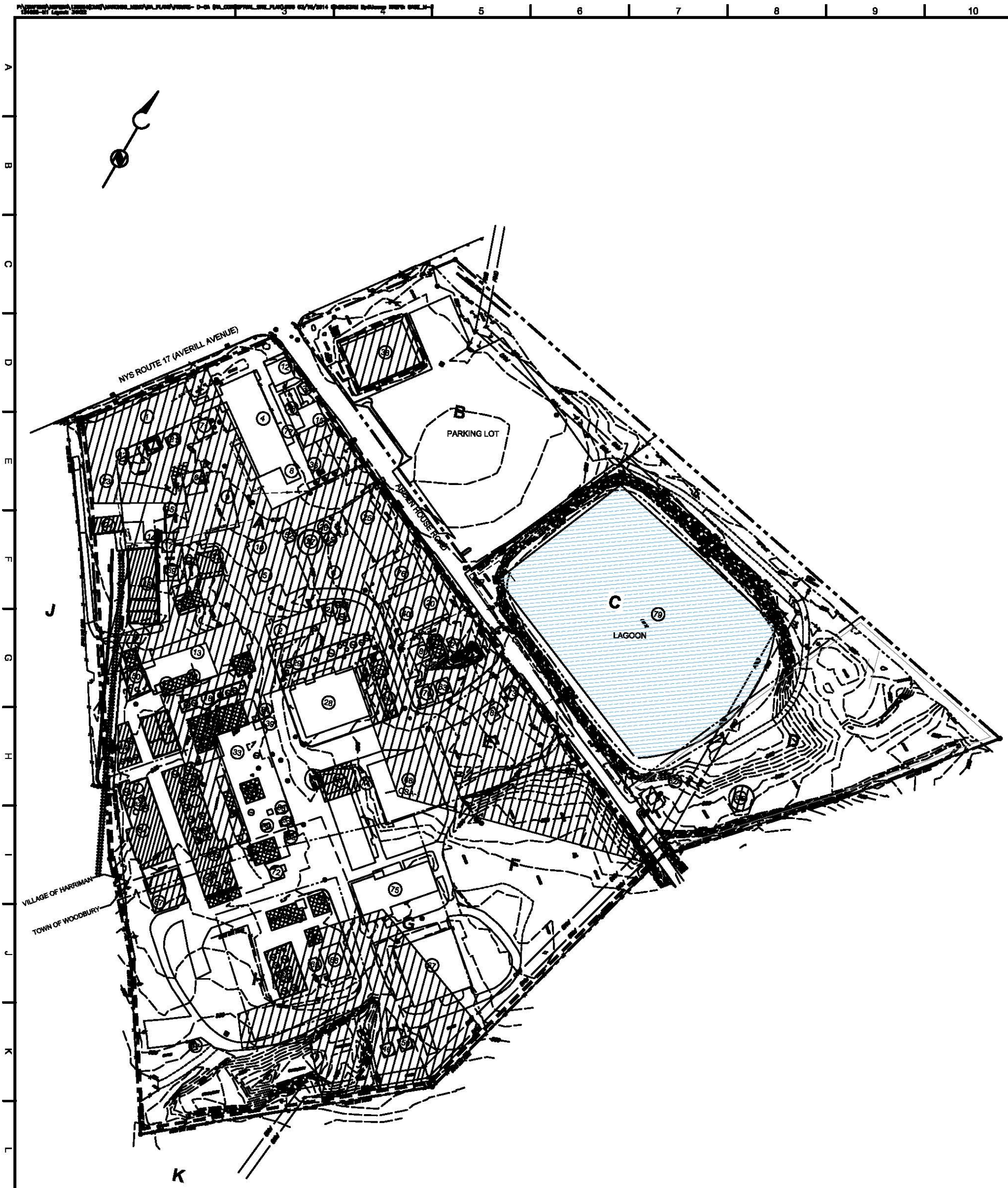
REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

FIGURE - D-4

RA - 4 CONCEPTUAL SITE PLAN
RE-GRADED SITE SURFACE COVER AND INSTITUTIONAL CONTROLS

FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

FILENAME: FIGURE D-4
BC PROJECT NUMBER: 135954.002
CLIENT PROJECT NUMBER: NA
DRAWING NUMBER: NA
SHEET NUMBER:



RA LEGEND:

RA AREA

CONCEPTUAL EXCAVATION LIMITS
(SCOs: 47 mg/kg MERCURY, 25 mg/kg PCBs, 89 mg/kg BENZENE)

APPROXIMATE EXCAVATION DEPTH = 2-8 FT BGS

APPROXIMATE EXCAVATION VOLUME = 71,000 CY (TOTAL), 25,000 CY (TREATMENT/DISPOSAL)

RA-5a WOULD INCLUDE OFF-SITE TREATMENT AND/OR DISPOSAL IN ACCORDANCE WITH APPLICABLE REGULATIONS.

RA-5a WOULD INCLUDE IMPLEMENTATION OF SITE COVER FOLLOWING EXCAVATION. SITE COVER WOULD BE SIMILAR TO RA-3 OR RA-4.

RA-5a WOULD INCLUDE INSTITUTIONAL CONTROLS TO RESTRICT SITE USE, PLACE LIMITATIONS ON FUTURE CONSTRUCTION ACTIVITIES AND REQUIRE MAINTENANCE OF SITE COVER AS AN ENGINEERING CONTROL.

NOTES:

1. REFER TO "SITE PLAN" FOR GENERAL LEGEND.
2. REFER TO FIGURE C-1 "RA-1 CONCEPTUAL SITE PLAN" FOR NOTES REGARDING BUILDING DEMOLITION, MANAGEMENT OF SPDES LAGOON, AND ROD-REQUIRED REMEDIAL ACTIONS.

SOURCE:

REFER TO "SITE PLAN"

0 80 160
SCALE IN FEET

Brown AND Caldwell
ASSOCIATES
UPPER SADDLE RIVER, NEW JERSEY

SUBMITTED: ADAM SHERMAN, PROJECT MANAGER DATE: 3/09
APPROVED: JEFF CAPUTI, BROWN AND CALDWELL DATE: 3/09

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED:
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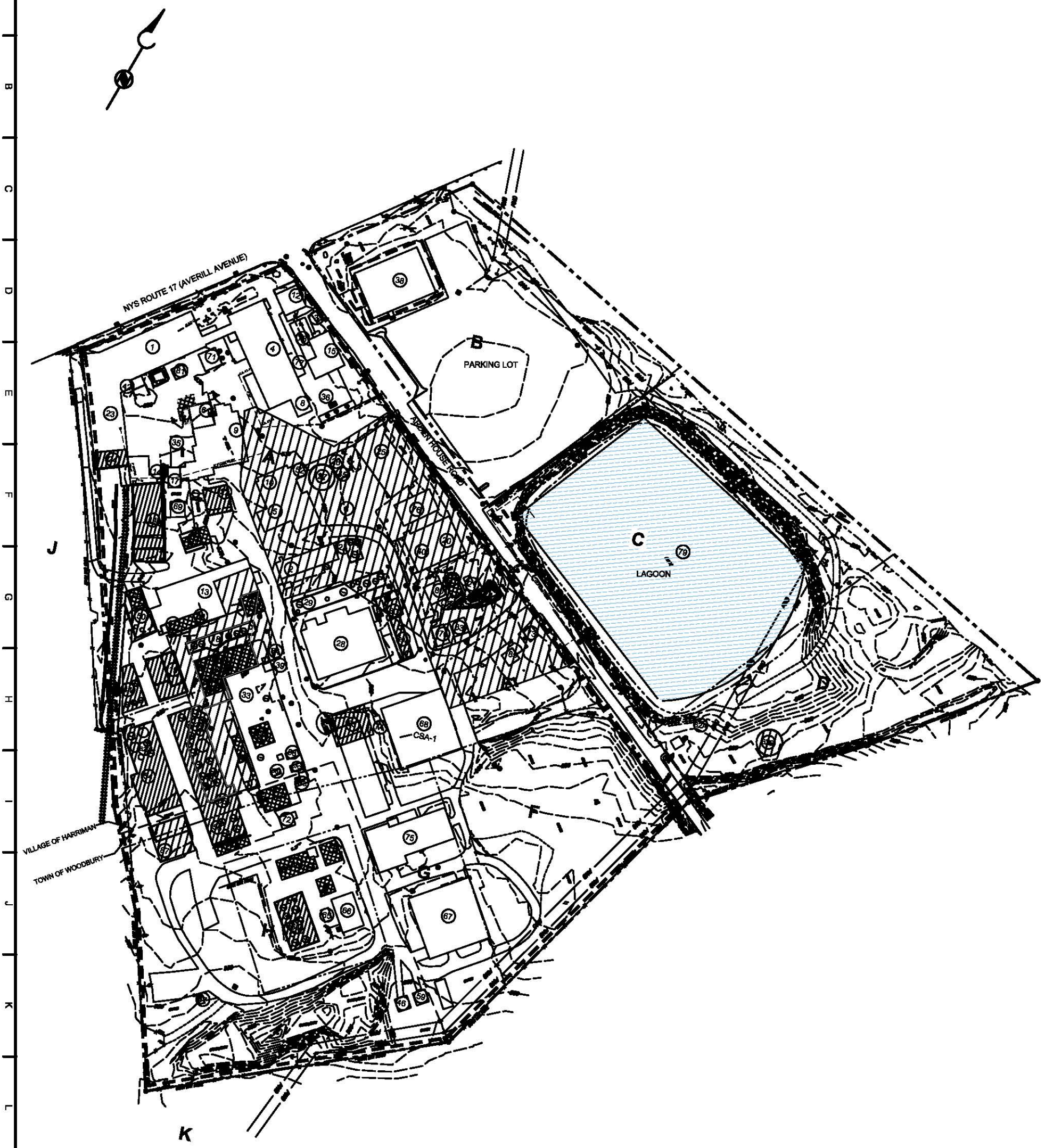
CHECKED:
APPROVED:

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

FIGURE - D-5a
RA-5a CONCEPTUAL SITE PLAN
TARGETED EXCAVATION (ALTERNATE MERCURY SCO 47 mg/kg) AND OFF-SITE TREATMENT/DISPOSAL, SITE COVER, AND INSTITUTIONAL CONTROLS

FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

FILENAME: FIGURE D-5a
BC PROJECT NUMBER: 135954.002
CLIENT PROJECT NUMBER: NA
DRAWING NUMBER: NA
SHEET NUMBER:



RA LEGEND:

- RA AREA
- CONCEPTUAL EXCAVATION LIMITS (SCOs: 220 mg/kg MERCURY, 25 mg/kg PCBs, 89 mg/kg BENZENE)

APPROXIMATE EXCAVATION DEPTH = 2-8 FT BGS

APPROXIMATE EXCAVATION VOLUME = 27,000 CY (TOTAL), 8,000 CY (TREATMENT/DISPOSAL)

RA-5b WOULD INCLUDE OFF-SITE TREATMENT AND/OR DISPOSAL IN ACCORDANCE WITH APPLICABLE REGULATIONS.

RA-5b WOULD INCLUDE IMPLEMENTATION OF SITE COVER FOLLOWING EXCAVATION. SITE COVER WOULD BE SIMILAR TO RA-3 OR RA-4.

RA-5b WOULD INCLUDE INSTITUTIONAL CONTROLS TO RESTRICT SITE USE, PLACE LIMITATIONS ON FUTURE CONSTRUCTION ACTIVITIES AND REQUIRE MAINTENANCE OF SITE COVER AS AN ENGINEERING CONTROL.

NOTES:

1. REFER TO "SITE PLAN" FOR GENERAL LEGEND.
2. REFER TO FIGURE C-1 "RA-1 CONCEPTUAL SITE PLAN" FOR NOTES REGARDING BUILDING DEMOLITION, MANAGEMENT OF SPDES LAGOON, AND ROD-REQUIRED REMEDIAL ACTIONS.

SOURCE:

REFER TO "SITE PLAN"

0 60 180
SCALE IN FEET

Brown AND Caldwell
ASSOCIATES
UPPER SADDLE RIVER, NEW JERSEY

SUBMITTED: ADAM SHERMAN, PROJECT MANAGER DATE: 3/09

APPROVED: JEFF CAPUTI, BROWN AND CALDWELL DATE: 3/09

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

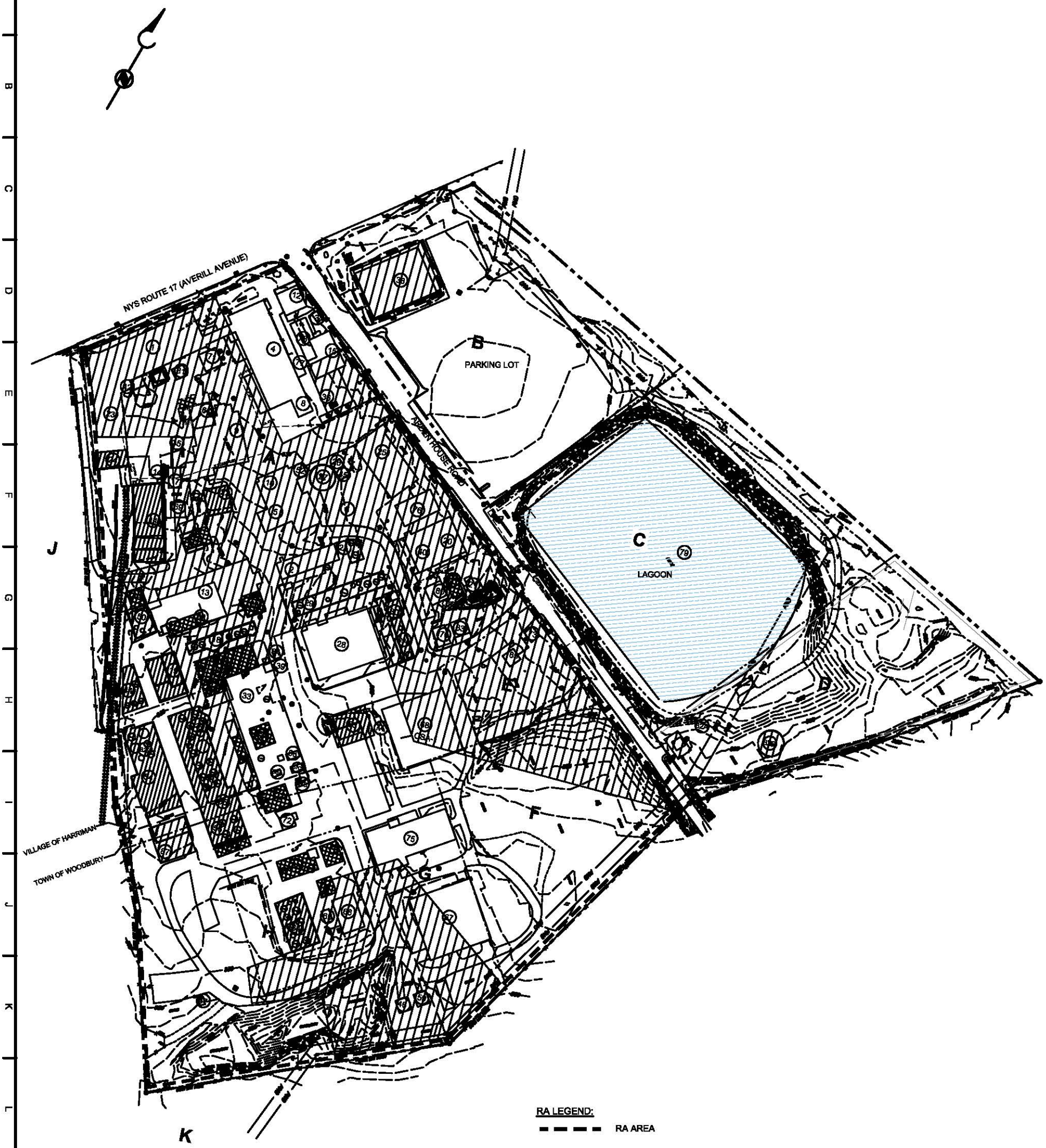
DESIGNED:
DRAWN:
CHECKED:
CHECKED:
APPROVED:

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

FIGURE - D-5b
RA-5b CONCEPTUAL SITE PLAN
TARGETED EXCAVATION (ALTERNATE MERCURY SCO 220 mg/kg) AND OFF-SITE TREATMENT/DISPOSAL, SITE COVER AND INSTITUTIONAL CONTROLS

FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

FILENAME: FIGURE D-5b
BC PROJECT NUMBER: 135954.002
CLIENT PROJECT NUMBER: NA
DRAWING NUMBER: NA
SHEET NUMBER:



RA LEGEND:

RA AREA

CONCEPTUAL EXCAVATION LIMITS
(SCOs: 47 mg/kg MERCURY, 25 mg/kg PCBs, 89 mg/kg BENZENE)

APPROXIMATE EXCAVATION DEPTH = 2-8 FT BGS

APPROXIMATE EXCAVATION VOLUME: 71,000 CY (TOTAL), 25,000 CY (TREATMENT/CONSOLIDATION)

RA-6a WOULD INCLUDE ON-SITE EX SITU TREATMENT AND BACKFILLING WITH TREATED MATERIALS.

RA-6b WOULD INCLUDE ON-SITE CONSOLIDATION OF EXCAVATED MATERIAL IN A CONSTRUCTED WASTE MANAGEMENT UNIT.

RA-6a,b WOULD INCLUDE IMPLEMENTATION OF SITE COVER FOLLOWING EXCAVATION. SITE COVER WOULD BE SIMILAR TO RA-3 OR RA-4.

RA-6a,b WOULD INCLUDE INSTITUTIONAL CONTROLS TO RESTRICT SITE USE, PLACE LIMITATIONS ON FUTURE CONSTRUCTION ACTIVITIES AND REQUIRE MAINTENANCE OF SITE COVER AS AN ENGINEERING CONTROL.

NOTES:

1. REFER TO "SITE PLAN" FOR GENERAL LEGEND.
2. REFER TO FIGURE C-1 "RA-1 CONCEPTUAL SITE PLAN" FOR NOTES REGARDING BUILDING DEMOLITION, MANAGEMENT OF SPDES LAGOON, AND ROD-REQUIRED REMEDIAL ACTIONS.

SOURCE:

REFER TO "SITE PLAN"

0 60 180
SCALE IN FEET

Brown AND Caldwell
ASSOCIATES
UPPER SADDLE RIVER, NEW JERSEY

SUBMITTED: ADAM SHERMAN, PROJECT MANAGER DATE: 3/09

APPROVED: JEFF CAPUTI, BROWN AND CALDWELL DATE: 3/09

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

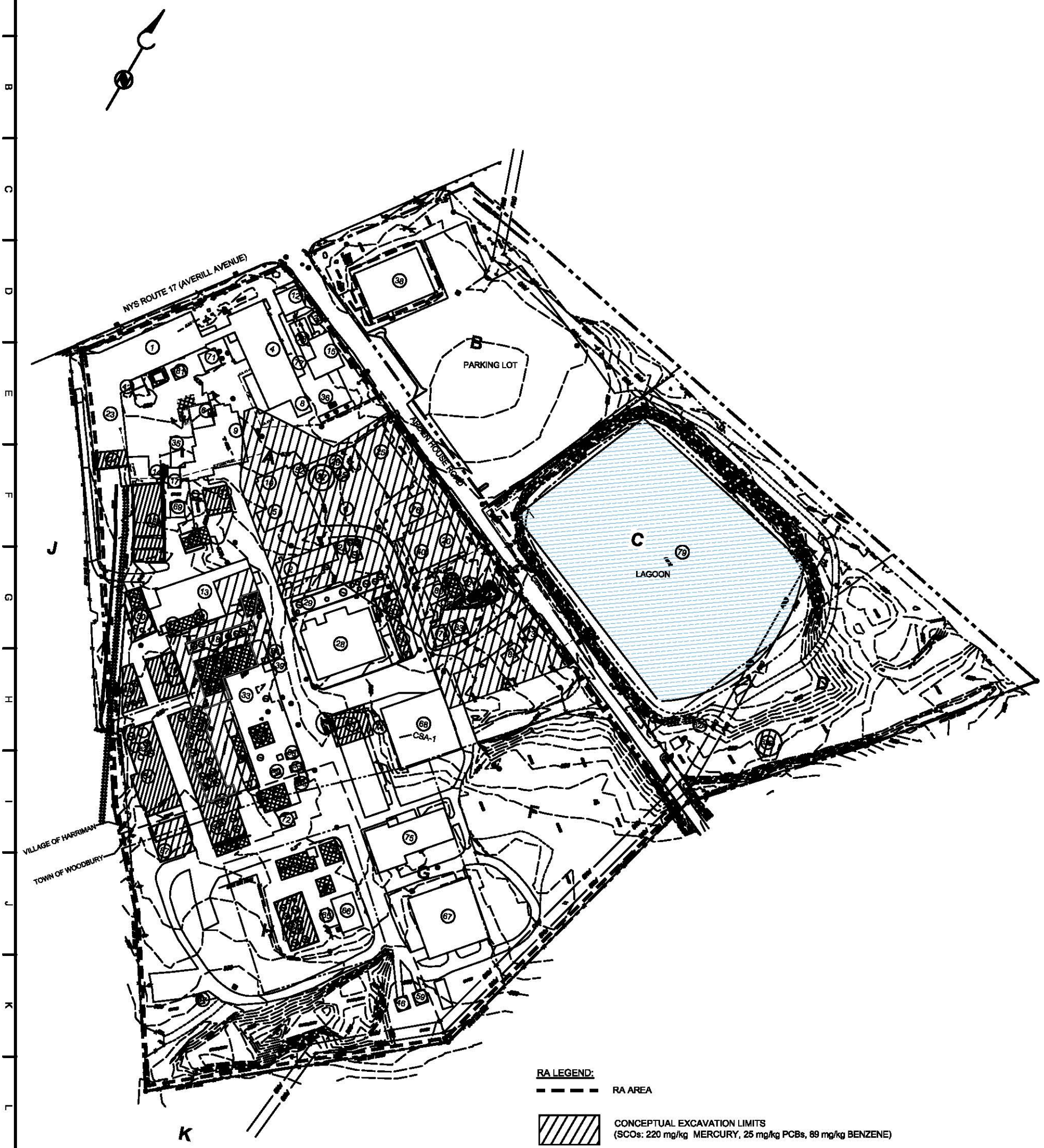
DESIGNED:
DRAWN:
CHECKED:
CHECKED:
APPROVED:

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

FIGURE - D-6a,b
RA-6a,b CONCEPTUAL SITE PLAN
TARGETED EXCAVATION (ALTERNATE MERCURY SCO 47 mg/kg) AND ON-SITE TREATMENT/CONSOLIDATION, SITE COVER, AND INSTITUTIONAL CONTROLS

FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

FILENAME: FIGURE D-6a,b
BC PROJECT NUMBER: 135954.002
CLIENT PROJECT NUMBER: NA
DRAWING NUMBER: NA
SHEET NUMBER:



NOTES:

1. REFER TO "SITE PLAN" FOR GENERAL LEGEND.
2. REFER TO FIGURE C-1 "RA-1 CONCEPTUAL SITE PLAN" FOR NOTES REGARDING BUILDING DEMOLITION, MANAGEMENT OF SPDES LAGOON, AND ROD-REQUIRED REMEDIAL ACTIONS.

