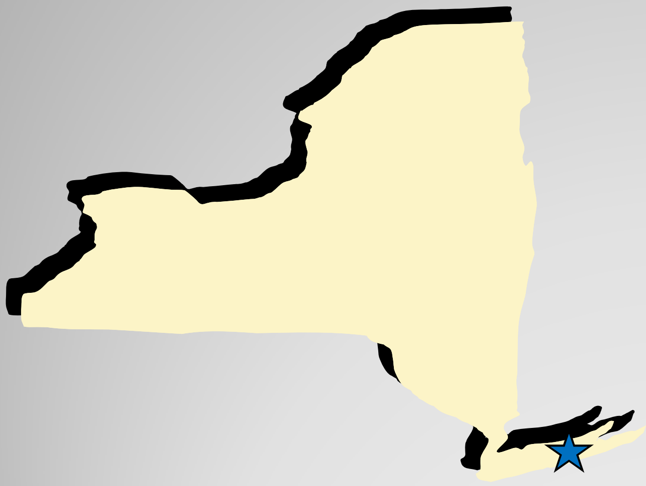
***FEASIBILITY STUDY***

# Bianchi/Weiss Greenhouses Site (152209)
# East Patchogue, Suffolk County, New York



***Prepared for:***

New York State Department of Environmental Conservation
Division of Environmental Remediation

***Prepared by:***

EA ENGINEERING, P.C. and Its Affiliate
EA SCIENCE and TECHNOLOGY

September 2011

# Feasibility Study
# Bianchi/Weiss Greenhouses Site (152209)
# East Patchogue, New York

*Prepared for*

New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233

*Prepared by*

EA Engineering, P.C. and Its Affiliate
EA Science and Technology
6712 Brooklawn Parkway, Suite 104
Syracuse, New York 13211-2158
(315) 431-4610

September 2011
Revision: FINAL
EA Project No. 14368.33

# Feasibility Study
# Bianchi/Weiss Greenhouses Site (152209)
# East Patchogue, New York

*Prepared for*

New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233

*Prepared by*

EA Engineering, P.C. and Its Affiliate
EA Science and Technology
6712 Brooklawn Parkway, Suite 104
Syracuse, New York 13211
(315) 431-4610

2 September 2011
Christopher J. Canonica, P.E., Program Manager — Date
EA Engineering, P.C.

2 September 2011
Robert S. Casey, Project Manager — Date
EA Science and Technology

September 2011
Revision: FINAL
EA Project No. 14368.33

**CONTENTS**

Page

# LIST OF FIGURES

# LIST OF TABLES

## LIST OF ACRONYMS

| | |
|---|---|
| bgs | Below ground surface |
| CFR | Code of Federal Regulations |
| DER | Division of Environmental Remediation |
| EA | EA Engineering, P.C. and its affiliate EA Science and Technology |
| EDR | Environmental Data Resources, Inc. |
| FS | Feasibility Study |
| GRA | General response actions |
| NYCRR | New York Code of Rules and Regulations |
| NYSDEC | New York State Department of Environmental Conservation |
| ppm | Parts per million |
| RAO | Remedial action objective |
| RI | Remedial Investigation |
| SCG | Standards, Criteria, and Guidance |
| SCO | Soil Cleanup Objectives |
| USEPA | United States Environmental Protection Agency |

# 1. INTRODUCTION AND PROJECT OVERVIEW

The New York State Department of Environmental Conservation (NYSDEC) tasked EA Engineering, P.C. and its affiliate EA Science and Technology (EA) to perform a remedial investigation (RI) and feasibility study (FS) at the Bianchi/Weiss Greenhouses site (NYSDEC Site No. 152209) located in East Patchogue, Suffolk County, New York (Figure 1).

## 1.1 PURPOSE AND SCOPE

This FS report has been prepared to develop and evaluate options for remedial action to determine which option is the most appropriate, cost effective, and protective of public health and the environment for the Bianchi/Weiss Greenhouses site.

The FS has been conducted in accordance with the most recent versions of the *Guidance for Conducting Remedial Investigations and Feasibility Studies under Comprehensive Environmental Response, Compensation, and Liability Act* (U.S. Environmental Protection Agency [USEPA] 1988) and *Division of Environmental Remediation* (*DER)-10, Technical Guidance for Site Investigation and Remediation* (NYSDEC 2010) and focused on a limited number of remedial alternatives proven effective at addressing the pesticide chlordane.

## 1.2 REPORT ORGANIZATION

The FS report has been organized as follows:

- ***Section 1***—Introduction and Project Overview
- ***Section 2***—Summary of Remedial Investigation and Exposure Assessment
- ***Section 3***—Development of Remedial Action Objectives
- ***Section 4***—General Response Actions
- ***Section 5***—Identification and Screening of Technologies
- ***Section 6***—Scoping and Development of Remedial Alternatives
- ***Section 7***—Costing and Evaluation Criteria
- ***Section 8***—Detailed Analysis of Alternatives and Recommendations
- ***Section 9***—References.

## 1.3 BACKGROUND

The following section provides a brief discussion of the site background for the Bianchi/Weiss Greenhouses site. A full description of the site is provided in the Final RI Report (EA 2011), which was submitted as a separate deliverable.

### 1.3.1 Site Location

The Bianchi/Weiss Greenhouses site is located at 25 Orchard Road, in East Patchogue, Suffolk County, New York (Figure 1). The property is an irregular-shaped parcel that has main access to the site from Orchard Road. An alternative access road exists on Hedges Road to the north of the property, but is currently overgrown with vegetation. Residential properties are located to the north, south, east, and west of the property.