SOURCE:

REFER TO "SITE PLAN"

0 80 160
SCALE IN FEET

Brown AND Caldwell
ASSOCIATES
UPPER SADDLE RIVER, NEW JERSEY

SUBMITTED: ADAM SHERMAN, PROJECT MANAGER DATE: 3/09
APPROVED: JEFF CAPUTI, BROWN AND CALDWELL DATE: 3/09

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)
DESIGNED:
DRAWN:
CHECKED:
CHECKED:
APPROVED:

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

FIGURE - D-6c,d
RA-6c,d CONCEPTUAL SITE PLAN
TARGETED EXCAVATION (ALTERNATE MERCURY SCO 220 mg/kg) AND ON-SITE TREATMENT/CONSOLIDATION, SITE COVER AND INSTITUTIONAL CONTROLS
FORMER NEPERA PLANT SITE
HARRIMAN, NEW YORK

FILENAME: FIGURE D-6c,d
BC PROJECT NUMBER: 135954.002
CLIENT PROJECT NUMBER: NA
DRAWING NUMBER: NA
SHEET NUMBER:

Appendix E: Photoionization Detector Procedures

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Technical Memorandum

Standard Operating Procedures
Soil Sampling

Table of Contents

Section 1: Objectives

The objective of this standard operating procedure (SOP) is to provide the methods to be used for the proper sampling of soils for environmental investigations and to provide standardized reporting formats for documentation of data. A further objective is to provide a detailed technical resource that can be used both for preparing detailed field sampling plans and for training. These methods are intended to be both technically and legally defensible while embracing a common sense approach. Furthermore, these methods attempt to address soil sample collection under a wide variety of physical and regulatory conditions.

Section 2: Applicability

This procedure is intended for use by Brown and Caldwell for the sampling of surficial and subsurface soils and associated documentation as part of an environmental investigation. This procedure is also intended for obtaining representative samples of stockpiled materials intended for off-site disposal or importation as backfill or cover material. Specific sampling methods and procedures depend on project specific objectives and subsurface conditions and should be discussed in project specific planning documents.

2.1 Health and Safety

Potential physical and chemical hazards will need to be addressed when planning soil sampling activities. A health and safety plan that addresses known and anticipated field conditions must be prepared prior to field work and be followed during soil sampling.

Section 3: Responsibilities

The project manager is responsible for ensuring that the project involving soil sampling is properly planned and executed and that the safety of personnel from chemical and physical hazards associated with the sampling is provided for. The field staff is responsible for conducting the sampling and to ensure that the project specifications defined in the project-specific planning documents are followed and that pertinent data are recorded on appropriate forms and in the field notebook. The site safety officer, typically the field geologist or engineer, is responsible for overseeing the health and safety of Brown and Caldwell employees and for stopping work if necessary to fix unsafe conditions observed in the field.

Section 4: Required Materials

Many materials are required for successfully completing a soil sampling event. The field personnel should be aware of what is required to conduct the work in accordance with the project specific sampling plan and have all required materials available and in working order prior to the beginning of the sampling. The following is a general list of materials that are needed for performing the tasks outlined in this SOP.

- Health and Safety supplies (e.g., steel toed boots, gloves, hard hat, hearing protection, etc.)
- Soil sampling equipment such as scoops, hand augers, trowels, rulers, plastic bags, driller jars, aluminum foil, etc., in accordance with the project specific goals and procedures
- Soil screening equipment such as a Photo-ionization detector (PID) in accordance with the project specific goals and procedures
- Analytical sample containers
- Decontamination Supplies

- Logbook
- Site Map
- General tools

Section 5: Procedure

5.1 Introduction

5.1.1 Preparatory Office Activities

Physical aspects of the sampling program will be organized in the office prior to embarking on a field sampling project. The time spent in the field is very valuable and should be spent on sample collection, making field measurements and recording data and not on the organization of equipment and containers.

- **Sampling Sequence** - The sequence of sampling will be pre determined on the basis of existing soil quality data if available. Generally, the least sample locations will be sampled first, proceeding to the progressively more contaminated sample locations.

5.1.2 Preparatory Field Activities

The following procedures will be conducted in the field prior to soil sampling.

- **Tailgate Meeting and Rig Maintenance Check** – The field team, including the drilling subcontractor if applicable, will go over the work plan and potential hazards that may be encountered to ensure that all work is performed to project specifications and in a safe manner. In addition, if drilling equipment is being used the drilling subcontractor will inspect it and make sure it is in safe working order prior to the beginning of sampling activities.
- **Preparation of Work Area** - A suitable work area will be established around the perimeter of the sample locations. This will provide a clean surface on which sampling equipment can be placed such that it will not become inadvertently contaminated. This work area may be prepared by placing new polyethylene (PE) sheeting on the ground around the well, taking care not to step on it. Alternatives can include the placement of a clean PE lined trash can or a clean PE covered table adjacent to the sampling location.

5.2 Soil Sampling

5.2.1 Collection of Sub-Surface Soil Samples from Soil Borings

Soil borings may be advanced using a variety of techniques such as direct-push techniques, hollow-stem auger drilling methods, and/or fluid-rotary methods, depending on the site logistics and the sampling objectives at a given area of concern. The final decision to change drilling methods will be based on the drilling contractor's and environmental consultant's experience with concurrence with the governing agency. Soil samples will be collected from the borings using split- barrel samplers (auger or wet-/mud-rotary methods) or macro-core samplers with dedicated acetate liners (direct-push rig). Samples from each barrel/sampler will be screened in the field using a PID and readings for each sample interval will be recorded on a field log book. Soil samples will be observed for physical properties such as color, sorting, etc. The grain size of the sampled soils will be visually characterized in the field by an experienced hydrogeologist and logged in accordance with a system after Burmister (1959). In addition, the Burmister classification will be converted to the Unified Soil Classification System (USCS) on the final boring log. Upon completion of drilling, a boring log will be prepared by the hydrogeologist that contains specific details regarding the drilling or monitoring well procedure, a description of the encountered subsurface materials, any information obtained from field readings (PID, etc.) and observations regarding evidence of contamination (i.e.,

discoloration, odor, etc.), and a drawing of record of the completed monitoring well. Analytical samples will be removed from the split spoon or acetate liner and placed in a clean, decontaminated stainless steel mixing bowl to be homogenized. Homogenization of the soil ensures are all completed sample containers will have an equally representative sample of the targeted soil interval. Following homogenization of the soil the samples will be placed in the laboratory prepared sample containers using only clean decontaminated tools, for example an unused plastic spoon. VOC sample containers will be collected first to ensure that volatilization of the targeted analytes does not occur. Once collected the samples will be stored and shipped in a manner consistent with the presiding regulatory authorities' guidance and regulations. All sample material not used for analytical samples or reserved for later lithologic analysis will be combined with the other investigation derived soil wastes.

5.2.2 Collection of Surficial Soil Samples

Before collecting a surficial soil sample (0-6 inches below the ground surface or 0-12 inches below the ground surface) the sample location will be carefully cleared by removing any vegetation layers, surface debris, or upper one centimeter of soil surface, as applicable. The soil samples will be collected using decontaminated stainless-steel scoops, hand augers, trowels, or equivalent tools. The collection of surface samples for VOCs will be conducted using an Encore™ Sampler in accordance with agency requirements. The sampling device is inserted into a freshly exposed soil surface (ground surface or soil core sampler). The 5-gram plug of soil is then capped and sent to the laboratory where it will be preserved, extracted and analyzed. To satisfy the volume requirements of multiple bottle sets, surface soil samples (other than those collected for VOCs using the Encore™ sampler) will be homogenized either in situ or in a decontaminated stainless steel mixing bowl or tray before being transferred to bottles. A description of the soil data (e.g., soil description, location, time, etc.) will be recorded in the project field book as described in Section 5.2.1.

5.2.3 Collection of Stockpile Samples

An important objective of any stockpile sampling is to obtain samples that are representative of the entire stockpile. Thus, in addition to observing sampling frequencies required by the work plan or other document, it is important to locate samples at various points on and around the stockpile, and to obtain the samples from below the surface of the stockpile (e.g., by spade or similar device). The locations and depths of the samples, whether they will be analyzed individually or composited, should be recorded by in the field log.

Stockpile samples will be collected using decontaminated stainless-steel scoops, hand augers, trowels, or equivalent tools. The collection of surface samples for VOCs will be conducted using an Encore™ Sampler in accordance with agency requirements. The sampling device is inserted into a freshly exposed soil surface of the stockpile. The 5-gram plug of soil is then capped and sent to the laboratory where it will be preserved, extracted and analyzed. To satisfy the volume requirements of multiple bottle sets, stockpile samples (other than those collected for VOCs using the Encore™ sampler) will be homogenized in a decontaminated stainless steel mixing bowl or tray before being transferred to bottles. A description of the soil data (e.g., soil description, location, time, etc.) will be recorded in the project field book as described in Section 5.2.1.

Section 6: Quality Assurance/Quality Control

Soil sampling details will be documented in detail in the field. Field documentation will consist of a sampling chronology and notes in the site field book, including the field descriptions of each sample interval and laboratory chains of custody. The field sample descriptions should include, at a minimum, the following:

- Location/boring identification
- Depth interval
- Sample Recovery

- PID, OVA or other relevant screening results
- Blow counts of Standard Penetration Test (SPT) if applicable
- Physical description of the sample including Burmister soil description, moisture, observations of impacts and anything else of note

Deviations from project-specific planning documents will be documented and explained in daily field notes. The program manager will be contacted to discuss project deviations. Field quality control can be maintained through 1) making sure employees are properly trained to conduct the work being implemented, and 2) performing routine field audits to evaluate how well employees are following procedures.

Section 7: Documentation and Recordkeeping

Field notes, Chains-of-Custody, and Health and Safety forms will be submitted to the Project Manager or designate immediately following the field event for checking and revision purposes. The Project Manager or designate shall review and transmit the completed forms for incorporation into the project file.

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Technical Memorandum

Standard Operating Procedures
Surface Water and Sediment Sampling

Table of Contents

Section 1: Objectives

The objective of this standard operating procedure (SOP) is to provide the methods to be used for the proper sampling of sediment for environmental investigations and to provide standardized reporting formats for documentation of data. A further objective is to provide a detailed technical resource that can be used both for preparing detailed field sampling plans and for training. These methods are intended to be both technically and legally defensible while embracing a common sense approach. Furthermore, these methods attempt to address sample collection under a wide variety of physical and regulatory conditions.

Section 2: Applicability

This procedure is intended for use by Brown and Caldwell for the sampling of sediment, and associated documentation as part of an environmental investigation. Specific sampling methods and procedures depend on project specific objectives and site conditions and should be discussed in project specific planning documents, e.g., Work Plans.

2.1 Limitations

This SOP does not address the health and safety concerns associated with the methods described herein, which may involve use of hazardous materials, equipment, and operations. Accordingly, the user must establish appropriate health and safety practices according to the site specific Health and Safety Plan (HASP).

Nothing in this SOP is intended to contradict applicable contractual and/or regulatory requirements.

Section 3: Responsibilities

The project manager is responsible for proper planning and execution of the surface water and sediment sampling project. The field staff is responsible for conducting and documenting the sampling in compliance with the project-specific planning documents. The site safety officer, typically the field scientist or engineer, is responsible for overseeing the health and safety of Brown and Caldwell employees and for stopping work if necessary to fix unsafe conditions observed in the field.

Section 4: Required Materials

Many materials are required for successfully completing a surface water and sediment sampling event. The field personnel should be aware of what is required to conduct the work in accordance with the project specific sampling plan and have required materials available and in working order prior to the beginning of the sampling. The following is a general list of materials that are needed for performing the tasks outlined in this SOP.

- Project documentation, including Work Plan, SOPs, Health and Safety Plan
- Logbook and other forms
- Health and Safety supplies (e.g., steel toed boots, gloves, hard hat, hearing protection, personal flotation devices, etc.)
- Surface water and sediment sampling equipment, as appropriate, to collect the samples at the appropriate depth in accordance with the project specific goals and procedures. See commentary in 5.2 regarding the advisability of multiple sediment sampling tools.
- Analytical sample containers – provided by the analytical laboratory
- Decontamination Supplies

- Site Map
- General tools

Section 5: Procedure

5.1 Introduction

5.1.1 Preparatory Office Activities

Physical aspects of the sampling program will be organized in the office prior to embarking on a field sampling project. The time spent in the field is very valuable and should be spent on sample collection, making field measurements and recording data and not on the organization of equipment and containers

- **Sampling Sequence** - The sequence of sampling will be pre determined on the basis of existing site conditions if available. Generally, surface water samples are collected prior to sediment samples, taking care not to disturb bottom sediments. In a stream environment, samples will be collected in a downstream-to-upstream sequence, to avoid spreading disturbed sediment to unsampled locations.

5.1.2 Preparatory Field Activities

The following procedures will be conducted in the field prior to sampling.

- **Tailgate Meeting and Equipment Maintenance Check** - The field team will review the work plan and potential hazards that may be encountered so that the work is performed to project requirements and in a safe manner. In addition, if boating equipment is being used the team will inspect it and make sure it is in safe working order prior to the beginning of sampling activities.
- **Preparation of Work Area** - A suitable work area will be established in proximity to the sample locations. This will provide a clean surface on which sampling equipment can be placed such that it will not become inadvertently contaminated. This work area may be prepared by placing new polyethylene (PE) sheeting on the ground, taking care not to step on it. Alternatives can include the placement of a clean PE lined trash can or a clean PE covered table adjacent to the sampling location.

5.2 Sediment Sampling

Sediment samples will generally be collected in a "downstream" to "upstream" direction to minimize the chance of spreading disturbed sediment to unsampled locations.

The depth(s)) of the sediment samples from the water-sediment interface will be pre-determined and documented in the project-specific document. The depths of sampling and nature of sediment characteristics will dictate the type(s) of sampling equipment that will be required. For example, using a coring device or a petit ponar dredge.

Collection of vertical depth interval sediment samples can present a challenge dependent on the sediment characteristics, e.g., grain size, plasticity, water depth, etc. Therefore, consideration should be given to bringing multiple types of sediment sampling apparatus into the field to maximize the chances for successful sample collection.

5.2.1 Collection of Sediment Samples

The procedures for collecting surface and subsurface sediment samples for analytical and physical parameters are provided below. Based on stream characteristics and logistics, a hand corer (or equivalent device) is selected as the default sampling method for sampling sediment because this method can be used to collect a relatively undisturbed sample that shows a profile of stratification. The procedure to collect a sample using a hand corer is described below.

1. Record the sample location on a site map and in the field logbook.
2. Decontaminate stainless steel sampling equipment.
3. Don a clean pair of latex gloves.
4. Push core tube into the surface of sediment.
5. Measure length of core tube above surface of water
6. Manually push or hammer the core tube into the sediment to the target depth.
7. Fill core tube with water (to remove air above sediment-water interface) and cap top of core tube.
8. Pull core tube out of sediment, as bottom tube breaks water surface, cap bottom of core.
9. Measure the sediment in the core tube to determine depth of penetration and recovery.
10. Transfer (using a decontaminated spoon) each selected depth interval of sediment into separate stainless steel bowls.
11. Decontaminate stainless steel sampling equipment.

Repeat the steps for pushing and retrieving the core tube to obtain a sufficient quantity of sediment for chemical and physical analyses. Sediment samples may also be collected using decontaminated stainless steel sampling scoops, trowels, or petit Ponar samplers. The following steps will be performed once the sample is collected:

- Label the sampling jars.
- Homogenize sediment from each depth interval and transfer the sediment into appropriate sample containers using the decontaminated spoon. Note that sample aliquots for VOC analysis will be placed directly into the sample container without homogenization.
- Store and document sample.
- Mark sampling location with a buoy, stake, or other indicator for subsequent surveying of sample locations.
- Sampling equipment shall be decontaminated after the collection of each sample.
- Record appropriate data (including sampling location, sampling depth, time of sampling, and description of sample) in field logbook, as described in Section 5.2.1.

Section 6: Quality Assurance/ Quality Control

Surface water and sediment sampling details will be documented in detail in the field. Field documentation will consist of a sampling chronology and notes in the site field book, including the field descriptions of each sample location and laboratory chains of custody. The field sample descriptions should include, at a minimum, the following:

- Location identification
- Physical description of the sample including sediment description, moisture content, and other observations of note

Deviations from project-specific planning documents will be documented and explained in daily field notes. The program manager will be contacted to discuss project deviations. Field quality control can be maintained through 1) making sure employees are properly trained to conduct the work being implemented, and 2) performing routine field audits to evaluate how well employees are following procedures.

Section 7: Documentation and Recordkeeping

Field notes, Chains-of-Custody, and Health and Safety forms will be submitted to the Project Manager or designate immediately following the field event for checking and revision purposes. The Project Manager or designate shall review and transmit the completed forms for incorporation into the project file.

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Technical Memorandum

Standard Operating Procedures
Soil Vapor Sampling

Table of Contents

Section 1: Objectives

The objective of this standard operating procedure (SOP) is to provide the methods to be used for the proper sampling of soil vapor for volatile organic compounds (VOCs) and to provide standardized reporting formats for documentation of data. A further objective is to provide a detailed technical resource that can be used both for preparing detailed field sampling plans and for training. These methods are intended to be both technically and legally defensible while embracing a common sense approach. Furthermore, these methods attempt to address sample collection under a wide variety of physical and regulatory conditions.

Section 2: Applicability

This procedure is intended for use by Brown and Caldwell for the sampling of soil vapor for VOCs, and associated documentation as part of an environmental investigation. Specific sampling methods and procedures depend on project specific objectives and subsurface conditions and should be discussed in project specific planning documents, e.g., Work Plans.

2.1 Limitations

This SOP does not address the health and safety concerns associated with the methods described herein, which may involve use of hazardous materials, equipment, and operations. Accordingly, the user must establish appropriate health and safety practices according to the site specific Health and Safety Plan (HASP).

This SOP does not address the issues associated with underground and overhead utility lines. Accordingly, the user must establish the presence, location, and types of utility lines in accordance with legal requirements and also the project-specific planning document, e.g., Work Plan.

Nothing in this SOP is intended to contradict applicable contractual and/or regulatory requirements.

Section 3: Responsibilities

The project manager is responsible for proper planning and execution of the soil vapor sampling project. The field staff is responsible for conducting and documenting the sampling in compliance with the project-specific planning documents. The site safety officer, typically the field geologist or engineer, is responsible for overseeing the health and safety of Brown and Caldwell employees and for stopping work if necessary to fix unsafe conditions observed in the field.

Section 4: Required Materials

Many materials are required for successfully completing a soil vapor sampling event. The field personnel should be aware of what is required to conduct the work in accordance with the project specific sampling plan and have the required materials available and in working order prior to the beginning of the sampling. The following is a general list of materials that are needed for performing the tasks outlined in this SOP.

Field Geologist or Engineer

- Project documentation, including Work Plan, SOPs, Health and Safety Plan
- Logbook and other forms
- Health and Safety supplies (e.g., steel toed boots, gloves, hard hat, hearing protection, etc.)
- Soil vapor sampling equipment such as Teflon lined tubing, air pump, etc., in accordance with the project specific goals and procedures
- Soil screening equipment such as a Photo-ionization detector (PID) in accordance with the project specific goals and procedures

- A soil vapor sample collection apparatus, assembled by field personnel according to Section 5.2.2 below.
- Analytical sample containers (Summa Canisters) – provided by the analytical laboratory
- Site Map
- General Tools

Direct-Push Drilling Contractor

- Direct-push drilling equipment, including drill rig, support trucks, potable water storage tanks, drilling tools, generators, compressors, pressure washers, etc.
- Sample collection tools and expendable supplies.
- Copies of drilling and vehicle operation licenses, health and safety records, etc. for working on site.
- General tools.

Section 5: Procedure

5.1 Introduction

5.1.1 Preparatory Office Activities

Physical aspects of the sampling program will be organized in the office prior to embarking on a field sampling project. The time spent in the field is very valuable and should be spent on sample collection, making field measurements and recording data and not on the organization of equipment and containers.

- **Sampling Sequence** - The sequence of sampling will be pre determined on the basis of existing soil quality data if available. Generally, the least contaminated sample locations will be sampled first, proceeding to the progressively more contaminated sample locations.

5.1.2 Preparatory Field Activities

The following procedures will be conducted in the field prior to soil sampling.

- **Tailgate Meeting and Rig Maintenance Check** – The field team, including the drilling subcontractor if applicable, will review the work plan and potential hazards that may be encountered so that the work is performed to project requirements and in a safe manner. In addition, if drilling equipment is being used the drilling subcontractor will inspect it and make sure it is in safe working order prior to the beginning of sampling activities.
- **Preparation of Work Area** - A suitable work area will be established around the perimeter of the sample locations. This will provide a clean surface on which sampling equipment can be placed such that it will not become inadvertently contaminated. This work area may be prepared by placing new polyethylene (PE) sheeting on the ground around the probe, taking care not to step on it. Alternatives can include the placement of a clean PE lined trash can or a clean PE covered table adjacent to the sampling location.

5.2 Soil Vapor Sampling

5.2.1 Installation of Soil Vapor Probes

Temporary soil vapor probes will be installed for each of the soil vapor sample locations. The soil vapor probes will installed as follows:

- A direct push drill rig (e.g., GeoProbe®) will be used to advance a 1” inch diameter borehole to a depth of 4 feet bgs. The depth may be reduced if the water table is shallower.

- Once the borehole is complete, ¼" diameter teflon-lined polyethylene sample tubing with a temporary vapor implant tip will be inserted into the hole.
- A hydrated bentonite slurry will be placed in the annular space above the filter pack to minimize infiltration of ambient air.
- Upon completion of soil vapor sampling, the soil vapor probes will be abandoned by pulling the temporary tubing out of the ground and backfilling the borehole with a hydrated bentonite slurry.

5.2.2 Collection of Soil Vapor Samples

USEPA method TO-15 utilizes pre-evacuated stainless steel canisters (Summa Canisters) through which soil vapor will be pulled utilizing the canister vacuum. Each canister will be equipped with a flow controller to regulate the intake or air to a predetermined sample interval (2 Hours). The process for collecting the soil vapor samples is as follows.

1. A leak test of the sample line will be conducted by establishing a shroud around the annulus, which will be filled with helium. A measurement of the helium concentration within the shroud will be made using a portable helium detector. Once the concentration of helium within the shroud has been established, soil vapor will be purged through the sample line using a low flow air pump at a rate of no greater than 200 ml/min. The helium concentration of air purging from the pump will be monitored to determine if helium is short-circuiting from the soil surface above the bentonite seal to the sample point. If helium concentrations in the purge are less than 5% of the concentration in the should, the leak test is considered acceptable and sampling will proceed. If helium is shown to be leaking through the annular seal, than further effort will be made to seal the hole and the leak test will be repeated.
2. Following the leak test, the sample tubing will be connected to the summa canister utilizing Swagelok compressing fittings. Duplicate samples will be collected by means of a T-fitting.
3. The valve of the summa canister will be opened and readings of canister pressure, ambient air pressure, ambient air temperature, and sample time will be made.
4. During sampling, canister pressure readings will be made to assure there is no malfunction of the canister or flow controller, and to make sure the negative pressure does not reach zero.
5. At the end of the sample interval, readings of the canister pressure, ambient air pressure, ambient air temperature, and sample time will be made again to note conditions at the end of sampling. The canister valve will be shut, and the sampling apparatus will be dismantled.

Section 6: Quality Assurance/ Quality Control

Soil vapor sampling details will be documented in detail in the field. Field documentation will consist of a sampling chronology and notes in the site field book, including the field descriptions of each sample location and laboratory chains of custody. The field sample descriptions should include, at a minimum, the following:

- Location identification
- PID, OVA or other relevant screening results
- Physical description of the sample location, ambient temperature, air pressure, and other observations of note

Deviations from project-specific planning documents will be documented and explained in daily field notes. The program manager will be contacted to discuss project deviations. Field quality control can be maintained through

- Making sure employees are properly trained to conduct the work being implemented, and
- Performing routine field audits to evaluate how well employees are following procedures.

Section 7: Documentation and Recordkeeping

Copies of field documentation including field notes, Chain-of-Custody forms, and Health and Safety forms will be submitted to the Project Manager or designate immediately following the field event for checking and revision purposes. The Project Manager or designate shall review and transmit the completed forms for incorporation into the project file.

PHOTOIONIZATION DETECTOR PROCEDURES

This Standard Operating Procedure (SOP) describes the use of a Photoionization Detector (PID). A PID is a non-specific vapor/gas detector that uses photoionization to detect various chemical compounds, both organic and inorganic, in air. Since it is nonspecific, it cannot identify substances, it can only roughly quantify them.

The PID site will be equipped with a 10.6 eV lamp. This type of lamp is capable of ionizing and detecting a broad range of volatile organic compounds. More information regarding the use of the PID for monitoring working conditions and determining the appropriateness of personal protection levels can be found in the Site Specific Health and Safety Plan (HASP).

Calibrating:

1. The PID will be calibrated in accordance with the procedures outlined in the owner's manual and the battery will be checked for proper voltage at the beginning of each day before use
2. Before calibrating; the instrument will be allowed to equilibrate with its surroundings temperature for about five minutes
3. The instrument will be turned on and set on measurement mode
4. The calibration result and background readings will be recorded in the field book
5. If the PID shows erratic readings, additional calibration will be performed

Sampling:

1. The acetate liner or split spoon will be opened to access the soil sample
2. Next, "pockets" will be burrowed in the soil with a clean sampling spoon or a gloved hand
3. The probe/tip of the PID will be placed in the pocket and "enclosed" with a gloved cupped hand
4. Conditions will be allowed to stabilize and the reading recorded in the field book
5. The portion of the soil column registering the highest PID reading above background will be collected for laboratory analysis

Because the PID is sensitive to wind, high humidity and moisture, all efforts will be taken to limit the impact of these elements on the soil screening process.

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Technical Memorandum

Standard Operating Procedures
Field Instrument Calibration

Table of Contents

Section 1: Objectives

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

Section 2: Applicability

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

Section 3: Responsibilities

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

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

Section 4: Definitions

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

CGI – Combustible Gas Indicator

DNAPL – Dense Non-aqueous Phase Liquid

LNAPL – Light Non-aqueous Phase Liquid

OVA – Organic Vapor Analyzer

OVM – Organic Vapor Meter

PID – Photo Ionization Detector

FID – Flame Ionization Detector

Section 5: Required Materials

The materials required for this SOP include the following:

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

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

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

Section 6: Procedure

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

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

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

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

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

- Calibrate the instrument prior to field use in accordance with manufacturer's procedures, and if necessary adjust the instrument to meet calibration specifications (this step is sometimes referred to as the initial calibration);
- If instrument malfunctions and can not be corrected, obtain another instrument and have the other repaired (see Section 6 for Corrective Action Procedures);
- Clean and decontaminate the instrument after use, and before storage;
- Conduct calibration verifications at least once per day, or as needed;
- Conduct final calibration verification at the end of each day, or at completion of field measurement collection for the day;
- Document calibration activities and results, and
- Recharge batteries, add carrier gases (if applicable), and regenerate the instrument (if applicable) at the end of each day or as needed. This should be carried out in a non-hazardous area.

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

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

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

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

Personnel responsible for the use of these instruments will read the manufacturer's instruction manual and will be adequately familiar with the use, calibration, and maintenance of the instrument prior to instrument use. The calibration, maintenance and use of these instruments will be conducted in accordance with the manufacturer's specifications and procedures. If instrument calibration cannot be met or if the instrument is malfunctioning, obtain another instrument and repair the malfunctioning instrument immediately (see Section 6 Corrective Action).

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

Section 7: Corrective Action Procedures

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

Field instruments can be affected by rainfall, changes in temperature, humidity, and barometric pressure and/or use in other aggressive environments. Instrument calibration should be checked when significant changes in ambient conditions occur. In addition, instrument calibration should be checked if maintenance activities (e.g., battery replacement, lamp replacement, or refueling) are required, if instrument malfunctions occur, or when questionable readings are observed. Calibration verification and recalibration activities shall be conducted and documented as outlined in Section 5.0.

Section 8: Corrections and Reviews

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

Section 9: Document Archive

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

Brown AND Caldwell

2 Park Way, Suite 2A
Upper Saddle River, New Jersey 07458
T: 201.574.4700
F: 201.236.1607

Technical Memorandum

Standard Operating Procedures
Field Equipment Decontamination

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Section 1: Objectives

Small, non-dedicated sampling equipment used to handle and collect a sample medium must be decontaminated prior to each use. This equipment would include water sample pumps, tube soil samplers, sediment dredge samplers, scoops, etc. This would not include larger equipment such as other drilling tools (e.g., bits and rods), excavation equipment, etc.

This procedure has been developed in accordance with ASTM D-5088(current version) "Standard Practice for Decontamination of Field Equipment Used at Non-radioactive Waste Sites" and the Field Sampling Procedures Manual, (NJDEP, 2005).

Section 2: Responsibilities

Project Manager, or designee, will be responsible for maintaining compliance with the requirements of the SOP.

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

Section 3: Required Materials

The equipment and supplies required for implementation of this SOP include the following:

- **Laboratory Detergent** - Alconox®, Liquinox®, or equivalent
- **Potable Water**
- **Acid Solution** - Made from 10% reagent grade nitric or hydrochloric acid and deionized water (1% acid solution to be used on equipment constructed of low carbon steel).
- **Organic Solvent** - Various organic solvents of very high purity will be used as a rinse of materials contaminated with organic compounds. Selection of the particular solvent will depend on the relative solubility of the contaminants of concern, usually based on polarity. For example, relatively polar solvents such as methanol or acetone are good solvents for other polar contaminants. Hexane, a relatively non-polar solvent, provides a good rinse agent for relatively non-polar contaminants such as PCBs and pesticides.
- **Reagent Water** – Type II prepared by distillation, as per ASTM D-1193(current version) contained in polyethylene or PTFE (e.g., Teflon®) wash bottle.
- **Assorted Brushes and Buckets**
- **Site Field Book**

Section 4: Procedure

This procedure is intended as a general framework for properly decontaminating small sampling equipment before it is used for the collection of each sample. More specialized procedures may need to be instituted depending on the nature of contamination, site conditions and the nature of the equipment being cleaned. All procedures should be outlined in the site Work Plan prior to the onset of field activities.

Contaminated equipment will be cleaned by following the steps listed below:

- Wash in potable water and laboratory detergent with a brush to remove particles of soil or sediment.
- Equipment with internal mechanisms that cannot be contacted with a brush (e.g., submersible pumps) will be washed by circulating the detergent solution through the equipment. (Note: some jurisdictions may require equipment disassembly rather than recirculation of solutions).Rinse with potable water.
- Rinse with organic solvent specific to the contaminant, only if the samples will undergo analyses for organic parameters.
- Rinse in acid solution, only if the samples will undergo analyses for inorganic parameters.
- Rinse with deionized water from wash bottle.
- Investigation-derived waste (IDW) including wash and rinse water and solvents will be contained pending appropriate disposal.
- Store decontaminated equipment such that it does not come in contact with potentially contaminated equipment or surfaces, e.g., wrapped in foil.
- Note decontamination in the site field book

Appendix F: Chain-of-Custody Form

NEW YORK CHAIN OF CUSTODY

Westborough, MA 01581
8 Walkup Dr.
TEL: 508-898-9220
FAX: 508-898-9193

Mansfield, MA 02048
320 Forbes Blvd
TEL: 508-822-9300
FAX: 508-822-3288

Service Centers
Mahwah, NJ 07430: 35 Whitney Rd, Suite 5
Albany, NY 12205: 14 Walker Way
Tonawanda, NY 14150: 275 Cooper Ave, Suite 105

Page
of

Date Rec'd in Lab

ALPHA Job #

Client Information

Client:
Address:
Phone:
Fax:
Email:

Project Information

Project Name:
Project Location:
Project #
(Use Project name as Project #) ☐
Project Manager:
ALPHAQuote #:

Turn-Around Time

Standard ☐ Due Date:
Rush (only if pre approved) ☐ # of Days:

Deliverables

☐ ASP-A ☐ ASP-B
☐ EQuIS (1 File) ☐ EQuIS (4 File)
☐ Other

Regulatory Requirement

☐ NY TOGS ☐ NY Part 375
☐ AWQ Standards ☐ NY CP-51
☐ NY Restricted Use ☐ Other
☐ NY Unrestricted Use
☐ NYC Sewer Discharge

Billing Information

☐ Same as Client Info
PO #

Disposal Site Information

Please identify below location of applicable disposal facilities.

Disposal Facility:
☐ NJ ☐ NY
☐ Other:

These samples have been previously analyzed by Alpha ☐

Other project specific requirements/comments:

Please specify Metals or TAL.

ANALYSIS

Sample Filtration
☐ **Done**
☐ **Lab to do**
Preservation
☐ **Lab to do**
(Please Specify below)

Total Bottle

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Sample Specific Comments

Preservative Code:
A = None
B = HCl
C = HNO_3
D = H_2SO_4
E = NaOH
F = MeOH
G = $NaHSO_4$
H = $Na_2S_2O_3$
K/E = Zn Ac/NaOH
O = Other

Container Code
P = Plastic
A = Amber Glass
V = Vial
G = Glass
B = Bacteria Cup
C = Cube
O = Other
E = Encore
D = BOD Bottle

Westboro: Certification No: MA935
Mansfield: Certification No: MA015

Container Type
Preservative

Relinquished By:	Date/Time	Received By:	Date/Time

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)

Appendix G: Health and Safety Plan

Health and Safety Plan for Supplemental RCRA Facility Investigation

The Nepera-Harriman Site
(A.K.A. the Former Nepera Plant Site)
NY Route 17
Village of Harriman, New York

December 2013
(Revision 03)

BC Project Number: 145302

Prepared by:

2 Park Way, Suite 2A
Upper Saddle River, New Jersey 07458

Prepared for
ELT Harriman LLC
1650 Des Peres Road, Suite 306
St. Louis, Missouri

Approval Page
Health and Safety Plan for
for Supplemental RCRA Facility Investigation
The Nepera-Harriman Site
(A.K.A. the Former Nepera Plant Site)
(Revision 03)

This Health and Safety Plan (HASP) has been prepared and reviewed by the following Brown and Caldwell (BC) personnel for use at: The Nepera-Harriman Site (A.K.A. the Former Nepera Plant Site) (BC Project Number: 145302).

	Name	Signature	Title	Date
Prepared By:	Catherine E. Trent, PE	To be executed prior to field implementation	Senior Engineer/ HS Specialist	To be executed prior to field implementation
Reviewed By:	Paul Thorn	To be executed prior to field implementation	Site Safety Officer	To be executed prior to field implementation
Reviewed By:	TO BE DETERMINED	To be executed prior to field implementation	Project Manager	To be executed prior to field implementation
Reviewed By:	Lydia Crabtree, CSP	To be executed prior to field implementation	Regional Safety Unit Manager	To be executed prior to field implementation
Effective Dates:	December 2013	through	November 2014	

The effective dates of this plan are not intended to cover a period greater than 12 months.

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CRITICAL PROJECT INFORMATION

Primary Known Compound(s) of Concern: List Compounds of Concern

- Benzene
- Toluene
- Ethylbenzene
- Xylene
- Pyridine
- Alpha-Picoline
- Mercury
- Ammonia

Minimum Level of Personal Protective Equipment: ☒ Level D ☐ Level C

Personal Protective Equipment:
Standard PPE for Level D consists of:

- Work shirt and long pants;
- ANSI- or ASTM-approved steel-toed boots or safety shoes,
- ANSI-approved safety glasses;
- ANSI-approved hard hat (where required on-site or when overhead hazards are present);
- Outer nitrile gloves (11 mil or thicker) and inner nitrile surgical gloves when direct contact with chemically affected soils or groundwater is anticipated (nitrile surgical gloves may be used for collecting or classifying samples as long as they are removed and disposed of immediately after each sampling event);
- Hearing protection when working around heavy operating equipment or otherwise when noise exists such that you need to elevate your voice to speak to someone at arm's length.
- Sturdy work gloves (when needed); and
- High-visibility traffic safety vest.

SEE SECTION 10 FOR SITE EMERGENCY CONTINGENCY PROCEDURES
Do not endanger your own life. Survey the situation before taking any action.

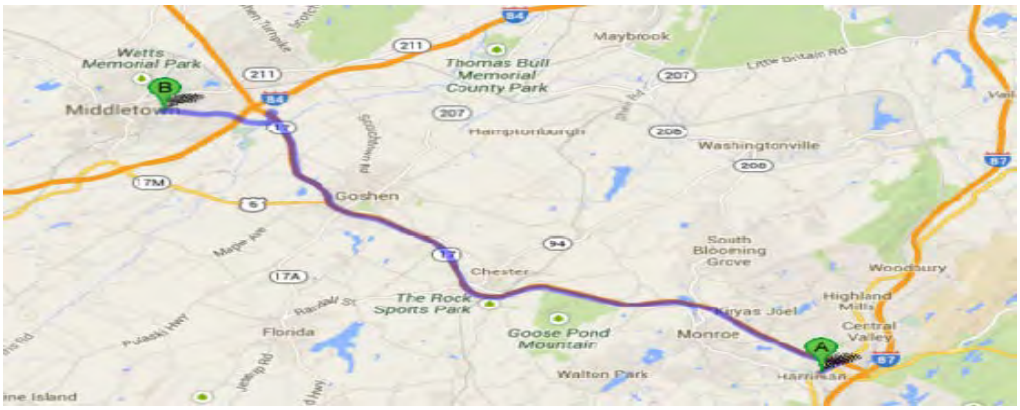
BC Office	**2 Park Way, Suite 2A** **Upper Saddle River, NJ** **201-574-4700**
Site Location Address	**NY Route 17** **Village of Harriman, New York** **(approximately one mile west of Exit 16 of the New York State Thruway)**

EMERGENCY PHONE NUMBERS: In the event of emergency, contact the Project Manager and/or Regional Safety Unit Manager.

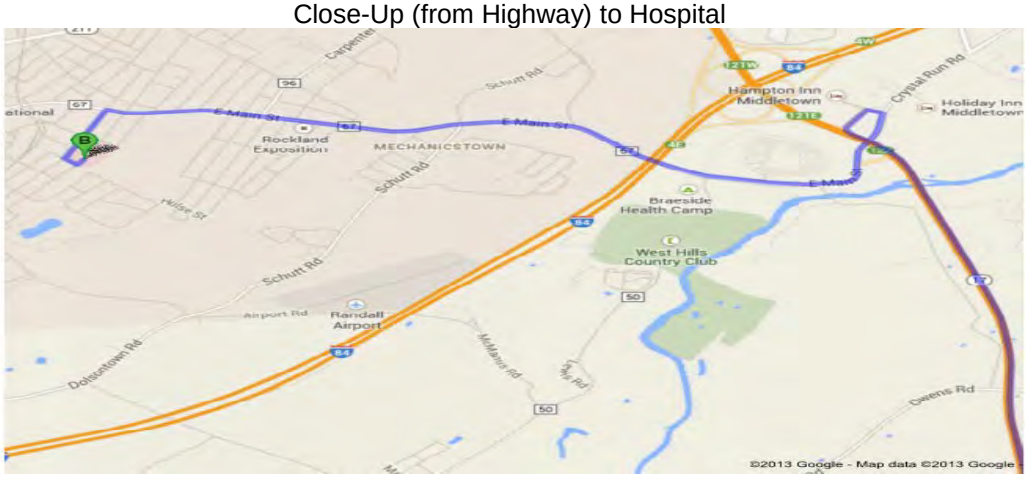
Emergency Services (Ambulance, Fire, Police)	911
Poison Control	(800) 876-4766 or (800) 222-1222
Hospital Name	Orange Regional Medical Center 707 E Main St Middletown, NY 10940
Hospital Phone Number	(845) 333-1000
BC Project Manager (PM): Paul Thorn	Office: (201) 574-4754 Cell: (201).803.1869
BC Site Safety Officer (SSO): TO BE DETERMINED	Office: ***-***-**** Cell: ***-***-****
BC Regional Safety Unit Manager (RSUM): Lydia Crabtree, CSP	Office: 615-250-1236 Cell: 615-202-1311
Corporate Risk Management	Property Loss Blythe Buetzow: (925) 210-2470 Injury Angela Hale: (925) 210-2218
Client Contact: Matthew D. Robinson President Environmental Liability Transfer, Inc.	Direct 314-835-2823 Office: 314-775-0500 ext 123 Cell: 314-258-2068 mrobinson@eltransfer.com
Subcontractors	
TO BE DETERMINED	Office: ***-***-**** Cell: ***-***-****

HOSPITAL LOCATION MAP

Overall Route



Close-Up (from Highway) to Hospital



HOSPITAL DIRECTIONS:

	1. Head **northeast** on **Averill Ave** toward **Commerce Dr S** About 1 min	go 0.6 mi total 0.6 mi
32	2. Continue onto **NY-32 N**	go 390 ft total 0.6 mi
32	3. Make a U-turn	go 315 ft total 0.7 mi
	4. Take the **New York 17 W** ramp to **US 6 W** Toll road	go 0.2 mi total 0.9 mi
17	5. Merge onto **NY-17 W** Toll road	go 0.7 mi total 1.6 mi
6	6. Continue onto **NY-17 W/US-6 W** About 11 mins	go 12.2 mi total 13.8 mi
17	7. Continue onto **NY-17 W** About 4 mins	go 3.7 mi total 17.5 mi
	8. Take exit **122** for **Crystal Run Crossing**	go 0.2 mi total 17.7 mi
	9. Turn right onto **Crystal Run Crossing**	go 282 ft total 17.7 mi
	10. Take the 1st right onto **Crystal Run Rd**	go 0.3 mi total 18.0 mi
	11. Continue onto **County Rd 67/E Main St** About 5 mins	go 2.5 mi total 20.5 mi
	12. Turn left onto **Prospect Ave** About 56 secs	go 0.3 mi total 20.8 mi
	13. Take the 2nd left onto **Hill St**	go 269 ft total 20.9 mi
	14. Turn left onto **Jackson Ave**	go 171 ft total 20.9 mi
B	Hospital	

HOSPITAL INFORMATION:

Orange Regional Medical Center
707 E Main St
Middletown, NY 10940

Phone: (845) 333-1000

EMERGENCY FIRST AID PROCEDURES

THE RESPONDER SHOULD HAVE APPROPRIATE TRAINING TO ADMINISTER FIRST AID OR CPR

1. Survey the situation. Do not endanger your own life. DO NOT ENTER A CONFINED SPACE TO RESCUE SOMEONE WHO HAS BEEN OVERCOME. FOLLOW PROTOCOLS INCLUDING THAT A STANDBY PERSON IS PRESENT. IF APPLICABLE, REVIEW MSDSs TO EVALUATE RESPONSE ACTIONS FOR CHEMICAL EXPOSURES.
2. Call 911 (if available) or the fire department **IMMEDIATELY**. Explain the physical injury, chemical exposure, fire, or release.
3. Decontaminate the victim if it can be done without delaying life-saving procedures or causing further injury to the victim.
4. If the victim's condition appears to be non-critical, but seems to be more severe than minor cuts, he/she should be transported to the nearest hospital by the SSO or designated personnel: let the doctor assume the responsibility for determining the severity and extent of the injury. If the condition is obviously serious, contact emergency medical services (EMS) for transport or appropriate actions.

Notify the PM and Regional Safety Unit Manager immediately and complete the appropriate incident investigation reports as soon as possible.

STOP BLEEDING AND CPR GUIDELINES	
To Stop Bleeding	**CPR**
1. Give medical statement by indicating you are trained in First Aid. 2. Assure: airway, breathing and circulation. 3. Use **DIRECT PRESSURE** over the wound with clean dressing or your hand (use non-permeable gloves). Direct pressure will control most bleeding. 4. Bleeding from an artery or several injury sites may require **DIRECT PRESSURE** on a **PRESSURE POINT**. Use pressure points for 30 -60 seconds to help control severe bleeding. 5. Continue primary care and seek medical aid as needed.	1. Give medical statement by indicating you are trained in CPR. 2. Arousal: Check for consciousness. 3. Call out for help, either call 911 yourself or instruct someone else to do so. It is very important to call for emergency assistance prior to initiating CPR. 4. Open airway with chin-lift. 5. Look, listen and feel for breathing. 6. If breathing is absent, give 2 slow, full rescue breaths, 1 second per breath. 7. If breathing remains absent, initiate CPR; 30 compressions for each two breaths. Repeat for 5 cycles before re-analyzing patient or until help arrives. 8. If an automated external defibrillator (AED) is available, use it in accordance with the AED instructions.

REVISION HISTORY

Revision No.	Revision Date	Reason	Editor
00	November 2006	New Project	Unknown
01	June 2008	RCRA Facility Investigation	C.Trent/ L.Crabtree
02	November 2010	Remedial Investigation Activities and Remedial Construction Activities	C.Trent/ L.Crabtree
03	December 2013	Supplemental RCRA Facility Investigation	C.Trent/ L.Crabtree
04			
05			
06			
07			
08			
09			
10			

Section 1

Introduction

Brown and Caldwell (BC) has prepared this Health and Safety Plan (HASP) for use during the Supplemental RCRA Facility Investigation activities to be conducted at The Nepera-Harriman Site, also referred to as the Former Nepera Plant Site (the "Site") located on NY Route 17 in the Village of Harriman, Orange County, approximately one mile west of Exit 16 of the New York State Thruway. Activities conducted under BC's direction at the Site will be in compliance with applicable Occupational Safety and Health Administration (OSHA) regulations, particularly those in Title 29 of the Code of Federal Regulations, Part 1910.120 (29 CFR 1910.120), and other applicable federal, state, and local laws, regulations, and statutes. A copy of this HASP will be kept on site during scheduled field activities.

This HASP addresses the identified hazards associated with planned field activities at the Site. It presents the minimum health and safety requirements for establishing and maintaining a safe working environment during the course of work. In the event of conflicting requirements, the procedures or practices that provide the highest degree of personnel protection will be implemented. If scheduled activities change or if site conditions encountered during the course of the work are found to differ substantially from those anticipated, the Regional Safety Unit Manager and Project Manager will be informed immediately upon discovery, and appropriate changes will be made to this HASP.

BC's health and safety programs and procedures, including medical monitoring, respiratory protection, injury and illness prevention, hazard communication, and personal protective equipment (PPE), are documented in the BC Health & Safety Manual. The Health & Safety Manual is readily accessible to BC employees via the BC Pipeline. These health and safety procedures are incorporated herein by reference, and BC employees will adhere to the procedures specified in the manual.

BC's HASP has been prepared specifically for this project and is intended to address health and safety issues solely with respect to the activities of BC's own employees at the site. A copy of BC's HASP may be provided to subcontractors in an effort to help them identify expected conditions at the site and general site hazards. The subcontractor shall remain responsible for identifying and evaluating hazards at the site as they pertain to their activities and for taking appropriate precautions. For example, BC's HASP does not address specific hazards associated with tasks and equipment that are particular to the subcontractor's scope of work and site activities (e.g., operation of a drill rig, excavator, crane or other equipment). Subcontractors are not to rely on BC's HASP to identify all hazards that may be present at the Site.

Subcontractors are responsible for developing, maintaining, and implementing their own health and safety programs, policies, procedures and equipment as necessary to protect their workers, and others, from their activities. Subcontractors shall operate equipment in accordance with their standard operating procedures as well as manufacturer's specifications. Any project monitoring activities conducted by BC at the Site shall not in any way relieve subcontractors of their critical obligation to monitor their operations and employees for the determination of exposure to hazards that may be present at the Site and to provide required guidance and protection. If requested, subcontractors will provide BC with a copy of their own HASP for this project or other health and safety program documents for review.

1.1 Site History

The Pyridium Corporation began chemical manufacturing operations at the Site in 1942. The Pyridium Corporation and its affiliate, the former Nepera Chemical Company, continued operations at the Site until 1956 at which time the companies were sold to the Warner-Lambert Company and dissolved. Nepera, Inc. was formed in 1957 as a wholly-owned subsidiary of the Warner-Lambert Company. Nepera, Inc. owned and operated the plant from 1957 to 1976 at which time the company was sold to Schering AG of Germany who in turn sold the company to the Cambrex Corporation (Cambrex) in 1986. On November 10, 2003 the assets of Nepera, Inc. were sold to Rutherford Chemicals LLC (RC).

Chemical by-products (organic compounds) were incinerated on site from September 1945 through May 1957. This activity was conducted in two areas. During the mid-1940s, a "burn pit" apparently was located near the former blind lagoon and the current SPDES lagoon. From the late 1940s on, a "burn pit" was located near where the cyano reactor now stands.

From the late 1940s to approximately 1953, calcium-sulfate sludge was disposed of in a swamp which was located where the administration building and parking lot now are. The calcium-sulfate sludge contained mercury, which was used as a catalyst in the manufacturing of niacinamide. The calcium-sulfate sludge may have also been disposed of in the area between "contractor's gate" and Arden House Road within Study Area E and potentially extending into the adjacent study areas to the east and west.

Drum burial occurred in an area near Buildings 67 and 75 and in an area near the southern boundary of the site. Drum removal from these areas was conducted during the mid-1980s.

The SPDES lagoon, constructed in the mid 1960s, is located southeast of the parking lot. It is reportedly approximately 12-feet deep, lined with compacted clay, and stores approximately 5.5 million gallons of water, derived from boiler blow-down and non-contact cooling water, stormwater runoff and treated groundwater. Water from the lagoon is discharged to the west branch of the Ramapo River under a SPDES permit. Before this, the lagoon served as a settling pond for aluminum hydroxide and magnesium silicate precipitates from manufacturing.

The former blind lagoon, previously located where the SPDES lagoon currently is, was used to drain fire-system sprinkler (deluge) water, which was conveyed via gravity flow through underground pipes. The water is now collected in a 20,000-gallon underground storage tank, and then when full, pumped to an above-ground 300,000-gallon storage tank.

1.2 Site Description

The Site is located in the Village of Harriman, Orange County, New York, approximately 1 mile south of Exit 16 of the New York State Thruway. The Site is bordered by the Ramapo River on the north, by the Norfolk Southern Corporation rail tracks on the south, New York Route 17 on the west, and undeveloped land on the east. The site location is depicted on Figure 2-1 of the RCRA Facility Investigation Work Plan (Brown and Caldwell, October 2006). The site plan, showing the site layout is presented on Figure 2-2 of the RCRA Facility Investigation Work Plan (Brown and Caldwell, October 2006). Both Figures are attached to this document.

The Site consists of two parcels of land comprising 28.38 acres. The administrative offices, parking lot and SPDES lagoon are located on the 9.74-acre parcel to the northeast of Arden House Road. The manufacturing facilities are located on the 18.64-acre parcel to the southwest of Arden House Road.

1.3 Scope of Work

The Scope of Work consists of the following activities:

- field inspections/walkthroughs,

- Soil Borings,
- sediment sampling from storm drains, and
- soil gas sampling for volatile organics

Brown and Caldwell personnel will be observing and documenting subcontractor activities. Brown and Caldwell personnel will also be conducting media sampling (i.e. soil, sediment and soil gases).

Section 2

Key BC Project Personnel and Responsibilities

Paul Thorn is the BC Project Manager (PM). Lydia Crabtree is the BC Regional Safety Unit Manager (RSUM). TO BE DETERMINED has been designated as the BC Site Safety Officer (SSO) for this project. An alternate SSO may be designated from the BC employees working as field staff. The BC project field staff have completed 40 hours of comprehensive health and safety training, which meets the requirements of 29 CFR 1910.120.

The responsibilities of key BC project personnel are presented below.

2.1 BC Project Manager

The PM is responsible for evaluating hazards anticipated at the Site and working with designated field staff and the RSUM to prepare this HASP to address the identified hazards. The PM is also responsible for the following.

- Informing project participants of safety and health hazards identified at the Site.
- Providing a copy of and requiring that each BC project team member, including subcontractors, reads or is briefed on the HASP.
- Checking that the BC project team is adequately trained and perform safety briefings in accordance with this HASP.
- Providing the resources necessary for maintaining a safe and healthy work environment for BC personnel.
- Communicating project safety concerns to the RSUM for determining corrective actions.

2.2 BC Site Safety Officer

The SSO has on-Site responsibility for verifying that BC team members, including subcontractors, comply with the provisions of this HASP. The SSO has the authority to monitor and correct health and safety issues as noted on-Site. The SSO is responsible for the following.

- Reporting unforeseen or unsafe conditions or work practices at the Site to the PM or RSUM.
- Stopping operations that threaten the health and safety of BC field team or members of the surrounding community.
- Monitoring the safety performance of Site personnel to evaluate the effectiveness of health and safety procedures.
- Performing air monitoring, as necessary, as prescribed in this HASP.
- Documenting field team compliance with this HASP by completing the appropriate BC forms contained in the Appendices of this document.
- Conducting daily tailgate safety meetings and assuring that project personnel understand the requirements of this HASP (as documented by each BC field team member's signature on the Signature Page).

- Limiting access to BC work areas on the Site to BC field team members and authorized personnel.
- Enforcing the "buddy system" or minimum 2-person teams as appropriate for Site activities.
- Performing periodic inspections to evaluate safety practices at the Site.
- Identifying the location and route to nearby medical facility and emergency contact information and coordinating appropriate responses in the event of emergency.

2.3 BC Regional Unit Safety Manager

The RSUM is responsible for final review and modification of this HASP. Modifications to this HASP that result in less protective measures than those specified may not be employed by the PM or SSO without the approval of the RSUM. In addition, the RSUM has the following responsibilities.

- Developing and coordinating the overall BC health and safety program.
- Advising the PM and SSO on matters relating to health and safety on this project.
- Recommending appropriate safeguards and procedures.
- Modifying this HASP, if necessary, and approving changes in health and safety procedures at the Site.

2.4 BC Team Members

BC employees and subcontractors are responsible for familiarizing themselves with health and safety aspects of the project and for conducting their activities in a safe manner. This includes attending site briefings, communicating health and safety observations and concerns to the SSO, maintaining current medical and training status and maintaining and using proper tools, equipment and PPE. Proper work practices are part of ensuring a safe and healthful working environment. Safe work practices are essential and it is the responsibility of BC employees and team members to follow safe work practices when conducting scheduled activities. Safe work practices to be employed during the entire duration of fieldwork include, but are not limited to, the following.

- Following the provisions of this HASP, company health and safety procedures and regulatory requirements.
- Reviewing safety-related information from other parties (i.e., client or contractors) as it relates to BC's activities.
- Inspecting personal protective equipment (PPE) before on-site use, using only intact protective clothing and related gear, and changing suits, gloves, etc. if they are damaged or beyond their useful service life.
- Set up, assemble, and check out all equipment and tools for integrity and proper function before starting work activities.
- Assisting in and evaluating the effectiveness of Site procedures (including decontamination) for personnel, protective equipment, sampling equipment and containers, and heavy equipment and vehicles.
- Practice the "buddy system" as appropriate for site activities.
- Do not use faulty or suspect equipment.
- Do not use hands to wipe sweat away from face. Use a clean towel or paper towels.
- Practice contamination avoidance whenever possible.
- Do not smoke, eat, drink, or apply cosmetics while in chemically-affected areas of the site or before proper decontamination.

- Wash hands, face and arms before taking rest and lunch breaks and before leaving the site at the end of the workday.
- Check in and out with the SSO upon arrival and departure from the site.
- Perform decontamination procedures as specified in this HASP.
- Notify the SSO immediately if there is an incident that causes an injury, illness or property loss. Incidents that could have resulted in injury, illness or property loss (close call) will also be reported to the SSO.
- Do not approach or enter an area where a hazardous environment (i.e., oxygen deficiency, toxic or explosive) may exist without employing necessary engineering controls, proper PPE and appropriate support personnel.
- Use respirators correctly and as required for the Site; check the fit of the respirator with a negative or positive pressure test; do not wear respirator with facial hair or other conditions that prevent a face-to-face piece seal.
- Confined spaces will not be entered without appropriate evaluation, equipment, training and support personnel.

2.5 BC Subcontractors

Subcontractor personnel are expected to comply fully with subcontractor's HASP and to observe the minimum safety guidelines applicable to their activities which may be identified in the BC HASP. Failure to do so may result in the removal of the subcontractor or any of the subcontractor's workers from the job site.

Section 3

Hazard Analysis

Hazards at the Site may include physical hazards, chemical hazards or biological hazards. Each type of identified hazard is addressed in the following sections. Hazards that are the specialty of a subcontractor (i.e., operation of a drill rig or excavator) are not addressed in this HASP. Subcontractors are responsible for identifying potential hazards associated with their activities and implementing proper controls.

3.1 Chemical Hazards

Exposure pathways of concern for chemical compounds that may be present at the Site are inhalation of airborne contaminants, direct skin contact with contaminated materials, and incidental ingestion of affected media. Wearing protective equipment and following decontamination procedures listed in Section 7 can minimize dermal contact and incidental ingestion. To minimize inhalation hazards, dust or vapor control measures will be implemented, where necessary, and action levels will be observed during scheduled activities. Site-specific action levels and air monitoring requirements are presented in Section 5.

Site Specific Chemical Concerns			
Known or Suspected Compounds	Source (soil/water/sludge, etc.)	Known Concentration Range (ug/kg)	
		Lowest	Highest
Benzene	Soil	0.3	250000
Toluene	Soil	0.2	36000
Ethylbenzene	Soil	2	130000
Xylene	Soil	0.5	11000000
Pyridine	Soil	370 U	1200 U
Alpha-Picoline	Soil	6	11000
Mercury	Soil	18	832000
Ammonia	NA	NA	NA

Chemical descriptions of select chemicals of concern, including health effects and exposure limits, are presented in the following paragraphs. Each chemical description includes physical and odor recognition characteristics, the health effects associated with exposure, and exposure limits expressed as an 8-hour time-weighted average (TWA). Provided are federal OSHA (OSHA) permissible exposure limits (PELs; located in 29 CFR 1910.1000) and the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLVs).

3.1.1 Benzene

Benzene is a clear, volatile liquid. It is colorless, highly flammable, and toxic, with a characteristic odor. It is a severe eye and moderate skin irritant. Human effects by inhalation and ingestion include euphoria, changes in sleep and motor activity, nausea and vomiting, other blood effects, dermatitis, and fever. In industry, inhalation is the primary route of chronic benzene poisoning. If the liquid is aspirated into

the lung it may cause pulmonary edema. Poisoning by skin contact has also been reported. Exposure to high concentrations (3,000 ppm) may result in acute poisoning, which is characterized by the narcotic action of benzene on the central nervous system. Chronic poisoning occurs most commonly through inhalation and dermal absorption. Benzene is a known human carcinogen that can cause leukemia.

- The OSHA PEL is listed as 1 ppm.
- The TLV is listed as 0.5 ppm.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

3.1.2 Toluene

Toluene is a colorless liquid with a benzol-like odor. Human systemic effects of exposure to toluene include central nervous system changes, hallucinations or distorted perceptions, motor activity changes, psychophysiological changes, and bone marrow changes. It is a severe eye irritant and an experimental teratogen. Inhalation of high vapor concentrations may cause impairment of coordination and reaction time, headaches, nausea, eye irritation, loss of appetite, a bad taste in the mouth, and lassitude.

- The OSHA PEL is listed as 200 ppm.
- The TLV is listed as 20 ppm.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

3.1.3 Ethylbenzene

Ethylbenzene is a clear, colorless liquid. It is mildly toxic by inhalation and skin contact. Inhalation can cause eye, sleep, and pulmonary changes. It is an eye and skin irritant at levels as low as 0.1% (1,000 ppm) of the vapor in air. At higher concentrations, it is extremely irritating at first, then can cause dizziness, irritation of the nose and throat, and a sense of constriction in the chest. Exposure to high concentrations of ethylbenzene vapor may result in irritation of the skin and mucous membranes, dizziness, irritation of the nose and throat, and a sense of constriction of the chest.

- The OSHA PEL is listed as 100 ppm.
- The TLV is listed as 20 ppm.

3.1.4 Xylene

Xylene is a clear, colorless liquid. It exhibits the general chlorinated hydrocarbon central nervous system effects, olfactory (smell) changes, eye irritation and pulmonary changes. It is a severe skin irritant. There are three isomers: ortho, meta, and para. Exposure to high concentrations of xylene vapor may result in eye and skin irritation. Eye irritation may occur at concentrations of about 200 ppm.

- The OSHA PEL is listed as 100 ppm.
- The TLV is listed as 100 ppm.

3.1.5 Pyridine

Pyridine is a colorless or yellow liquid with a strong sickening (fish-like) odor. It is used in making pharmaceuticals and as a solvent. It has an odor threshold of 0.66 ppm. Pyridine is incompatible or reactive with strong oxidizers and strong acids. Exposure to pyridine may occur via inhalation, skin absorption, ingestion, and/or skin/eye contact.

- OSHA General Industry PEL is listed as 5 ppm , 15 mg/m3
- ACGIH TLV is listed as 5 ppm , 15 mg/m3

- NIOSH REL is listed as 5 ppm , 15 mg/m3

Target organs for pyridine are the central nervous system, eyes, liver, kidneys, skin, and gastrointestinal tract. Health effects are cumulative liver, kidney, and bone marrow damage; and central nervous system effects. Symptoms of exposure include irritation to eyes; headache, anxiety, dizziness, insomnia; nausea, anorexia; dermatitis; and liver and/or kidney damage.

3.1.6 Alpha Picoline (2-methylpyridine)

Alpha picoline is a clear liquid with an unpleasant characteristic smell. Picolines are useful as solvents and as raw materials for various chemical products used in the industry of polymers, textiles, fuels, agrochemicals, pharmaceuticals and colorants. Exposure to alpha picoline may occur via inhalation, skin absorption, ingestion, and/or skin/eye contact. There currently are no federal regulatory or recommended exposure limits. Note that picolines are a pyridine.

Target organs for alpha picoline are skin and the respiratory tract. Health effects are corrosive to eyes and skin, and irritate the respiratory tract. Symptoms of exposure include headaches, nervousness, dizziness, insomnia; nausea, anorexia; frequent urination; eye irritation; dermatitis; liver and kidney damage.

3.1.7 Mercury

Mercury is a silver-colored, heavy, mobile liquid element. Mercury is a poison by inhalation, and is corrosive to skin, eyes, and mucous membranes. It may be absorbed into the body through the skin. Human systemic effects by inhalation include wakefulness, muscle weakness, anorexia, headache, diarrhea, liver changes, dermatitis, and fever. It is an experimental teratogen with experimental reproductive effects and tumorigenic data. When heated to decomposition it emits toxic fumes of mercury.

- The OSHA PEL is listed as 0.1 mg/m3 as a Ceiling Value for elemental mercury, inorganic compounds and aryl compounds. The OSHA PEL is listed as 0.04 mg/m3 as a Ceiling Value for Alkyl compounds.
- The TLV is listed as 0.01 mg/m3 for mercury alkyls, 0.1 mg/m3 for mercury aryl compounds, and 0.025 mg/m3 for inorganic forms including metallic mercury

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

3.1.8 AMMONIA

Ammonia or Anhydrous ammonia is a colorless gas with a pungent, suffocating odor.. Ammonia is easily liquefied under pressure. Ammonia is corrosive to copper or galvanized surfaces. It is reactive with strong oxidizers, acids, halogens, salts of silver and zinc. Ammonia should be treated as a flammable liquid, though it does not meet the DOT definition for labeling purposes. Symptoms of exposure consist of irritation to the eyes, nose, throat; wheezing, breathing difficulty, chest pain; swelling and fluid accumulation in the lungs; pink frothy sputum; skin burns; and vesiculation. The target organs are eyes, skin, and respiratory system. Routes of exposure include inhalation, ingestion (in solution), and skin and eye contact.

- The OSHA PEL is listed as 25 ppm.
- The TLV is listed as 25 ppm.

3.2 Hazard Communication

In accordance with the Hazard Communication standard, material safety data sheets (MSDSs) will be maintained on site for chemical products used by BC personnel at the Site (i.e., spray paint, PVC cement, etc.). Subcontractors will be responsible for maintaining MSDSs for chemical products they bring on Site. In addition, containers will be clearly labeled in English to indicate their contents and appropriate hazard warnings. Please note that labeling containers includes, but is not limited to, any waste, used PPE, and/or decontamination materials collected.

3.3 Opening Wells and Well Vaults

Direct-reading instrumentation specified in Section 5 will be used to monitor any work in a well vault at the site where VOCs are a concern. The well vault will be opened carefully with the BC employee staying upwind as much as possible and then left open for a minimum of three minutes to allow the vault to vent. If the well cap is then removed, allow another three minutes for the well head to vent before proceeding. Please note that if there are other established protocols that differ from 3 minutes; the more protective time increment will be followed. Personnel should stay upwind as much as possible while working in and around the vault.

When removing a well cap, personnel will remain upwind as much as possible and will carefully remove the cap by opening it away from them in order to minimize the likelihood of exposure to vapors. Personnel will wait a minimum of three minutes to allow the well to vent before proceeding.

3.4 Physical Hazards

The following physical hazards, as marked below, have been identified and may be encountered during scheduled field activities.

- ☒ Slips, Trips and Falls
- ☒ Heavy Equipment
- ☐ Excavations
- ☐ Noise
- ☒ Overhead Utilities
- ☐ Electrical Hazards
- ☒ Confined Spaces
- ☒ Sharp Objects/Cutting Utensils
- ☐ Elevated Platforms/Working Surfaces
- ☒ Traffic
- ☐ Arc Flash Protection
- ☒ Water Hazards (non-boating)
- ☒ Removing Manhole Covers
- ☒ Housekeeping
- ☒ Materials and Equipment Handling - Lifting
- ☒ Drilling
- ☒ Underground Utilities
- ☐ Equipment Refueling
- ☐ Lockout/Tagout
- ☐ Fire/Explosion
- ☒ Cutting Acetate Sleeves
- ☐ Ladder Use
- ☒ Driving
- ☐ Boating Safety
- ☒ Building Collapse
- ☒ Personal Safety – Urban Setting

Actions to be taken to protect against the hazards identified are provided in the sections below.

3.4.1 Slip, Trips and Falls

Slipping hazards may exist due to uneven terrain, wet or slick surfaces, leaks or spills. Tripping hazards may be present from elevation changes, debris, poor housekeeping or tools and equipment. Some specific hazards may include: climbing/descending ladders, scaffolding, berms or curbing. Collectively, these types of injuries account for nearly 50 percent of all occupational injuries and accepted disabling

claims. Prevention requires attention and alertness on the part of each worker, following and enforcing proper procedures, including good housekeeping practices, and wearing appropriate protective equipment.

3.4.2 Housekeeping

Personnel shall maintain a clean and orderly work environment. Make sure that all materials stored in tiers are stacked, racked, blocked, interlocked, or secured to prevent sliding, falling, collapse, or overturning. Keep aisles and passageways clear and in good repair to provide for free and safe movement of employees and material-handling equipment. Do not allow materials to accumulate to a degree that it creates a safety or fire hazard.

During construction activities, scrap and form lumber with protruding nails and other items shall be kept clear from work areas, passageways, and stairs. Combustible scrap and debris shall be removed at regular intervals. Safe means must be provided to facilitate removal of debris.

Containers must be provided for collecting and separating waste, used rags and other debris. Containers used for garbage and other oily flammable or hazardous waste such as caustics, acids, harmless dusts, etc., must be separated and equipped with covers. Garbage and other waste shall be disposed of at frequent and regular intervals.

3.4.3 Heavy Equipment

Equipment, including earth-moving equipment, drill rigs, or other heavy machinery, will be operated in compliance with the manufacturer's instructions, specifications, and limitations, as well as any applicable regulations. The operator is responsible for inspecting the equipment prior to use each work shift to verify that it is functioning properly and safely.

The following precautions should be observed whenever heavy equipment is in use:

- PPE, including steel-toed boots, safety glasses, high visibility vests, and hard hats must be worn.
- Personnel must be aware of the location and operation of heavy equipment and take precautions to avoid getting in the way of its operation. Workers must never assume that the equipment operator sees them; eye contact and hand signals should be used to inform the operator of the worker's intent.
- Personnel should not walk directly in back of, or to the side of, heavy equipment without the operator's knowledge. Workers should avoid entering the swing radius of equipment and be aware of potential pinch points.
- Nonessential personnel will be kept out of the work area.

3.4.4 Materials and Equipment Handling - Lifting

The movement and handling of equipment and materials on the Site pose a risk to workers in the form of muscle strains and minor injuries. These injuries can be avoided by using safe handling practices, proper lifting techniques, and proper personal safety equipment such as steel-toed boots and sturdy work gloves. Where practical, mechanical devices will be utilized to assist in the movement of equipment and materials. Workers will not attempt to move heavy objects by themselves without using appropriate mechanical aids such as drum dollies or hydraulic lift gates.

Proper lifting techniques include the following:

- Lift with the strength of your knees, not your back.
- Firmly plant your feet approximately shoulder-width apart.
- Turn your whole body, don't bend or twist at the waist.

- Be sure that the path is clear of obstructions or tripping hazards; avoid carrying objects that will obstruct your vision.
- Use caution when holding an object from the bottom to prevent crushing of the hands or fingers when lowering.

3.4.5 Excavations

A competent person who is capable of identifying existing and predictable hazards in the surroundings, or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them, will be present during excavation activities.

The atmosphere will be tested in excavations, before employees are permitted to enter and begin work, greater than 4 feet in depth or where oxygen deficiency or toxic or flammable gases are likely to be present. The atmosphere shall be ventilated and re-tested until flammable gas concentrations less than 5 percent of the lower explosive limit (LEL) and site-specific action levels are obtained. Worker entry will not be allowed if the oxygen concentration is less than 20 percent. In addition, a safe means of access and egress (i.e., a ladder, stairs or ramp) must be provided so that no more than 25 feet of lateral travel is required by employees.

Workers will not enter unstable excavations or excavations greater than 5 feet in depth without appropriate protective systems such as benching, sloping, or shoring. If shoring or shielding systems are not used, side slopes will not be steeper than 1½:1 without written confirmation from the competent person that the slope is safe for the soil conditions. Excavations will be constructed in accordance with the OSHA Excavation Safety Standard (29CFR1926 Subpart P).

The competent person will inspect excavations daily. If there is evidence that a cave-in or slide is possible, work will cease until the necessary safeguards have been taken. Excavated material will be placed far enough from the edge of the excavation (a minimum of 2 feet) so that it does not fall back into the opening or affect the integrity of the sidewall. At the end of each day's activities, open excavations will be clearly marked and secured to prevent nearby workers or unauthorized personnel from entering them. Remote sampling techniques will be the preferred method of sample collection in excavations.

3.4.6 Drilling

During all drilling activities, the operator must verify that the appropriate level of protection and appropriate safety procedures are utilized. The operator will verify that equipment "kill switches" are functioning properly at the start of each day's use. Hard hats, steel-toed boots, and ear and eye protection will be required at all times when working around drill rigs. The proximity of underground and overhead utilities must be identified before any drilling is attempted. The rig may not be moved with the mast in the upright position.

Workers can effectively manage hazards associated with working around heavy equipment if a constant awareness of these hazards is maintained. These hazards include the risk of becoming physically entangled in rotating machinery, slipping and falling, impact injury to eyes, head and body, and injury from machinery operations. Never work or walk on piles of well casings. Make sure all high-pressure lines and hoses have whip checks attached. Constant visual or verbal contact with the equipment operator will facilitate such awareness.

3.4.7 Noise

Noise may result primarily from the operation of heavy equipment, process machinery or other mechanical equipment. Hearing protection with the appropriate noise reduction rating (NRR) shall be worn in areas with high noise levels. A good rule of thumb to determine if hearing protection is needed is

the inability to have a conversation at arms length without raising voice levels. If loud noise is present or normal conversation becomes difficult, hearing protection in the form of ear plugs, or equivalent, will be required.

3.4.8 Underground Utilities

Reasonable efforts will be made to identify the location(s) of underground utilities (e.g., pipes, electrical conductors, fuel lines, and water and sewer lines) before intrusive soil work is performed. The state underground utility notification authority (e.g., USA, Dig Alert, Blue Stake, etc.) will be contacted prior to the start of intrusive field activities in accordance with local notification requirements. In areas not evaluated or serviced by the underground utility notification authority, and a reasonable potential for underground utilities exists, one or more of the following techniques will be employed to determine the location of subsurface structures.

- Contracting the services of a qualified private utility locator.
- Having a survey of the subject area conducted by staff trained in the use of subsurface utility locating equipment.
- Subsurface testing (i.e., hand digging or potholing) to the expected depth of probable utilities (not less than 5 feet).

If utilities cannot be located or if unlocated utilities are suspected to be present, subsurface activities (i.e., borings, excavation) should not be conducted before the location(s) or absence of underground utilities is confirmed.

Typical subsurface location marks are as follows:

- Red – electrical,
- Yellow – gas/oil/steam,
- Blue – water,
- Green – sanitary/storm drains/culverts,
- Orange – communications, and
- White – proposed excavation or boring.

Intrusive work should be limited to the area 3.3 feet (1 meter) on either side of the location marks. In some special cases such as fiber optics and high-pressure pipelines this area should be expanded to 16.5 feet (5 meters) on either side of the utility.

3.4.9 Overhead Utilities

If work is to be conducted in the vicinity of overhead electrical utilities, the owner of the overhead line will be contacted to determine the maximum voltage. Any overhead utility will be considered to be energized unless and until the person owning or operating such line verifies that the line is not energized, and the line is visibly grounded at the work site.

Workers will not perform work in proximity to energized high-voltage lines (including scaffolding, well drilling, pile driving, or hoisting equipment) until danger from accidental contact with high-voltage lines has been effectively guarded against.

Equipment with articulated upright booms or masts are not permitted to operate within 15 feet of an overhead utility line (less than 50kV) while the boom is in the upright position. For transmission lines in excess of 50kV, an additional distance of 4 inches for each 10 kV over 50kV will be used.

3.4.10 Equipment Refueling

Care shall be exercised while refueling generators, pumps, vehicles, and other equipment to prevent fire and spills. Personnel shall eliminate static electricity by grounding themselves (touching metal) prior to using refueling hoses and or containers of petroleum liquids. Items being refueled shall be grounded or be located on the ground and not on a trailer, work bench or inside a truck bed. Equipment that is hot must be allowed to cool prior to refueling. Spill response materials shall be available when conducting refueling operations.

3.4.11 Electrical Hazards

Electrical equipment to be used during field activities will be suitably grounded and ed. Ground-fault circuit interrupters (GFCI), or equivalent, will be used with electrical equipment to reduce the potential for serious electrical shock. Electrical equipment including batteries, generators, panels and extension cords shall be kept dry during use. Extension cords may not be used as a permanent means of providing power and will be removed from service if they are worn, frayed, or if the grounding prong is missing.

Extension cord precautions include the following:

- Be aware of exposed or bare wires, especially on metal grating. Warning: Electrical contact with metal can cause fatal electrocution.
- Prior to use, inspect cords for exposed or bare wires, worn or frayed cords, and incorrect splices. Splices are permitted, but there must be insulation equal to the cable, including flexibility.
- Cables and extension cords in passageways, steps or any area where there may be foot traffic should be secured so as to not create a tripping hazard. Overhead cables and extension cords shall be rigged to a height greater than 6 feet.
- Shield extension cords that must run across driveways or areas where vehicle traffic is present.
- Do not run cords across doorways or windows where they can be frayed or cut by a closed door or window.
- Do not run wires through wet or puddled areas.
- Flexible cord sets that are used on construction sites or in damp locations shall be of hard usage or extra hard usage type.

Observation of energized machinery will take place from a safe distance. Only qualified personnel will remove guards, hatch covers, or other security devices if necessary. Equipment lockout procedures and the appropriate facility work permit requirements will be followed. Lockout/tagout procedures will be conducted before activities begin on or near energized or mechanical equipment that may pose a hazard to site personnel. Workers conducting the operation will positively isolate the piece of equipment, lock/tag the energy source, and verify effectiveness of the isolation. Only employees who perform the lockout/tagout procedure may remove their own tags/locks. Employees shall complete lockout/tagout training before initiating this procedure.

Only qualified personnel will remove covers of electrical equipment to expose energized electrical parts. Entering electrical rooms/vaults or areas with live exposed electrical part by BC employees shall be permitted only when accompanied by a qualified personnel after notification and approval of the appropriate facility personnel.

3.4.12 Lockout/Tagout

Lockout/tagout (LO/TO) procedures in accordance with 29 CFR 1910.147 will be performed before activities begin on or near energized or mechanical equipment that may pose a hazard to site personnel. The purpose of the lockout/tagout (LO/TO) system is to safeguard exposure from machinery,

energized electrical circuits, piping under pressure, or any type of energy source from unexpected energization or start up that could cause harm to an individual. Workers conducting the operation will positively isolate the piece of equipment, lock/tag the energy source, and verify effectiveness of the isolation. Only employees who perform the lockout/tagout procedure may remove their own tags/locks. Employees must be thoroughly trained before initiating this procedure.

Whenever multiple personnel (or multiple employers are working on the same worksite) are to be engaged in activities requiring LO/TO, employees/employers shall inform each other of their activities and coordinate their respective LO/TO procedures. When applicable, BC shall request an owner's representative to initiate the LO/TO procedure and apply the first lock. When initiated by others, BC will remove their locks prior to leaving a facility. Whenever a group lockout/tagout procedure must be performed, they shall utilize a procedure that affords the same level of protection as that provided by the implementation of a personal lockout or tagout device. Group LO/TO devices shall meet the requirements of 29 CFR 1910.145(f)(3).

Basic Lockout/Tagout Procedures

1. Each person will maintain their own lock, key, and lockout device so that no one else can remove the lock.
2. Always notify the operator when work is to be done.
3. Use your own lock to lock out electrical power. Attach a tag or sign to the power disconnect to indicate that maintenance work is in progress. Use the wording "Do Not Operate."
4. Bleed all pressure from pneumatic, hydraulic, or other fluid lines, or safely isolate them from the area where work is being done.
5. Drain contents of lines or tanks as needed. Lock valves open or closed to prevent buildup of pressure.
6. Ground electrical systems as needed.
7. Secure any device under tension or compression so as to prevent accidental movement. Move suspended parts that could drop or cycle to a safe position and block, clamp, or chain them in place.
8. Verify (test) that the mechanism has been isolated from the source of energy.
9. Ensure that all workers remove their individual locks after work is completed. The last worker should remove the locking devices.
10. Ensure that the last person double-checks that all is clear and safe before start-up.

Portable Equipment

Portable electrical equipment such as hand drills, computers, and power saws that use plug type connectors must be unplugged prior to any task that may expose the employee to energized portions of the equipment. Removal of the plug from the power source, such as the generator or wall socket, may be combined with a tagout system, particularly if the plug is at a distance from the equipment being repaired

3.4.13 Confined Spaces

Entry into confined spaces will be conducted in strict accordance with 29 CFR 1910.146. Confined spaces will be evaluated prior to entry to determine if hazards are present that could pose a risk to entrants. Before workers may enter a permit-required confined space, an entry permit must be completed by the PM or SSO, approved by the RSUM and, all requirements for entry must be met.

- Confined spaces may be described as having, but not being limited to, the following characteristics:

- is large enough to permit an employee to enter and perform work; and
- has limited or restricted means of entry and exit; and
- is not equipped, designed, or intended for continuous human occupancy.

If there is any serious health and safety hazard present in the confined space, the space is considered a permit-required confined space (permit space). A permit-space is a confined space that has one or more of the following characteristics:

- contains or has the potential to contain a hazardous atmosphere; or
- contains or has the potential to contain a material with the potential to engulf or entrap an employee; or
- is so configured that an employee may become trapped, disoriented, or asphyxiated by wall configurations or floors that taper to smaller cross sections; or
- contains any other established safety or health hazard (examples may include sources of energy, moving parts or thermal considerations).

All fluid, electrical, and steam lines and other sources of energy that could harm entrants must be completely isolated before entry. The following atmospheric conditions must be met before entry is permissible (air monitoring may be necessary to verify these conditions are met):

- flammable vapor or dust must be at a concentration less than 5 percent of the lower explosive limit (LEL); and
- oxygen must be at a concentration greater than 20 percent and less than 22 percent; and
- hydrogen sulfide concentration must be less than 5 parts per million (ppm); and
- toxic substances must be at a concentration less than half their respective permissible exposure limits or specified action limits.

In addition, the following roles must be designated before entry into permit-required confined spaces is allowed: Entry Supervisor; Attendant; and Authorized Entrant(s). Confined space entry for each project also requires training for the project team on written operating procedures, including the use of the Confined Space Entry Permit form.

BC employees are not trained in rescue services. Such services are to be arranged locally, prior to entry operations, by the PM. Rescue services can typically be provided by the local fire department or contracted service provider.

3.4.14 Fire/Explosion

Site workers should have an increased awareness concerning fire and explosion hazards whenever working with or near flammable materials, especially when performing any activity that may generate sparks, flame, or other source of ignition. Intrinsically safe equipment is required when working in or near environments with the potential for an explosive or flammable atmosphere. The SSO will verify facility requirements for a “hot work” permit before activities that may serve as a source of ignition are conducted.

Flammable materials will be kept away from sources of ignition. In the event of fire, work will cease, the area will be evacuated, and the local fire response team will be notified immediately. Only trained, experienced fire fighters should attempt to extinguish substantial fires at the Site. Site personnel should not attempt to fight fires, unless properly trained and equipped to do so. A fully charged ABC dry chemical fire extinguisher will be readily available for use during all scheduled activities at the Site.

3.4.15 Sharp Objects/Cutting Utensils

Frequently field tasks require the cutting of items such as rope, packaging or containers. Care should be exercised in using knives and/or cutting implements while performing such cutting tasks. Personnel should cut down and away from their body and other personnel. The item being cut should be braced or secured from movement while cutting. When slicing open acetate liners, such as those utilized in direct push drilling, personnel should use a hook blade cutting implement designed for this task versus a straight blade knife.

3.4.16 Cutting Acetate Sample Sleeves

The cutting of acetate sleeves presents a potential hazard to sampling personnel. By following proper procedures, the risk associated with this activity can be effectively minimized. To remove the soil sample the acetate liner must be cut with a bladed tool or knife. Knives are more frequently the source of disabling injuries than any other hand tool. The principal hazard in the use of knives is the hand slipping from the handle onto the blade or the blade strikes another part of the body. To prevent this, the following safety procedures should be followed:

- Provide a safety blade holder with a retraction spring on a track where blade mounts. Use a hook type linoleum blade which has a reduced cutting edge. When the hook of the blade is cutting the acetate liner it keeps the blade extended. If the blade breaks or the operator's hand slips the blade automatically retracts into the handle of the safety blade holder.
- Replace blades when they become dull. If material becomes hard to cut then the blade is dull.
- Wear leather cut-resistant (such as Kevlar) gloves.
- Wear safety glasses.
- The cutting stroke should be away from the body. If that is not possible, then the hands and body should be in the clear.
- Provide an angle iron device to place the liner in when cutting. This gives a holder for the liner.
- If you drop the knife, just let it fall to the ground and DO NOT try to catch it.
- If you lay the knife down, make sure the blade is retracted into the holder or the knife is placed in a protective holder.

3.4.17 Elevated Platforms / Working Surfaces

When working at heights that expose employees to falls greater than 6 feet, especially on sloping roofs and elevated platforms, the requirements of 29 CFR 1926.502 shall be observed. In such instances, a safety harness shall be worn and the lanyard secured at a level not lower than the employee's waist, limiting the free-fall distance to a maximum of 6 feet.

Elevated work platforms shall be constructed, used, and maintained in accordance with Subpart L of the OSHA Construction Safety Orders. Scaffolds and hoisting lines shall be inspected daily by a competent person to verify the integrity of the components. If a material is determined to be defective, it may not be used for any purpose and will be replaced immediately.

A standard railing shall consist of top rail, intermediate rail, toe board, and post. It shall have a vertical height of approximately 42 inches (±3 inches) from the top surface of the top rail to the floor, platform, runway, or ramp. The top rail shall have a smooth surface throughout. The intermediate rail shall be set half way between the top rail and the floor, platform, runway, or ramp.

A cover of standard strength and construction that is secured against accidental displacement shall guard floor holes, hatchways, or any other openings into which a person can walk. When the cover is not in place, the openings shall be guarded with a standard railing (equipped with a toe board) on all exposed sides. Any cover on floor openings shall be properly labeled or stenciled with letters at least one inch high or greater stating "OPENING – DO NOT REMOVE".

Personal Fall Protection Equipment

Full body harness is the only acceptable means of fall arrest for personnel working over surfaces greater than six feet in height. A Fall Arrest System consisting of safety harness and anchor lanyard must be worn by anyone working on elevated surfaces that lack "general" fall protection such as railings, etc.

Lanyards must be tied off at a point above the worker's head and to a firm structure or a portion thereof designed to hold a weight of 5,000 lbs. Only hooks with locking snaps that operate in "as new" condition will be used. These hooks are also referred to as "double action lanyard hooks".

When other possible means of fall protection (railings, etc.) are not available, individuals working at heights of less than 6 feet must tie-off if there is danger of impalement, especially if the impalement hazard cannot be mitigated in accordance with OSHA standards.

All workers must perform routine inspection of belts/harnesses and lanyards prior to their use. The employer shall conduct regular inspections (every three months) of all fall protection equipment. In addition, there shall be an inspection of all workers' personal tools and equipment prior to the employees using them on the job.

Lanyards are to be used for tie-off purposes only, and damaged belts, harnesses, and lanyards must be retired and discarded.

3.4.18 Ladder Use

Ladders are to be maintained in good condition at all times, with tight joints, hardware, and fittings securely attached, and moveable parts freely operating without binding or undo play. Defective ladders must be "tagged" out of service. Safety "feet" shall be kept in good condition. Ladders are to be visually inspected for possible signs of damage or defects daily, before each use.

Where possible, portable straight rung ladders shall be set up so that the horizontal distance from the top support to the foot of the ladder is ¼ of the working length of the ladder. The ladder shall be secured by tying it off to a firm point, or held in place by another worker while in use. If the ladder is used to gain access to a roof or platform, the side rails shall extend at least 3 feet beyond the point of support at the edge of the roof or platform.

Step ladders shall always be set up properly, so that they are in the "A" frame position, level and with all four feet on firm ground, and fully opened with the spreaders locked in place. Personnel are forbidden to stand on the top cap or on the last step of a step ladder, or to stand on the hinged back of a step ladder. A step ladder shall never be used at a straight ladder.

3.4.19 Traffic

Vehicular traffic presents opportunities for serious injury to persons or property. Traffic may consist of street traffic or motor vehicles operated by facility employees or visitors to the Site. Workers and other pedestrians are clearly at risk during periods of heavy traffic. Risk from motor vehicle operations may be minimized by good operating practices and alertness, and care on the part of workers and pedestrians.

Site personnel will wear high-visibility traffic safety vests whenever activities are conducted in areas of heavy traffic. Work vehicles will be arranged to be used as a barrier between site workers and nearby traffic. If required by local ordinances or site location, a traffic control plan will be developed and implemented. Consider using amber/yellow warning lights to alert traffic to the work zone. Note that amber/yellow warning lights may be required by specific clients or ordinances.

It is important to be conscious of all vehicular traffic that may be present during conduct of field operations. Use caution tape, barricades, or safety cones to denote the boundaries of the work area and to alert vehicle operators to the presence of operations which are non-routine to them. Be careful when exiting the work area and especially when walking out from between parked vehicles to avoid vehicular traffic.

Never turn your Back on Traffic. When working in or near a roadway, walk and work with your face to the oncoming traffic. If you must turn your back to traffic, have a coworker watch oncoming traffic for you.

Vehicle and Worksite Position. Whenever possible, place a vehicle between your worksite and oncoming traffic. Not only is the vehicle a large, visible warning sign, but if an oncoming car should fail to yield or deviate, the parked vehicle, rather than your body, would absorb the first impact of a crash. Turn the wheels so that if the vehicle were struck, it would swing away from the worksite. Even though the vehicle would protect you in a crash, it might be knocked several feet backward. Always leave some room between the rear of the vehicle and the work area.

Use of Signs and Cones to Direct Traffic. Traffic signs and cones are used to inform drivers and direct traffic away from and around you. Cones and signs are only effective if they give oncoming drivers enough time to react and make it clear how traffic should react.

Cone Positioning. The most common coning situation is setting a taper of cones that creates a visual barrier for oncoming motorists and gradually closes a lane.

The position of the taper depends on the road width, position and size of the work area, and also on the characteristics of the traffic.

3.4.20 Driving

A lot of driving is required to get to, from, and between project Sites. Safe vehicle maintenance and operation must be a priority. It requires knowledge of directions to (and conditions of) the Site in advance, careful exiting and merging into traffic, anticipating the unexpected, remaining alert to one's physical and mental condition, resisting distractions such as cell phone use, other car activities and contacting assistance when needed. Report all vehicle collisions/incidents to BC's Risk Manager.

3.4.21Arc Flash Protection

An arc flash is a short circuit through the air when insulation or isolation between electrified conductors is breached or can no longer withstand the applied voltage. Statistics show that there are 5 to 10 arc flash explosions a day near electrical equipment that result in hospitalization of a burn victim. An arc flash can be caused by common occurrences such as dropping tools, accidental contact with electrical systems, and build up of dirt or corrosion.

The temperature of an arc can reach more than 35,000 F as it creates a brilliant flash of light and a loud noise. Concentrated energy explodes outward from the electrical equipment, spreading hot gases, molten metal, causing death or severe burns, and creating pressure waves that can damage hearing or brain function and a flash that can damage eyesight. The fast-moving pressure wave also can send loose material such as pieces of equipment, metal tools, and other objects flying, injuring anyone standing nearby.

Regulations require the calculation of the "flash protection boundary" inside which qualified workers must be protected when working. This boundary is an imaginary sphere surrounding the potential arc point, "within which a person could receive a second-degree burn if an electrical arc flash were to occur," according to the National Fire Protection Association (NFPA) 70E standard. Brown and Caldwell's Health and Safety Manual gives direction of when and where to establish this boundary.

BC's Electrical Safety/Arc Flash Policy provides information and instruction for BC employees who work on or near energized power circuits, electrical distribution equipment, electrical utilization equipment and those who inspect energized equipment, where a phase-to-ground or phase-to-phase short or fault occurrence may cause an Arc Flash event.

BC employees must comply with BC's Electrical Safety and Lock-Out/Tag-Out Policy in the Health and Safety Manual and treat electrical equipment and circuits as energized until:

1. Lock-Out/Tag-Out protection is in place and the equipment or circuit has been tested to verify "no voltage" present, by a trained and qualified electrical worker, or
2. The equipment or circuit has been physically isolated from every power source, tested, and clearly labeled.

For those BC employees involved with energized electrical work (i.e. design verification, equipment check-out, or start-up adjustments), the following ordered approach must be used:

1. BC employees will seek to have a trained and qualified electrical worker perform all energized electrical hands-on work (i.e. switching, metering, testing, etc.) while BC employees remain outside the flash protection boundary, with the exception of those BC employees who have completed NFPA 70 E and have appropriately planned, including appropriate PPE, for the task.
2. BC employees that closely supervise work within the flash protection boundary should document the possible electrical hazards, appropriate PPE, and mitigation techniques to be implemented during the project with a detailed project work plan attached to this plan's appendices. The Electrical Safety Officer (ESO) or similarly qualified person must approve all project work plans with identified shock or arc flash hazards.
3. Prior to performing this work, the Project Manager (PM) will verify that the above-mentioned project work plan is prepared and approved and reviewed by the PM, the project field team, the SSO, and cognizant Health and Safety Manager.
4. Only BC employees with NFPA 70E Qualified Person training shall enter the flash protection boundary wearing the proper Personal Protective Equipment (PPE) and only for Hazard/Risk Categories 0-2 – see the 'Warning' section below.

WARNING

Qualified BC personnel are limited to work in Hazard/Risk Categories 0-2, and therefore only require PPE meeting the requirements of Hazard/Risk Categories 0-2.

Only qualified electricians may conduct work categorized as a Hazard/Risk Category of 3 or 4.

Qualified BC personnel are NOT to cross a flash protection boundary which involves a Hazard/Risk Category 3 or 4 situation.

BC employees and management shall review the Arc Flash policy in BC's Health and Safety Manual for detailed requirements.

Questions concerning this policy should be directed to the BC Electrical Safety Officer RSUM.

Definitions

Energized Electrical Work. Work performed on or near energized electrical systems or equipment with exposed components operating at 50 volts or greater. Electrical system testing, thought to be de-energized, but not yet proven to be (for example, a LO/TO effectiveness check).

Flash Protection Boundary. The distance from energized exposed electrical equipment at which an unprotected person will receive a curable burn: 2nd degree burn or blistering. Work performed inside this boundary requires that the person be a "qualified person" and the use of appropriate personal protective equipment (PPE) to protect against arc flash burns.

Newly installed/serviced electrical equipment may contain an Arc Flash Label that will identify the energy, hazard category and PPE requirements associated with the equipment. For all other unlabeled equipment, where the specific flash protection boundary (energy, hazard category, and applicable PPE) is not established or cannot be established first (prior to live electrical exposure), BC personnel must maintain a 4-foot minimum observation distance (10 feet is preferred) from the exposed (i.e. doors open, covers off) live electrical equipment rated 600V and below. In the event that the flash protection boundary must be crossed, qualified BC personnel will don PPE appropriate for Hazard/Risk Category 2. For equipment rated above 600V, BC personnel must maintain a 10-foot minimum observation distance and not enter the flash protection boundary unless qualified and approved to do so.

Qualified BC Employee. A person with the training and experience having knowledge of energized electrical equipment hazards from an operational standpoint and from the safety training standpoint.

Educational credentials alone do not make a person qualified. Determination of qualification must be established by the employee's supervisor or other designated knowledgeable management representative.

3.4.22 Boating Safety

Boating or similar activities on aerated water treatment ponds and/or tanks by BC personnel is not permitted. The aeration process affects the buoyancy of the liquid and therefore boats can not consistently stay afloat.

Performing work activities from a boat can present unique hazards to employees. The following guidelines can help mitigate the risk. The boat can become unstable if the weight in it is excessive or loaded improperly. Too much weight will reduce maneuverability and freeboard (the height of the boat sides above the water) and can increase the risk of sinking.

When boarding the boat, the operator must be sure that the boat is secure. With one hand on the boat, each employee should quickly lower themselves straight down into the center of the boat. A United States Coast Guard (USCG) certified personal floatation device will be worn by each BC employee in the boat. In addition, other USCG-required items (i.e., throwable cushion, retrieval line, etc.) will be present on the boat. To move around in a boat, one should step along the fore-and-aft centerline of the boat while the boat is held in place along the pier.

Do not board the boat while carrying equipment, rather first board the craft and then have someone hand in the equipment or place the equipment in the boat prior to launch The amount and location of weight is critical and can reduce the risk of capsizing. Weight should be kept towards the middle or centerline of the boat, both fore and aft and side to side, also the weight should be kept low to the bottom of the boat to reduce the center of gravity.

It is not anticipated that waves of substantial size will be encountered, however, if a wave approaches the boat, steer the bow towards the oncoming wave. Overloading the boat increases draw and the potential for swamping. Watercraft must be operated within the boat manufacturers weight limits.

Should the boat capsize, Brown and Caldwell personnel shall abandon the boat and return to shore as quickly as possible. It is important that the employees attempt to remove themselves from the water as soon as possible, and get inside and call for help. Hypothermia (cold stress) is a significant risk for anyone involved in a boating mishap due to the rapid conduction of body heat by cold water. Wet or dry suits are recommended for cold weather/cold water (less than 45° F) operations.

3.4.23 Water Hazards (non-boating activities)

Wading in streams poses a few natural hazards such as uneven terrain, and potentially dangerous water levels. Field work should be halted when there has been significant rainfall within the past 24 hours or during the course of a work day. The potential for rapidly rising water levels is present in many of these streams/rivers within the project area. SSO shall evaluate field conditions after a rainfall and halt field work if there is the possibility of the development of a hazardous condition.

Open Water

Streams or stormwater ditches may be located near freeways and highways. High stream flows commonly associated with storm events present a threat to workers. Slippery conditions, streamside vegetation, and unstable stream banks could cause a worker to fall into a stream. The risks of a fall include bodily injury, hypothermia and drowning. Work in and around streams will require the use of the buddy system for safety purposes. During storm events that cause streams and rivers to rise to dangerously high conditions, employees should discontinue their work until safe working conditions resume. Prior to entering water, employees must evaluate the need to wear PFDs, rubber boots, or waders and use them as is deemed necessary based on conditions present. Some factors to consider when evaluating the need to wear a PFD are stream current speed, stream bed material (e.g. slippery stones vs. small gravel/sand), water depth, and how far out from the bank the employee will be required to go into the stream.

Changing Water Levels

When precipitation falls in the area, water levels within the stream may change quickly. Rising water levels may be dangerous. All personnel should exit the stream once wet weather has occurred in the area. If the forecast calls for rain, the group should meet and discuss alternative activities that may be planned for the day. After a rain, the SSO must evaluate field conditions and halt field work if there is the possibility of the development of a hazardous condition. When walking in the stream, efforts will be made to walk in the shallow and/or slower moving parts of the stream whenever possible.

3.4.24 Building Collapse

Buildings collapse for a variety of reasons. Natural phenomena such as earthquakes, hurricanes, floods, mudslides, avalanches, and storms are the usual cause for building collapses. Vacant buildings may be at risk for collapse since maintenance-related activities have been often neglected thus resulting in structural damage.

Project personnel should attempt to answer the following questions whenever working near suspect building structures:

- Are there any vacant buildings present on site?
- Will it be necessary to enter or work next to the vacant building(s)?
- Are there any apparent hazards including external damage, falling objects, sticky doors, structural instability, or possible asbestos and/or lead paint?

  - External damage may include, but not necessarily be limited to, foundation cracks, damaged or missing porch roofs and overhangs, supports, gaps between steps and the structure, missing supports or portions of walls, and “washed away” ground.
  - Falling objects may include, but not necessarily be limited to, building cornices, gutters, bricks, and roofs/roofing materials.
- Be aware that when entering a building, if the door sticks at the top it could mean the ceiling is ready to fall. If you force the door open, stand outside the doorway clear of falling debris.
- Has the building(s) been inspected by a qualified professional and deemed safe for entry?
- Are there any viable alternatives for conducting work that preclude the need to enter or work next to the suspect building(s)?

If you have any concerns about entering the building after answering the above questions, speak with the PM immediately. The client will need to be informed that a proper building inspection or engineering controls may be needed before work can be performed.

If you don't feel safe entering a building, notify the PM and RSUM and stay outside the building at an appropriate distance to avoid falling debris.

3.4.25 Removing/Replacing Manhole Covers

Manhole structures are the principal means of access into wastewater collection systems and into other underground utilities and facilities. In general, manhole entries are conducted to determine the physical conditions of manholes and pipelines, collect data, and for maintenance activities.

Removing and replacing manhole covers can present potential hazards (overexertion, struck by, caught between, contaminated air, traffic, etc.) to personnel. Therefore, personnel should always first seek to have client or contractor personnel remove and install the manhole cover whenever possible. If this is not possible, then BC personnel need to plan and carefully consider all the potential hazards and controls associated with the removal and installation. Hard hat, safety glasses, safety boots, and leather/cut-resistant gloves must be used when attempting to remove manhole covers.

When working in the vicinity of an open sewer manhole, air monitoring must be performed to verify that the atmosphere is safe for work activities. At no time are personnel to break the plane of the manhole with any part of their body. Where entry must be made, the requirements of the Confined Spaces section of this HASP must be complied with at all times (i.e. training, air monitoring, ventilation, permitting, rescue, etc.).

General Procedures for Removing/Replacing Manhole Covers

The following are general guidelines for the removal and replacement of manhole covers. Use procedures as they apply to the specific covers to be removed. Additional tools or different procedures may be necessary for a particular location.

Freeing the Manhole Cover

When the cover is stuck in its frame, remove any encrustation with a cold chisel. Next, place a block of wood on the cover near the rim and hit the block of wood with a heavy hammer. Do this at different points around the rim until the cover has loosened.

Unseating the Manhole Cover

Lift the cover with the Hook and Lifter tool. Next, attach the hook and lifter tool to the outer edge/rib before trying to move the cover. Unseat the cover, about four inches, by pulling and lifting with a fluid motion.

Removing the Manhole Cover

Evaluate the area surrounding the manhole cover to be removed and verify conditions that could present a hazard during removal have been properly mitigated. Use proper body mechanics – using the leg and arm muscles to lift and pull the cover – don't use your back.

With your feet properly positioned evenly apart and footing secure, pull the cover clear of the frame. Once clear of the frame keep pulling the cover with a steady motion and remove it from the work area. Potential pinch points exist to the hands, fingers, and feet. Never place your hands, fingers, or feet under the manhole cover. Whenever possible, have someone assist with the removal and replacement of the manhole cover.

Replacing the Manhole Cover

Stand parallel to the desired direction of travel for moving the manhole and check the cover frame of the manhole to make sure it is free of any obstructions or debris.

Place the point of the Hook and Lifter tool under the edge of the cover, lift slightly, and drag the cover toward its frame.

Move to the opposite side of the cover and repeat the lifting and dragging motion.

Continue alternating the lifting and dragging until the cover is partially over the manhole frame.

With the hook, lift the edge that is farthest from the opening until the cover slides into the frame of the manhole.

Check the cover for proper seating in the manhole cover frame.

3.4.26 Personal Safety - Urban Setting

Working in a distressed neighborhood may present hazards associated with street violence or other crime. In these situations, mental preparation before going to the Site and awareness while on Site are of key importance. If in doubt, always ask Site or client personnel about the safety of a neighborhood. Forethought should be given to arranging to work during daylight hours if possible. Take advantage of any Site security measures (monitoring cameras, security guards) and investigate such measures prior to the field work. Once in the field, work in parties of two or more and stay within view of the general public. Keep a charged cell phone nearby or on your person at all times. Become familiar with your location so you can effectively communicate it over the phone.

In addition to these basic principals, the following is a list of common personal safety rules that apply not only to work at the Site, but to general safety practices while in the field and also between work shifts:

- If at all possible, work/travel in groups. Do not venture out alone.
- Be alert. Notice who passes you and who's behind you. Maintain distance between yourself and strangers. Know where you are, and note potential exit paths.
- If work has paused, do not appear slack or distracted. Do not sit in a vehicle with the doors unlocked.
- Walk in well-lighted areas. Don't walk close to bushes, alleys, and so on. In dark or deserted neighborhoods, walk down the middle of the street (be alert to vehicle traffic).
- If a car pulls up slowly, or the occupants of the vehicle bother you, cross the street and walk or run in the other direction. If you are pursued, dial 911.
- If you feel someone is following you, turn around and check. Proceed to the nearest lighted house or place of business.

- Don't overburden yourself with bags or packages, which might impede running or taking care of yourself.
- Be aware of loose clothing, packs/purses and hair. These give an assailant an easier method of grabbing and controlling you. Wear unrestrictive clothing for ease of movement (but not overly loose).
- Carry a non-weapon personal safety device (such as a whistle, panic button, or key light) - anything that could visually or audibly draw attention to your location.
- What you carry in your hand(s) is important. Valuables make you a potential target. Items such as a hand auger or tool may help you be perceived as a less-than-inviting victim.
- Carry as little cash as possible.
- Hold your purse tightly, close to your body. Keep your wallet in a front or in a buttoned, hip pocket. When at a fixed location, lock your valuable items away and out of site (i.e., in a trunk).
- Be careful when people stop you for directions or information. Always reply from a distance; never get too close to a stranger's car.
- If you feel that you are in danger, don't be afraid to scream and run.
- Toss wallet/keys away from direction of escape.
- Don't attach car keys to house keys.
- Leave large valuables (purse, laptop) locked and hidden in the vehicle.

3.5 Natural Phenomena

Natural phenomena such as weather-related emergencies and acts of nature can affect employees' safety. Natural phenomena can occur with little or no warning. If an emergency situation arises as a result of natural phenomena, adhere to the contingency procedures outlined in Section 10. The following natural phenomena have been identified and may be encountered during scheduled field activities.

- ☒ Sunburn
- ☒ Cold Stress
- ☒ Hurricanes/Nor' Easters
- ☐ Earthquakes
- ☒ Heat Stress
- ☒ Lightning/Electrical Storms
- ☒ Tornados and Strong/Straight Line Winds
- ☒ Flooding

3.5.1 Sunburn

Working outdoors with the skin unprotected for extended periods of time can cause sunburn to the skin. Excessive exposure to sunlight is associated with the development of skin cancer. Field staff should take precautions to prevent sunburn by using sunscreen lotion and/or wearing hats and long-sleeved garments.

3.5.2 Heat Stress

Climate conditions, particularly heat, are important considerations in planning and conducting site operations. Heat-related illnesses range from heat fatigue to heat stroke, with heat stroke being the most serious condition. Workers should be trained and aware of signs and symptoms of heat-related illnesses, as well as first aid for these conditions. These are summarized in the table below. The SSO and site workers will monitor each other for signs of heat stress. If an employee exhibits signs or symptoms of heat-related illness, the SSO, or designee, must be notified and the appropriate response procedures initiated.

Heat Related Illness			
Condition	Signs	Symptoms	Response
Heat Rash or Prickly Heat	Red rash on skin.	Intense itching and inflammation.	Increase fluid intake and observe affected worker.
Heat Cramps	Heavy sweating, lack of muscle coordination.	Muscle spasms, and pain in hands, feet, or abdomen.	Increase fluid uptake and rest periods. Closely observe affected worker for more serious symptoms.
Heat Exhaustion	Heavy sweating; pale, cool, moist skin; lack of coordination; fainting.	Weakness, headache, dizziness, nausea.	Remove worker to a cool, shady area. Administer fluids and allow worker to rest until fully recovered. Increase rest periods and closely observe worker for additional signs of heat exhaustion. If symptoms of heat exhaustion recur, treat as above and release worker from the day's activities after he/she has fully recovered.
Heat Stroke	Red, hot, dry skin; disorientation; unconsciousness	Lack of or reduced perspiration; nausea; dizziness and confusion; strong, rapid pulse.	Immediately contact emergency medical services by dialing emergency medical services. Remove the victim to a cool, shady location and observe for signs of shock. Attempt to comfort and cool the victim by administering small amounts of cool water (if conscious), loosening clothing, and placing cool compresses at locations where major arteries occur close to the body's surface (neck, underarms, and groin areas). Carefully follow instructions given by emergency medical services until help arrives.

The effects of ambient temperature can cause physical discomfort, loss of efficiency, and personal injury, and can increase the probability of mishaps. In particular, protective clothing that decreases the body's ventilation can be an important factor leading to heat-related illnesses.

To reduce the potential for heat-related illness, workers are encouraged to drink plenty of water/fluids to stay properly hydrated. in addition, a work schedule will be established that will provide sufficient rest periods for cooling down (at least five minutes when workers feel the need to do so) and have access to shade from the sun (which, in addition to natural shade or canopies, includes resting inside a vehicle with the air conditioner running). Personnel must maintain an adequate supply of non-caffeinated drinking fluids on site for personal hydration – a minimum of one quart of water per employee per hour.

3.5.3 Cold Stress

Workers performing activities during winter and spring months may encounter extremely cold temperatures, as well as conditions of snow and ice, making activities in the field difficult. Adequate cold weather gear, especially head and foot wear, is required under these conditions. Workers should be aware of signs and symptoms of hypothermia and frostbite, as well as first aid for these conditions. These are summarized in the table below.

Cold Stress Symptoms and Response			
Condition	Signs	Symptoms	Response
Hypothermia	Confusion, slurred speech, slow movement.	Sleepiness, confusion, warm feeling.	Remove subject to a non-exposed, warm area, such as truck cab; give warm fluids; warm body core; remove outer and wet clothing and wrap torso in blankets with hot water bottle or other heat source. Get medical attention immediately.
Frostbite	Reddish area on skin, frozen skin.	Numbness or lack of feeling on exposed skin.	Place affected extremity in warm, not hot, water, or wrap in warm towels. Get medical attention.

Cold Stress Symptoms and Response			
Condition	Signs	Symptoms	Response
Trench Foot	Swelling and/or blisters of the feet	Tingling/itching sensation; burning; pain in the feet	Remove wet/constrictive clothing and shoes. Gently dry and warm feet with slight elevation. Seek medical attention.

3.5.4 Lightning/Electrical Storms

Lightning can be unpredictable and may strike many miles in front of, or behind, a thunderstorm. Workers will therefore cease field operations at the first sign of a thunderstorm and suspend activities until at least 30 minutes after the last observed occurrence of lightning or thunder. For purposes of this HASP, signs of a thunderstorm will include any visible lightning or audible thunder.

In the event of a thunderstorm, field personnel will take the following actions:

- Get inside a permanent building structure (not a shed or canopy) or fully enclosed metal vehicle (not a convertible or camper shell) with the windows fully up.
- If in a house or building, do not use the telephone or any electrical appliance that's connected to the building's electrical wiring.
- Stay away from tall isolated objects, such as trees, drill rigs, telephone poles, or flag poles.
- Avoid large open areas, such as fields or parking lots, where a person is the relatively highest object.
- Stay away from lakes, ponds, railroad tracks, fences, and other objects that could transmit current from a distant lightning strike.
- If caught out in the open without time to escape or find shelter, seek a low area (if time permits), crouch down, and bend forward holding the ankles. Tuck the head so that it's not the highest part of the body, without letting it touch the ground. Under no circumstances lay down.

If a person is struck by lightning contact emergency medical services, even if he/she appears only stunned or otherwise unhurt as medical attention may still be needed. Check for burns, especially at fingers and toes, and areas next to buckles and jewelry.

3.5.5 Hurricanes/Nor' Easters

The key to responding to hurricane conditions is being informed. Before taking to the roads to leave for or from a jobsite during suspect hurricane conditions, listen to the radio for current and forecast conditions. Know what the weather reports mean by "watch" and "warning." A hurricane watch means hurricane conditions are possible in the specified area of the watch, usually within 36 hours. A hurricane warning indicates hurricane conditions are expected in the specified area of the warning, usually within 24 hours.

If watch or warning conditions exist, employees will communicate with the project manager to determine the appropriate course of action. Travel to or from work is not recommended if the employee will travel in the vicinity of a hurricane warning area. Restrictions on travel during hurricane watches are largely dependent on the actual weather conditions at the time. Employees are discouraged from driving during weather conditions where visibility and vehicle control are severely limited.

Nor'easters have the potential to cause as much damage as hurricanes, with powerful winds, rain or snow and large waves. They can pound and erode beaches with heavy surf, affect inland areas with flooding, or coat the land with thick layers of ice and snow.

Nor'easters result from the counterclockwise rotation of a low pressure system and the clockwise rotation of a high pressure system, combining to bring wind and moisture to the northeast. The nor'easter's ferocity will depend on the strength of the two systems.

One reason nor'easters are so dangerous is that they tend to move much more slowly than hurricanes. That slow movement allows the storm's effects to accumulate in a given area.

A nor'easter's wind circulation can cause tidal waters in back bays to be held in place, and not allow the water to drain through inlets and into the ocean. The accumulation of more and more water in tidal areas can cause widespread flooding.

Nor'easters can occur all year long, but are primarily a risk between September and April.

In the event of a hurricane or nor' easter, be prepared by:

- Checking NOAA Weather Radio All Hazards, your local radio and TV stations (i.e, The Weather Channel) for updates, watches, warnings or emergency instructions.
- Know the Coastal Evacuation Route for coastal areas or an inland area with chronic flooding.

For long term projects with temporary or permanent office area, keep an emergency preparedness kit consisting of, but not limited to:

- Current project/office contacts list – (how to reach folks in an emergency),
- Blankets,
- Flashlights,
- Radio (operated by batteries),
- Batteries for flashlight and radio (note: batteries should be replaced annually to assure freshness) ,
- Water (unless there is a water bubbler that can be used with no electricity), and
- Snack crackers, dried fruit, etc. - a source of food that won't go bad.

3.5.6 Tornados and Strong/Straight Line Winds

Tornados and strong or straight line winds are potentially dangerous weather conditions because both have the ability to generate on very short notice (in some cases under one hour from clear weather conditions). Tornados and strong or straight line winds both have the same warning properties and recommendations. If a tornado "watch" is issued for your area, it means that a tornado is "possible". If a tornado "warning" is issued, it means that a tornado has actually been spotted, or is strongly indicated on radar, and it is time to go to a safe shelter immediately.

Be alert to what is happening outside, but do not place yourself in jeopardy by standing next to windows. Some common observations during a tornado include: a sickly greenish or greenish-black color to the sky; if there is a watch or warning announced or posted; an abrupt fall of hail (however, hail can occur in the absence of a tornado); a strange quiet that occurs within or shortly after a thunderstorm; clouds moving by very fast, especially in a rotating pattern or converging toward one area of the sky; a sound like a waterfall or rushing air at first, but turning into a roar as it comes closer (the sound of a tornado has been likened to that of both railroad trains and jets); debris dropping from the sky; an obvious "funnel-shaped" cloud that is rotating; or debris such as branches or leaves being pulled upwards, even if no funnel cloud is visible.

During a tornado warning or tornado occurrence, each employee is instructed to do the following:

- Proceed to interior rooms and halls on the lowest floor (do not use an elevator to exit an upper floor). Avoid halls that open to the outside in any direction. If there are no interior hallways, avoid those that open to the southwest, south, or west, since that is usually the direction from which the tornado will come.
- Stay away from glass, both windows and doors. Crouch down, and make as small a "target" as possible. If you have something with which to cover your head, do so, otherwise, use your hands.

- Exercise extreme caution when leaving your area of shelter. Be aware of potential hazards (i.e., natural gas smell, smoke, fire). In the event these hazards are encountered in your area of shelter, immediately evacuate the shelter. If the building/shelter has been damaged by a tornado, do not flush the toilets, as the sewer lines may have been damaged.
- If you are traveling in an automobile and can see a tornado, do not stay in your car and try to outrun a tornado. If possible, stop the car and enter the nearest business and seek shelter.
- If you are outside and it is not possible to get inside, seek a low lying ditch, culvert, etc. and keep your body as low to the ground and as braced as possible.

3.5.7 Earthquakes

Earthquakes strike suddenly, violently, and without warning. If your project is located near a fault line, earthquakes are an unpredictable possibility. For long term projects with temporary or permanent office area, keep an emergency preparedness kit consisting of, but not limited to:

- Current project/office contacts list - how to reach folks in an emergency,
- Blankets,
- Flashlights,
- Radio (operated by batteries),
- Batteries for flashlight and radio (note: batteries should be replaced as needed to assure freshness),
- Water (unless there is a water bubbler that can be used with no electricity), and
- Snack crackers, dried fruit, etc. - a source of food that won't go bad.

This kit is meant to serve as overnight survival in the event that it becomes unsafe to leave the project site. The kit's contents should be suited to meet the size and needs of your project. If you feel the earth shaking, consider the following tips:

- Drop down; take cover under a desk or table and hold on.
- Stay indoors until the shaking stops and you are sure it is safe to exit.
- Stay away from bookcases, shelves, or anything that could fall on you.
- Stay away from windows.
- If inside a building, expect fire alarms and sprinklers to go off during the quake.
- If you are outdoors, find a clear spot away from buildings, trees, and power lines. Drop to the ground and cover your head.
- If you are in a car, slow down and drive to a clear place, preferably away from power lines. Stay in the car until the shaking stops.

3.5.8 Flooding

Flooding may occur at or en-route to and from the Site and may be the result of weather conditions or due to thawing of ice and snow (especially in the Spring).

In the event flooding starts to occur:

- Stay tuned to NOAA Weather Radio All Hazards, your local radio and TV stations (i.e., The Weather Channel) for updates, watches, warnings or emergency instructions.
- Know the Coastal Evacuation Route for coastal area or an inland area with chronic flooding
- If the waters start to rise inside before you have evacuated, retreat to higher ground, including the roof. Use cell phone or land line to call for help. Take a flashlight and a portable radio. Then, wait for help. Don't try to swim to safety; wait for rescuers to come to you.

- Avoid flooded areas. Do not attempt to cross any flooded areas in a vehicle or on foot. Flood waters may be deeper than they look.
- Avoid low-lying areas like ditches, creeks, and rivers.
- Before entering or re-entering a building, check for any signs of structural damage.
- When entering a building, do not use matches, lighters, or open flame. Use a flashlight only.
- After a flood, steps and floors are often slippery with mud and covered with debris, including nails and broken glass. Be careful walking around.

3.6 Biological Hazards

The following biological hazards have been identified and may be encountered during scheduled field activities.

- ☐ Bloodborne Pathogens/Sanitary Waste
- ☒ Reptiles/Snakes
- ☒ Mosquitoes
- ☒ Spiders/Scorpions
- ☒ Chiggers
- ☒ Rodents and Mammals
- ☒ Venomous Insects
- ☐ Fire Ants
- ☒ Ticks
- ☒ Poisonous Plants

If any biological hazards are identified at the Site, workers in the area will immediately notify the SSO and nearby personnel.

3.6.1 Bloodborne Pathogens/Sanitary Waste

Potential exposure to bloodborne pathogens may occur during some work activities (e.g., sewer video surveys or source sampling), rendering first aid or CPR. Direct contact is an important route of exposure for bloodborne pathogens due to puncture injuries, contact with abraded skin, or contact with areas such as the eyes, without appropriate protection. While very few organisms can enter the body through normal intact skin, direct contact with sewage, blood and body fluids is to be avoided. Site personnel should thoroughly wash their hands and face before eating, drinking or smoking and before leaving the work site.

Exposure controls and Universal Precautions are required at suspect locations, in order to prevent contact with blood or other potentially infectious materials as specified in Brown and Caldwell's Bloodborne Pathogens Program. All blood or other potentially infectious material will be considered infectious regardless of the perceived status of the source individual. A Hepatitis B vaccination will be offered to BC personnel before the person participates in a task where direct exposure to potentially infectious materials is a possibility (i.e., first aid or CPR). For personnel who have potential exposure to sanitary wastes, a current tetanus/diphtheria inoculation or booster is recommended.

3.6.2 Rodents/Mammals

Animals may potentially carry the rabies virus or disease causing agents. Do not attempt to feed or touch animals. Feces from some small mammals may contain diseases such as Hanta Virus. Avoid generating dust in the vicinity of rodent feces. In addition, animals such as dogs or wild predators (i.e., cougars or coyotes) may pose an attack hazard. Persons should slowly back away in a non-threatening manner if an encounter with a threatening animal occurs. In order to avoid such encounters, use the buddy system and make noise when working in areas where such animals may be present.

3.6.3 Reptiles/Snakes

The primary reptiles of concern are venomous snakes (rattlesnake, water moccasin, and copperhead). Avoid contact and areas that may harbor snake populations including high grass, shrubs, and crevices. In the event of a bite, immobilize the affected area and contact emergency medical services. If more than 30 minutes from emergency care, apply bandage wrap two to four inches above the bite (note: bandage should be loose enough to slip your finger underneath).

Wear shoes and heavy pants when walking and hiking in areas where snakes are likely found. Do not reach into rocky cracks, under logs, or large rocks. Even if a snake looks dead, do not touch it. A snake can still bite up to one hour after its death. Do not get near or tease a snake. Snakes are shy creatures and generally will not attack unless bothered.

Diamond Back Rattle Snake

Diamond backs are large snakes. They have a row of dark diamonds down the back and a rattle on their tail. These snakes have cat-like eyes and a pit between their nostril and eye. Eastern diamond backs like pine flat woods and scrub areas where palmetto thickets and gopher tortoise burrows are found. These snakes travel during the day and hide at night.

Timber Rattle Snake

Timber rattle snakes have a reddish-brown stripe running down the center of their back and black cross bands. Their tails are solid black with a rattle. These snakes have cat-like eyes and a pit between their nostril and eye. Timber rattlers live in damp river beds, pine flat woods, swamps, and cane thickets.

Pygmy Rattle Snake

These small snakes are light to dark grey in color. They have a tiny rattle. Pygmy rattle snakes have cat-like eyes and a pit between their nostril and eye. These snakes are found in lowland pine flat woods, prairies, around lakes, ponds, and swamps. Pygmy rattlers are aggressive and will strike anything within striking range.

Cottonmouth (Water Moccasin)

Young cottonmouths are often mistaken for copperheads because of their reddish-brown cross bands. As these snakes age, their cross bands darken until they become almost solid black. Cottonmouths live near water sources like lakes, streams, rivers, ponds, and swamps. When threatened, cottonmouths may coil and open their mouths as though ready to bite. The white inside of the mouth is what gives this snake its name, "cottonmouth".

Copperhead

Copperheads have dark coppery red-brown hourglass cross bands on a lighter brown color. The top of the head is covered with large plate-like scales. Copperheads have cat-like eyes and a pit between their nostril and eye. These snakes live in rocky, wooded areas and low, wet swampy areas. Copperheads are sluggish and rarely bite, unless stepped on or touched.

Coral Snake

The body of this snake is ringed with black, yellow and red bands. (Remember: Red on yellow can kill a fellow. Red on black, venom lack.) The head of a coral snake is black, while the tail is black and yellow.

3.6.4 Venomous Insects

Common examples include bees, fire ants and wasps. Avoid contact with insects and their hives. If stung, remove the stinger by gently scraping it out of the skin (do not use tweezers). If the worker is stung by an insect, immediately apply an ice pack to the affected area and wash area with soap and water and apply antiseptic. If an allergic reaction occurs, contact emergency medical services for appropriate treatment. Seek medical attention immediately if you are allergic to venomous stings such as bees or if anaphylaxis symptoms are present.

3.6.5 Mosquitoes

Mosquitoes may transmit diseases such as West Nile Virus. Symptoms of West Nile Virus include: fever, headache, tiredness, body aches, and occasional rash. Avoid mosquito bites by wearing long sleeved shirt and long pants. Apply insect repellent to clothes and/or skin (if FDA approved for topical use). Report any dead birds in the area to local health officials. Mosquitoes are most active from dusk to dawn.

3.6.6 Fire Ants

Red and Black Fire Ants are capable of inflicting numerous stings (7 to 9) per ant in a matter of seconds, and large numbers of fire ants will typically attack at the same time. Fire ants are very aggressive and will sting simply upon coming in contact with skin. Individuals who are allergic to bees should carry bee sting kits when there is the potential to come in contact with fire ants. Fire ants are predominantly located in the southern United States.

The best way to avoid fire ants is to avoid disturbing their mounds. Fire ant mounds are typically constructed in disturbed habitats such as open fields, along roadsides, lawns, and many other open sunny areas. The mounds are constructed of dirt and/or other organic materials. Mounds are typically 10” to 24” in diameter and approximately 18” in height. If you disturb a mound, get away from the mound immediately.

Fire ant stings typically leave tiny red blisters and sometimes white pustules. Symptoms of stings include blistering, burning, swelling, pain, and irritation of the affected area. Recommended treatment consists of antihistamines along with topical antibiotic cream. Anaphylaxis symptoms such as shortness of breath, discomfort, lowered heart rate, etc. may also accompany fire ant stings. Seek medical attention immediately if you are allergic to venomous stings such as bees or if anaphylaxis symptoms are present.

3.6.7 Spiders/Scorpions

The black widow and brown recluse spiders are the most venomous. Avoid contact with spiders and scorpions and areas where they may hide. They favor dark hiding places. Inspect clothing and shoes before getting dressed. Wear gloves and safety shoes when working with lumber, rocks, inspecting buildings, etc. Signs and symptoms of bites include: headache, cramping pain/muscle rigidity, rash and/or itching, nausea, dizziness, vomiting, weakness or paralysis, and convulsions or shock. Wash bite area with soap and water and apply antibiotic cream. Contact emergency medical services if allergic reaction or severe symptoms occur.

3.6.8 Ticks

Deer ticks may carry and transmit Lyme disease to humans. Signs of Lyme disease include a reddish “bulls-eye” around the affected area approximately a week after the bite. Symptoms include headache, fever, and muscle/joint pain. Persons suspecting infection should contact a health professional. Whenever possible, avoid areas likely to be infested with ticks during the spring and summer months.

Wear light-colored clothing so ticks can be easily spotted and removed. Wear long sleeves and pants and tuck pant legs into boots or socks. Apply insect repellents to clothing and skin (if FDA approved for topical application). Persons with long hair should tie their hair back to minimize the potential for ticks to nestle in the scalp.

Personnel should self perform tick checks once daily field work is completed. If a tick is embedded in the skin, use tweezers to grasp the tick's head (near the skin) and pull straight out. Consider saving the removed tick for laboratory analysis.

3.6.9 Poisonous Plants

Common examples include poison ivy, poison oak and poison sumac. Avoid contact. Long-sleeved shirts and pants will allow some protection against inadvertent contact. If contact occurs, immediately wash the affected area thoroughly with soap and water. If an allergic reaction occurs, seek the care of a medical professional.

Poison Ivy is a trailing or climbing woody vine or a shrub-like plant with leaves that are each divided into three broad, pointed leaflets. The leaflets are commonly dark glossy green on top and slightly hairy underneath. They produce small yellowish or greenish flowers followed by berry-like drupes.

Poison Oak is a member of the same family as poison ivy and has a very similar appearance. Poison oak has leaves divided into three leaflets and generally has three to seven distinct lobes. Typically they are a shrubby type plant that can grow to eight feet in height, or sometimes can be a climbing plant.

The best way to prevent exposure is the ability to recognize these plants. Conduct an initial survey of the area to determine if the plants are present in the work area, and avoid contact with them.

If plants are located and work must be conducted in that area, have the plants removed if possible. If this is not possible, wear long sleeved shirts, gloves, and a heavy material type pants. Remember not to touch contaminated clothing. There are products available that can be applied to exposed skin, (similar to sunscreen products) prior to working around the plants. Tyvek suits may be another option used at the wearer's discretion to keep poisonous plant oils from getting on clothing. Please note that using Tyvek suits may increase the risk of heat stress conditions so extra precautions should be taken such as more frequent breaks and drinking plenty of fluids

Section 4

Personal Protective Equipment

The purpose of PPE is to protect employees from hazards and potential hazards they are likely to encounter during site activities. The amount and type of PPE used will be based on the nature of the hazard encountered or anticipated. Respiratory protection will be utilized when an airborne hazard has been identified using real-time air monitoring devices, or as a precautionary measure in areas designated by the RSUM or SSO.

Dermal protection, primarily in the form of chemical-resistant gloves and coveralls, will be worn whenever contact with chemically affected materials (e.g., soil, groundwater, sludge) is anticipated, without regard to the level of respiratory protection required.

On the basis of the hazards identified for this project, the following levels of personal protective equipment (PPE) will be required and used. Changes to the specified levels of PPE will not be made without the approval of the SSO after consultation with the RSUM.

4.1 Conditions Requiring Level D Protection

In general, site activities will commence in Level D PPE unless otherwise specified, or if the SSO determines on site that a higher level of PPE is required. Air monitoring of employee breathing zones will be routinely conducted using real-time air monitoring devices to determine if upgrading to Level C PPE is necessary. Level D PPE will be permitted as long as air monitoring data indicate that airborne concentrations of chemicals of concern are maintained below the site-specific action levels defined in Section 5.2. Level A or B PPE is not anticipated and is therefore not addressed in this plan. If Level A or B PPE is necessary, this HASP will be revised to reflect changes as appropriate.

It is important to note that dermal protection is required whenever contact with chemically-affected materials is anticipated. The following equipment is specified as the minimum PPE required to conduct activities at the Site:

- Work shirt and long pants,
- ANSI- or ASTM-approved steel-toed boots or safety shoes,
- ANSI-approved safety glasses, and
- ANSI-approved hard hat (where required on-site or when overhead hazards are present);
- Outer nitrile gloves (11 mil or thicker) and inner nitrile surgical gloves when direct contact with chemically affected soils or groundwater is anticipated (nitrile surgical gloves may be used for collecting or classifying samples as long as they are removed and disposed of immediately after each sampling event).
- Hearing protection when working around heavy operating equipment or otherwise when noise exists such that you need to elevate your voice to speak to someone at arm's length.
- Sturdy work gloves.
- High-visibility traffic safety vest.

Other personal protection readily available for use, if necessary, includes the following items.

- Chemical goggles when in contact with chemical liquids can be reasonably expected or when handling corrosive chemicals. In addition, a face shield may be required to protect the face from splash hazards.
- Chemical-resistant clothing (e.g., Tyvek or polycoated Tyvek coveralls) when contact with chemically affected soils or groundwater is anticipated.
- Safety shoes/boots with protective overboots or knee-high PVC polyblend boots when direct contact with chemically affected soils is anticipated.

Work will cease and PPE upgraded if action levels specified in Section 5.2 are exceeded. The RSUM will be notified whenever PPE is upgraded or downgraded.

4.2 Conditions Requiring Level C Protection

If air monitoring indicates that the site-specific action levels defined in Section 5.2 are exceeded, workers in the affected area(s) will upgrade PPE to Level C. In addition to the protective equipment specified for Level D, Level C also includes the following items.

- NIOSH-approved half- or full-face air-purifying respirator (APR) equipped with appropriate cartridges (reference Section 5.2). Note: safety glasses are not required when wearing a full-face APR.

Respirators will be stored in clean containers (i.e., self-sealing bag) when not in use. Respirator cartridges will be replaced in accordance with the following change-out schedule.

Respirator Cartridge Replacement

Type of Cartridge	Cartridge Change-out Schedule
Particulate (i.e., HEPA)	At least weekly or sooner the employee detects an increase in breathing resistance. This will occur as the filter becomes loaded with particulate matter.
Sorbent (i.e., organic vapor)	At the end of each day's use or sooner if the employee detects an abnormal odor or other indicator.

Personnel who wear air-purifying respirators must be trained in their use and must have successfully passed either a qualitative or quantitative respirator fit test, and medical evaluation within the last 12 months in accordance with and 29 CFR 1910.134.

4.3 Stop Work Conditions

If air monitoring indicates that the site-specific action levels defined in Section 5.2 are exceeded, activities will cease, and personnel must evacuate the designated Exclusion Zone. The PM and RSUM will be contacted immediately.

Work will also cease if unanticipated conditions or materials are encountered or if an imminent danger is identified. The SSO will immediately contact the RSUM for consultation.

Section 5

Air Monitoring Plan

Real-time air monitoring devices will be used to analyze airborne contaminant concentrations approximately every 15 minutes in the workers' breathing zones while workers are in the designated Exclusion Zone, or when task or exposure conditions change (whichever frequency is less). If elevated concentrations are indicated, the monitoring frequency will be increased, as appropriate.

Background concentrations will be determined at the beginning of each work shift by collecting several instrument readings upwind of the scheduled activities. Alternatively, background levels can be determined by collecting readings from a nearby (upwind) area that can reasonably be considered unaffected by Site activities.

Real-time measurements will be made as near as feasible to the breathing zone of the worker with the greatest exposure potential in each active work area. If authorized by the RSUM, real time measurements may cease being taken when sufficient historical data is generated to warrant its cessation. Air monitoring will be reinstated if potential exposure conditions change.

The equipment will be calibrated daily, and the results will be recorded on BC's Air Monitoring Form. The results of air monitoring will also be recorded on the Air Monitoring Form and will be retained in the project files following completion of field activities. A copy of the Air Monitoring Form is located in Appendix A.

5.1 Monitoring Instruments

On-site worker exposure to airborne contaminants will be monitored during intrusive site activities.

5.1.1 Photoionization Detector and Flame ionization Detector

A calibrated photoionization detector (PID) with a lamp strength of 10.6 eV or flame ionization detector (FID) will be used to monitor changes in personnel exposure to volatile organic compounds (VOCs). The SSO, or designee, will perform routine monitoring during site operations to evaluate concentrations of VOCs in employee breathing zones. If VOCs are detected above predetermined action levels specified in Section 5.2, the procedures found in Section 4 of this HASP will be followed.

5.1.2 Real-Time Aerosol Monitor

A miniature real-time aerosol monitor (mini-RAM or equivalent) will be used to monitor exposure to airborne dusts. The SSO, or designee, will perform routine monitoring during site operations to evaluate concentrations of airborne dusts in employee breathing zones. If airborne dusts are detected above predetermined action levels specified in Section 5.2, the procedures found in Section 4 of this HASP will be followed.

5.1.3 Colorimetric Tubes

A hand-held Draeger pump along with Benzene Draeger tubes will be used to monitor changes in exposure to benzene during intrusive site activities. The SSO, or designee, will perform routine monitoring during site operations to evaluate the presence of benzene in employee breathing zones. If benzene is detected above predetermined action levels specified in Section 5.2, the procedures found in Section 4 of this HASP will be followed.

5.1.4 Combustible Gas and Hydrogen Sulfide Gas Monitoring

A multi-gas detector will be used to monitor changes in levels/exposure to combustible gases (lower explosive limit; LEL) and hydrogen sulfide gas during intrusive site activities. The SSO, or designee, will perform routine monitoring during site operations to evaluate concentrations of target compound in the vicinity of boreholes, test pits, sewers, or elsewhere, as necessary. If target compounds are detected above predetermined action levels specified below, work will cease and the Regional Safety Unit Manager will be contacted immediately.

5.2 Site Specific Action Levels

(Typical – to be approved by RSUM prior to mobilization and field implementation)

The following action levels were developed for exposure monitoring with real-time air monitoring instruments. Air monitoring data will determine the required respiratory protection levels at the Site during scheduled intrusive activities. The action levels are based on sustained readings indicated by the instrument(s). Air monitoring will be performed and recorded at up to 15-minute intervals.

If elevated concentrations are indicated, the monitoring frequency will be increased, as appropriate. If during this time, sustained measurements are observed, the following actions will be instituted, and the PM and RSUM will be notified. For purposes of this HASP, sustained readings are defined as the average airborne concentration maintained for a period of one (1) minute above established background levels.

5.2.1 Action Levels for Volatile Organic Compounds

Draeger tubes will be used to determine the presence or absence of benzene when PID/FID readings exceed 1 ppm.

VOC – Action Levels		
Activity	**Action Level**	**Level of Respiratory Protection**
Soil-intrusive activities	< 5 ppm above background (no benzene indicated)	Level D: No respiratory protection required. Note: For PID/FID values above 1 ppm, benzene is to be analyzed for with a colorimetric tube.
	5 to 25 ppm above background (no benzene indicated) or Benzene indicated < 1.0 ppm (colorimetric tube)	Level C: Half- or full-face air-purifying respirator fitted with organic vapor cartridges: Increase engineering control efforts and re-monitor effectiveness. Note: For PID/FID values above 1 ppm, benzene is to be analyzed for with a colorimetric tube. Contact Director and RSUM prior to respirator upgrade.

VOC – Action Levels		
Activity	**Action Level**	**Level of Respiratory Protection**
	> 25 ppm above background (no benzene indicated) or Benzene indicated > 1.0 ppm (colorimetric tube)	Cease operations and evacuate work area. Contact Director and RSUM and PM immediately.

5.2.2 Action Levels for Airborne Dust

Dust – Action Levels		
Activity	**Action Level**	**Level of Respiratory Protection**
Soil-intrusive activities	< 0.5 mg/m^3 above background	Level D: No respiratory protection required.
	0.5 to 2.5 mg/m^3	Level C: Half- or full-face air-purifying respirator fitted with HEPA (P-100) cartridges: Increase engineering control efforts and re-monitor effectiveness. Contact Director and RSUM prior to respirator upgrade.
	> 2.5 mg/m^3	Cease operations and evacuate work area. Contact Director and RSUM and PM immediately.

5.2.3 Action Levels for Hydrogen Sulfide and LEL

Hydrogen Sulfide and LEL – Action Levels		
Activity	**Action Level**	**Level of Respiratory Protection**
Not Anticipated for this Project	< 5 ppm H_2S < 5% LEL	Level D: No respiratory protection required.
	< 5 ppm H_2S < 5% LEL	Cease operations and evacuate work area. Contact Director and RSUM and PM immediately.

Section 6

Site Control Measures

The SSO will conduct a safety inspection of the work site before each day's activities begin to verify compliance with the requirements of the HASP. Results of the first day's inspection will be documented on the Site Safety Checklist. A copy of the checklist is included in Appendix B. Thereafter, the SSO should document unsafe conditions or acts, along with corrective action, in the project notes or field log book.

Procedures must be followed to maintain site control so that persons who may be unaware of site conditions are not exposed to hazards. The work area will be barricaded by tape, warning signs, or other appropriate means. Site equipment or machinery will be secured and stored safely.

Access to the specified work area will be limited to authorized personnel. Only BC employees and designated BC subcontracted personnel, as well as designated employees of the client, will be admitted to the work site. Personnel entering the work area are required to sign the signature page of this HASP, indicating they have read and accepted the health and safety practices outlined in this plan.

In some instances it may be necessary to define established work zones: an Exclusion Zone, a Contamination Reduction Zone, and a Support Zone. Work zones may be established based on the extent of anticipated contamination, projected work activities, and the presence or absence of non-project personnel. The physical dimensions and applicability of work zones will be determined for each area based on the nature of job activity and hazards present. Within these zones, prescribed operations will commence using appropriate PPE. Movement between zones will be controlled at checkpoints.

Considerable judgment is needed to maintain a safe working area for each zone, balanced against practical work considerations. Physical and topographical barriers may constrain ideal locations. Field measurements combined with climatic conditions may, in part, determine the control zone distances. Even when work is performed in an area that does not require the use of chemical-resistant clothing, work zone procedures may still be necessary to limit the movement of personnel and retain adequate site control.

Personnel entering the designated Exclusion Zone should exit at the same location. There must be an alternate exit established for emergency situations. In all instances, worker safety will take precedence over decontamination procedures. If decontamination of personnel is necessary, exiting the Site will include the decontamination procedures described in the following section.

Section 7

Decontamination Procedures

Decontamination will take place in the decontamination area identified on-Site. Workers, PPE, sampling equipment, and heavy equipment leaving the exclusion area will be inspected to determine the level of decontamination necessary to prevent the spread of potentially hazardous materials. Unnecessary equipment and support vehicles are to be left outside the designated Exclusion Zone so that decontamination will not be necessary.

Despite protective procedures, personnel may come in contact with potentially hazardous compounds while performing work tasks. If so, decontamination needs to take place using an Alconox or TSP wash, followed by a rinse with clean water. Standard decontamination procedures for levels C and D are as follows.

- equipment drop,
- boot cover and outer glove wash and rinse,
- boot cover and outer glove removal,
- suit removal,
- safety boot wash and rinse,
- inner glove wash and rinse,
- respirator removal,
- inner glove removal, and
- field wash of hands and face.

Site workers should employ only applicable steps in accordance with level of PPE worn and extent of contamination present. The SSO shall maintain adequate quantities of clean water to be used for personal decontamination (i.e., field wash of hands and face) whenever a suitable washing facility is not located in the immediate vicinity of the work area.

Disposable items will be disposed of in an appropriate container. Wash and rinse water generated from decontamination activities will be handled and disposed of properly. Non-disposable items (i.e., respirators) may need to be cleaned or sanitized before reuse. Each site worker is responsible for the maintenance, decontamination, and sanitizing of their own PPE.

Used equipment may be decontaminated as follows.

- Remove adhered materials (i.e., dirt or mud) to increase the effectiveness of the decontamination process.
- An Alconox or TSP and water solution may be used to wash the equipment.
- The equipment will then be rinsed with clean water until it is determined clean.

Each person must follow these procedures to reduce the potential for transferring chemically affected materials off site.

Section 8

Training Requirements

BC Site personnel, including subcontractors and visitors conducting work in controlled areas of the Site, must have completed the appropriate training as required by 29 CFR 1910.120. In addition, the SSO will have completed the 8-hour Site Supervisor course, have current training in first aid and CPR, and any additional training appropriate to the level of site hazards. Further site-specific training will be conducted by the SSO prior to the initiation of project activities. This training will include, but will not necessarily be limited to, emergency procedures, site control, personnel responsibilities, and the provisions of this HASP. Each employee will document that they have been briefed on the hazards identified at the site and that they have read and understand the requirements of this HASP by signing the H&S Plan Acknowledgement Form attached as Appendix C.

A daily morning briefing to cover safety procedures and contingency plans in the event of an emergency is to be included with a discussion of the day's activities. These daily meetings will be recorded on the Daily Tailgate Safety Meeting Form. A copy of the Daily Tailgate Safety Meeting Form is included in Appendix D.

Exception: When there is only one employee performing field activities for the project, a formal and documented daily tailgate safety meeting (or completion of the form) is not required. However, personnel are still expected to plan their work activities and attend any site specific safety meetings or training so that tasks are performed safely.

Section 9

Medical Surveillance Requirements

BC Site personnel, including subcontractors and site visitors, who will or may work in an area designated as an exclusion zone must have fulfilled the appropriate medical monitoring requirements in accordance with 29 CFR 1910.120(f). Each individual entering an exclusion zone must have successfully completed an annual surveillance examination and/or an initial baseline examination within the last 12 months.

Medical surveillance is conducted as a routine program for BC field staff in accordance with the requirements of 29 CFR 1910.120(f). There will not be any special medical tests or examinations required for staff involved in this project.

A Hepatitis B vaccination will be offered to BC personnel before the person participates in a task where direct exposure to potentially infectious materials is a possibility (i.e., first aid or CPR). For personnel who have potential exposure to sanitary wastes, a current tetanus/diphtheria inoculation or booster is recommended.

Section 10

Contingency Procedures

Minimum emergency equipment maintained on site will include a fully charged ABC dry chemical fire extinguisher, an adequately stocked first aid kit, and an emergency eyewash station (when corrosive chemicals are present). In addition, employees will consider maintaining the personal emergency supply items listed in Section 3: Natural Phenomena, as appropriate.

In the event of an emergency, site personnel will signal distress with three blasts of a horn (a vehicle horn will be sufficient), or other predetermined signal. Communication signals, such as hand signals, must be established where communication equipment is not feasible or in areas of loud noise.

It is the SSO's duty to evaluate the seriousness of the situation and to notify appropriate authorities. The first part of this plan contains emergency telephone numbers as well as directions to the hospital. Nearby telephone access must be identified and available to communicate with local authorities. If a nearby telephone is not available, a cellular telephone will be maintained on site during work activities. The operation of the cellular phone will be verified to confirm that a signal can be achieved at the work location.

The SSO, or designee, should contact local emergency services in the event of an emergency. After emergency services are notified, the PM and RSUM will be notified of the situation as soon as possible. If personal injury, property damage or equipment damage occurs, the PM and BC Risk Manager will be contacted as soon as practicable. An Incident Investigation Report will be completed within 24 hours by the SSO, or other designated person. A copy of the Incident Investigation Report is included in Appendix E.

10.1 Injury or Illness

If an exposure or injury occurs, work will be temporarily halted until an assessment can be made to determine it is safe to continue work. The SSO, in consultation with the RSUM, will make the decision regarding the safety of continuing work. The SSO will conduct an investigation to determine the cause of the incident and steps to be taken to prevent recurrence.

In the event of an injury, the extent and nature of the victim's injuries will be assessed and first aid/CPR will be rendered as appropriate. If necessary, emergency services will be contacted or the individual may be transported to the nearby medical center. The mode of transportation and the eventual destination will be based on the nature and extent of the injury. A hospital route map is presented at the front of this HASP.

In the event of a life-threatening emergency, the injured person will be given immediate first aid and emergency medical services will be contacted by dialing the number listed in the Critical Project Information section at the beginning of this plan. The individual rendering first aid will follow directions given by emergency medical personnel via telephone.

10.2 Vehicle Collision or Property Damage

If a vehicle collision or property damage event occurs, the SSO, or designee, will contact the BC Risk Manager for appropriate action.

10.3 Fire

In the event of fire, the alarm will be sounded and Site personnel will evacuate to a safe location (preferably upwind). The SSO, or designee, should contact the local fire department immediately by dialing 911. When the fire department arrives, the SSO, or designated representative, will advise the commanding officer of the location and nature of the fire, and identification of hazardous materials on site. Only trained, experienced fire fighters should attempt to extinguish substantial fires at the Site. Site personnel should not attempt to fight fires, unless properly trained and equipped to do so. Site personnel should not attempt to fight a fire if it poses a risk to their personal safety.

Note that smoking is not permitted in controlled areas (i.e., exclusion or contamination reduction zones), near flammable or combustible materials, or in areas designated by the facility as non-smoking areas.

10.4 Underground Utilities

In the event that an underground conduit is damaged during subsurface work, mechanized equipment will immediately be shut off and personnel will evacuate the area until the nature of the piping can be determined. Depending on the nature of the broken conduit (e.g., natural gas, water, or electricity), the appropriate local utility will be contacted.

10.5 Site Evacuation

The SSO will designate evacuation routes and refuge areas to be used in the event of a Site emergency. Site personnel will stay upwind from vapors or smoke and upgradient from spills. If workers are in an Exclusion or Contamination Reduction Zone at the start of an emergency, they should exit through the established decontamination corridors, if possible. If evacuation cannot be done through an established decontamination area, site personnel will go to the nearest safe location and remove chemically-affected clothing there or, if possible, leave it near the Exclusion Zone. Personnel will assemble at the predetermined refuge following evacuation and decontamination. The SSO, or designated representative, will count and identify site personnel to verify that all have been evacuated safely.

10.6 Spill of Hazardous Materials

If a hazardous material spill occurs, site personnel should locate the source of the spill and determine the hazard to the health and safety of site workers and the public. Attempts to stop or reduce the flow should only be performed if it can be done without risk to personnel.

Isolate the spill area and do not allow entry by unauthorized personnel. De-energize sources of ignition within 100 feet of the spill, including vehicle engines. Should a spill be of the nature or extent that it cannot be safely contained, or poses an imminent threat to human health or the environment, an emergency cleanup contractor will be called out as soon as possible. Spill containment measures listed below are examples of responses to spills.

- Right or rotate containers to stop the flow of liquids. This step may be accomplished as soon as the spill or leak occurs, providing it is safe to do so.
- Sorbent pads, booms, or adjacent soil may be used to dike or berm materials, subject to flow, and to solidify liquids.
- Sorbent pads, soil, or booms, if used, must be placed in appropriate containers after use, pending disposal.
- Contaminated tools and equipment shall be collected for subsequent cleaning or disposal.

Section 11

Documentation

The implementation of the HASP must be documented on the appropriate forms (see appendices) to verify employee participation and protection. In addition, the regulatory requirements must be met for recordkeeping on training, medical surveillance, injuries and illnesses, exposure monitoring, health risk information, and respirator fit-tests. Documentation of each BC employee's health and safety records is maintained by the Health and Safety Data Manager in Walnut Creek, California.

Health and safety documentation and forms completed, as specified by this plan, are to be retained in the project file.

Other relevant project-specific health and safety documents, such as MSDSs or client-specified procedures, will be attached to this HASP in Appendix F.

Appendix A:

Air Monitoring Form

Brown AND Caldwell

Air Monitoring Form

Instructions: Complete this form immediately prior to project start.
File in project folder when complete.

Name of Project/Site:	Project No:
Project/Site Location:	
Employee Performing Air Monitoring: (Print and Sign):	Date:

Instrument(s)

Manufacturer/Model:	Manufacturer/Model:
Manufacturer/Model:	Manufacturer/Model:

Does the instrument(s) have a current calibration per the manufacturer's instructions? ☐ Yes ☐ No

Was the instrument(s) field checked (i.e bump tested or field calibrated) per the manufacturer's instructions? ☐ Yes ☐ No

Remarks:

Monitoring Data

TIME	LOCATION AND ACTIVITY	P/FID (PPM)	COLORIMETRIC TUBES (PPM)	RAM (mg/m³)	MULTI-GAS DETECTION %LEL	H2S	O2	OTHER

Appendix B:

Site Safety Checklist

Brown AND Caldwell

Site Safety Checklist

Instructions: Complete this form immediately prior to project start.

File in project folder when complete.

Name of Project/Site:	Project No:
Project/Site Location:	
Employee Completing Checklist: (Print and Sign):	Date:

Yes	No	N/A		Yes	No	N/A	
☐	☐	☐	Written Health and Safety (H&S) Plan is on site?	☐	☐	☐	Respirators are available, properly cleaned, and stored?
☐	☐	☐	Addenda to the H&S Plan are documented on site?	☐	☐	☐	Overhead utilities do not present a hazard to equipt./personnel?
☐	☐	☐	H&S Plan information matches conditions/activities at the site?	☐	☐	☐	Traffic control measures have been implemented?
☐	☐	☐	H&S Plan read/signed by all site personnel, including visitors?	☐	☐	☐	Trenches and excavations are safe for entry?
☐	☐	☐	Daily tailgate H&S meetings have been held/documented?	☐	☐	☐	Soil Spoils are at least 2 feet from the edge of the excavation?
☐	☐	☐	Site personnel have required training and medical?	☐	☐	☐	Emergency/FA equipt. is on site as described in the H&S Plan?
☐	☐	☐	Air monitoring is performed/documented per the H&S Plan?	☐	☐	☐	Drinking water is readily available?
☐	☐	☐	Air monitoring equipment has been calibrated daily?	☐	☐	☐	Phone is readily available for emergency use?
☐	☐	☐	Site zones are set up and observed where appropriate?	☐	☐	☐	Utility locator has cleared subject locations?
☐	☐	☐	Access to the work area limited to authorized personnel?	☐	☐	☐	Proper drum and material handling techniques are used?
☐	☐	☐	Decontamination procedures followed/match the H&S Plan?	☐	☐	☐	Waste containers/drums are labeled appropriately?
☐	☐	☐	Decontamination stations (incl. hand/face wash) are set up and used?	☐	☐	☐	Ext. cords are grounded/protected from water/vehicle traffic?
☐	☐	☐	PPE used matches H&S Plan requirements?	☐	☐	☐	Tools and equipment are in good working order?
☐	☐	☐	Hearing protection used where appropriate?	☐	☐	☐	GFCIs used for portable electrical tools and equipment?

Notes

(All "no" answers must be addressed and corrected immediately. Note additional health and safety observations here):

Appendix C:

H&S Plan Acknowledgement Form

Brown AND Caldwell

H&S Plan Acknowledgement Form

Instructions: Complete this form immediately prior to project start or as new personnel join the project.
File in project folder when complete.

Name of Project/Site:	Project No:
Project/Site Location:	
Employee Performing Briefing: (Print and Sign):	Date:

Employee Acknowledgement:

The following signatures indicate that these personnel have read and/or been briefed on this Health and Safety (H&S) Plan and understand the potential hazards/controls for the work to be performed.

Important Notice to Subcontractor(s):

Subcontractors are responsible for developing, maintaining, and implementing their own health and safety programs, policies, procedures and equipment as necessary to protect their workers, and others, from their activities. Subcontractors shall operate equipment in accordance with their standard operating procedures as well as manufacturer's specifications. Any project monitoring activities conducted by BC at the Site shall not in any way relieve subcontractors of their critical obligation to monitor their operations and employees for the determination of exposure to hazards that may be present at the Site and to provide required guidance and protection. If requested, subcontractors will provide BC with a copy of their own H&S Plan for this project or other health and safety program documents for review.

BC's Health and Safety Plan has been prepared specifically for this project and is intended to address health and safety issues solely with respect to the activities of BC's own employees at the site. A copy of BC's H&S Plan may be provided to subcontractors in an effort to help them identify expected conditions at the site and general site hazards. The subcontractor shall remain responsible for identifying and evaluating hazards at the site as they pertain to their activities and for taking appropriate precautions. For example, BC's H&S Plan does not address specific hazards associated with tasks and equipment that are particular to the subcontractor's scope of work and site activities. (e.g., operation of a drill rig, excavator, crane or other equipment). Subcontractors are not to rely on BC's H&S Plan to identify all hazards that may be present at the Site. Subcontractor personnel are expected to comply fully with subcontractor's Health and Safety Plan and to observe the minimum safety guidelines applicable to their activities which may be identified in the BC H&S Plan. Failure to do so may result in the removal of the subcontractor or any of the subcontractor's workers from the job site.

Print	Sign	Date	Print	Sign	Date

Appendix D:

Daily Tailgate Meeting Form

Brown AND Caldwell

DAILY TAILGATE MEETING FORM

Name of Project/Site:	**Project No:**
Project/Site Location:	
Employee Completing Form (*print and sign*):	**Date:**

Employee Acknowledgement:

The following signatures indicate that these personnel have read and/or been briefed on this Health and Safety (H&S) Plan and understand the potential hazards/controls for the work to be performed.

Important Notice to Subcontractor(s):

Subcontractors are responsible for developing, maintaining, and implementing their own health and safety programs, policies, procedures and equipment as necessary to protect their workers, and others, from their activities. Subcontractors shall operate equipment in accordance with their standard operating procedures as well as manufacturer's specifications. Any project monitoring activities conducted by BC at the Site shall not in any way relieve subcontractors of their critical obligation to monitor their operations and employees for the determination of exposure to hazards that may be present at the Site and to provide required guidance and protection. If requested, subcontractors will provide BC with a copy of their own H&S Plan for this project or other health and safety program documents for review.

BC's Fieldwork Safety Plan has been prepared specifically for this project and is intended to address health and safety issues solely with respect to the activities of BC's own employees at the site. A copy of BC's H&S Plan may be provided to subcontractors in an effort to help them identify expected conditions at the site and general site hazards. The subcontractor shall remain responsible for identifying and evaluating hazards at the site as they pertain to their activities and for taking appropriate precautions. For example, BC's H&S Plan does not address specific hazards associated with tasks and equipment that are particular to the subcontractor's scope of work and site activities. (e.g., operation of a drill rig, excavator, crane or other equipment). Subcontractors are not to rely on BC's H&S Plan to identify all hazards that may be present at the Site. Subcontractor personnel are expected to comply fully with subcontractor's Fieldwork Safety Plan and to observe the minimum safety guidelines applicable to their activities which may be identified in the BC H&S Plan. Failure to do so may result in the removal of the subcontractor or any of the subcontractor's workers from the job site.

Print	Sign	Date	Print	Sign	Date

Plan of the Day

(Describe the activities that are planned to be performed today)

Potential Hazards and Topics Discussed

(Describe the potential hazards and controls that may be associated with planned activities)

☐ Physical ☐ Natural Phenomena ☐ Chemical ☐ Electrical ☐ Biological ☐ Radiological

☐ Other (specify):

Appendix E:

Incident Investigation Report

Preliminary Incident Investigation Report Form

Privileged and Confidential
Do Not Distribute

Instructions:

If an incident occurs, complete all applicable information in this form, make a copy for your records, and immediately forward the original to the office Health and Safety Coordinator (HSC). If fields are not applicable, indicate with "N/A". Use separate sheet(s) if necessary and attach sketches, photographs, witness statements, or other information that may be helpful in understanding how the accident/incident occurred. For assistance in completing this form, contact your office H&S Coordinator/Specialist or your Regional Safety Unit Manager (RSUM).

HSC – Review and enter report into the BC Online Incident Reporting System within 3 workdays of receipt. File original in appropriate office health and safety file.

NOTE:

This report is important – please take the time necessary to properly complete it. Incomplete reports will be forwarded to appropriate management for review and action.

General Information

Date of Accident/Incident	Time of Accident/Incident:	Date Accident/Incident Reported:	To Whom:
Exact Location of Accident/Incident (Street, City, State):			BC Office:
Name Project:			Project Number:
Employee Completing the Investigation (Print and Sign):			Date:

Injured/Ill Employee/Property Damage Information

Employee Name:	Employee No.	Department:	Phone Number:
Job Title:		Manager's Name and Phone Number:	
Nature of Injury/Illness (laceration, contusion, strain, etc.):		Body Part Affected (arm, leg, head, hand, etc.):	
Describe Property Damage and Estimate Loss :			

Description of Accident/Incident

Describe the accident sequentially, beginning with the initiating event, and followed by secondary and tertiary events. End with the nature and extent of injury/damage. Name any object or substance and tell how they were included. Examples: 1) Employee was pulling utility cart that was loaded with wastepaper from office area to hallway. Wheel of utility cart caught against door casing. Bags of heavy wastepaper that were in cart fell to end of cart. Cart tipped over onto foot of employee. Right foot was crushed between utility cart and door casing, resulting in severe contusion to right foot of employee. 2) Employee was driving rental car from office to project site. Car struck icy section of road. Employee lost control of vehicle, which skidded across road into concrete abutment on side of road. Accident resulted in damage to right fender, tire, headlight, and grill.

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Preliminary Incident Investigation Report Form

Privileged and Confidential
Do Not Distribute

Analysis of Accident Causes

Immediate Causes - Substandard Actions

What substandard actions caused or could have caused the accident/incident? State the actions on the part of the employee or others that contributed to the occurrence of the accident/incident. Examples: 1) Employee overloaded the utility cart with wastepaper. 2) Employee exceeded safe speed on icy road, and was inattentive to hazard.

Codes (check all that apply)

- ☐ Failure to recognize hazard(s)
- ☐ Failure to use equipment or use it properly
- ☐ Failure to use PPE or use it properly
- ☐ Failure to warn, secure, or barricade
- ☐ Horseplay
- ☐ Improper lifting
- ☐ Improper loading, placement, or position for task
- ☐ Performing excessive repetitive activities
- ☐ Operating equipment without authority
- ☐ Removing or making safety devices inoperable
- ☐ Servicing equipment in operation
- ☐ Using defective equipment
- ☐ Unclassified (not determined)
- ☐ Other (specify): _____

Immediate Causes - Substandard Conditions

What substandard conditions caused or could have caused the accident/incident? State the conditions that existed at the time of the accident (the specific control factors that were or may have been the direct or immediate cause or causes of the accident). Examples: 1) Wheel of utility cart was worn and would not roll properly; utility cart was overloaded with wastepaper. 2) Road was covered with icy spots; weather was foggy.

Codes (check all that apply)

- ☐ Congested or restricted area
- ☐ Defective tools, equipment, or materials
- ☐ Fire or explosion hazards
- ☐ Hazardous environmental conditions (vapors, dusts, etc.)
- ☐ High or low temperature exposures
- ☐ Inadequate guards or barriers
- ☐ Inadequate or excessive illumination
- ☐ Inadequate ventilation
- ☐ Inadequate walking/working surfaces
- ☐ Noise Exposures
- ☐ Poor housekeeping
- ☐ Radiation exposures
- ☐ Unclassified (not determined)
- ☐ Other (specify): _____

Basic Causes - Personal and Job Factors

What personal and/or job factors caused or could have caused the accident/incident? State the influencing factors or underlying causes, either conditions or actions or both, that contributed to the accident/incident. Examples: 1) Employee had not been instructed in overloading hazards. 2) Employee had not been trained in driving under winter conditions; company has no driver training program.

Codes (check all that apply)

Personal Factor Codes

- ☐ Alcohol or drug influence (possible)
- ☐ Fatigue
- ☐ Inadequate skill, capability, knowledge, or training
- ☐ Inattention
- ☐ Rushing to complete work
- ☐ Unclassified (not determined)
- ☐ Other (specify): _____

Job Factor Codes

- ☐ Inadequate engineering
- ☐ Inadequate leadership/supervision
- ☐ Inadequate maintenance, wear, abuse, or misuse
- ☐ Inadequate planning or accelerated schedule
- ☐ Inadequate tools/equipment
- ☐ Inadequate work standards/procedures
- ☐ Unclassified (not determined)
- ☐ Other (specify): _____

Remedial Actions

Describe the actions taken or planned to prevent recurrence of accident/incident - provide the implementation date and person responsible for any planned corrective action.. Examples: 1) Wheels of utility cart were replaced with larger size wheels; all carts were inspected for safe operation; employees were instructed in overloading hazards. 2) All project personnel were instructed at the safety training meeting on driving under hazardous conditions; driver training program will be implemented.

Codes (check all that apply)

- ☐ Equipment repair or replacement
- ☐ Improve design or construction
- ☐ Improve housekeeping
- ☐ Improve PPE
- ☐ Install safety guard or device
- ☐ Reinstruction or reprimand of personnel involved
- ☐ Temporary/permanent reassignment of personnel
- ☐ Work method change
- ☐ Use safer materials or equipment
- ☐ Develop and publish lessons learned
- ☐ Unclassified (not determined)
- ☐ Other (specify): _____

Appendix F:

Miscellaneous Health and Safety Information

Appendix H: Community Air Monitoring Plan

4832-8759-8615, v. 4

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. “Periodic” monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or

overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

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

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

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009

Appendix 1B
Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

(a) Objects to be measured: Dust, mists or aerosols;
(b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);
(c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;
(d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
(e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;
(f) Particle Size Range of Maximum Response: 0.1-10;
(g) Total Number of Data Points in Memory: 10,000;
(h) Logged Data: Each data point with average concentration, time/date and data point number
(i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
(j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
(k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
(l) Operating Temperature: -10 to 50^{o} C (14 to 122^{o} F);
(m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

(a) Applying water on haul roads;
(b) Wetting equipment and excavation faces;
(c) Spraying water on buckets during excavation and dumping;
(d) Hauling materials in properly tarped or watertight containers;
(e) Restricting vehicle speeds to 10 mph;
(f) Covering excavated areas and material after excavation activity ceases; and
(g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.