### 1.3.2 Property Information

Based upon a review of historical information presented in the Environmental Data Resources, Inc. (EDR) report, the site first appears with nine structures including six greenhouses on the 1947 U.S. Geological Survey topographical map. No U.S. Geological Survey topographical maps were provided for the site location between 1904 and 1947 in the EDR report. Historical property ownership documents identified operations of the greenhouses began at the site sometime in 1929. Historic on-site structures were reportedly utilized as a nursery for commercial growing purposes. On-site structures consisted of three buildings (1.5-story storage building, 1.5-story brick/frame residential dwelling, and a generator building), a single-story horse barn, a frame garage, and six greenhouses. During an inspection of the greenhouses and other on-site buildings, it was documented that no slop sinks or floor drains were observed. Planting fields were reported to have been located on the eastern and western portions of the site; however, the western portions of the site are presently covered with asphalt or concrete foundations. Two 275-gal fuel oil aboveground storage tanks, one 1,000-gal aboveground storage tank, and one 20,000-gal fuel oil underground storage tank were identified as being located on the property. Another underground storage tank was identified during the RI in 2009 using ground penetrating radar. The underground storage tank is located just north of the former generator house, as shown on Figure 2. EA also noted what appeared to be the remnants of a drainage trench feature that bisected the northern and southern greenhouses. This drainage feature was an exposed concrete structure (concrete walls and base) approximately 2-3 ft below ground surface (bgs) and assumed to flow from north to south. A copy of the EDR report was provided in the RI/FS Work Plan (EA 2008).

The site is currently zoned for residential use, but is unoccupied and vacant. Figure 2 identifies the existing features at the site. It is estimated that the site operated as a greenhouse/nursery for at least 70 years. After taking ownership in 2005, Henron Development Corporation (Henron) proceeded with demolition activities; therefore, in present condition, none of the greenhouses or on-site structures exist.

### 1.3.3 Site History

The site historically operated as a nursery and commercial greenhouse from 1929 to 2005. According to property ownership documents, the site, or at least portions of the site, was owned by the Bianchi family and Bianchi Orchards from 1929 to 1990. The Weiss family and Kirk

Weiss Greenhouses purchased the site property in 1992. In December 2005, the site property was purchased by Henron and planned for residential redevelopment.

### 1.3.4 Physiography

The subject site is located on the U.S. Geological Survey Bellport, New York 7.5-minute topographic quadrangle map, dated 1967.

Elevation at the site is approximately 16 ft above mean sea level. The nearest surface water feature, as noted on the topographic map, is Moss Creek which is located approximately 0.25 mi south of the subject site and Abets Creek, which is located approximately 0.25 mi southwest of the subject site. Both creeks flow from north to south and drain to Patchogue Bay. Reportedly, no wetlands or surface expressions of groundwater are located on the property. According to the Federal Emergency Management Agency, the property is not located within the 100-year flood plain. The closest wetlands and surface water bodies are located approximately within 0.5 mi west of the property and are associated with Abets Creek.

### 1.3.5 Site Geology

A review of the geologic map of New York, Lower Hudson Sheet published by the University of the State of New York, the State Education Department and dated 1970, indicates that the subject site lies within the coastal plain deposits above the Monmouth, Matawan, and Magothy Groups, which are part of the Upper Cretaceous Period. According to the EDR report, the subject site is located within the sands and loams associated with the Pliestocene Epoch in the Quarternary Period.

### 1.3.6 Site Hydrogeology

Based on groundwater monitoring performed in the vicinity of the site, groundwater was typically encountered 6-8 ft bgs on-site and ranged from 2.5 ft bgs south of the site to 13 ft bgs at monitoring locations north of the property. The regional shallow groundwater flow was previously determined to be in a south-southwest direction.

# 2. SUMMARY OF REMEDIAL INVESTIGATION AND EXPOSURE ASSESSMENT

The following sections briefly summarize the environmental impacts at the Bianchi/Weiss Greenhouses site. A detailed discussion is provided in the Remedial Investigation report. This section is organized by media of potential concern. The impacts associated with the environmental media are based on analytical results and their comparison with the appropriate standards, criteria, and guidance (SCGs). The media of concern discussed are soil and groundwater.

## 2.1 SURFACE AND SUBSURFACE SOIL

The focus of the soil screening and characterization efforts conducted during the RI were to determine the nature and extent of pesticides contamination, specifically chlordane, in site soil using both immunoassay field test kits and confirmatory analytical analyses.

Soil samples with the highest total chlordane concentrations were located primarily within the footprints of the former greenhouses and northern portions of the site. As discussed in the RI report (EA 2011), technical grade chlordane is comprised of various chlorinated hydrocarbons with a typical composition of approximately 24 percent *gamma*-chlordane, 19 percent *alpha*-chlordane, 10 percent heptachlor, 21.5 percent chlordene isomers, 7 percent nonachlor, and 18.5 percent closely-related chlorinated hydrocarbon compounds. EA assessed the overall percentage of *alpha* and *gamma*-chlordane analytical results as compared to the total chlordane analytical results to develop a site percentage. Surface soil results reported an average *alpha*-chlordane percentage of 19 percent and an average *gamma*-chlordane percentage of 13 percent. Subsurface soil results reported an average *alpha*-chlordane percentage of approximately 15 percent and an average *gamma*-chlordane percentage of approximately 12 percent.

The percentages reported for the sites are within the expected ranges of composition based on the persistence and assumed degradation of the compounds over time.

### 2.1.1 Pesticides in Surface Soils

Chlordane was found in surface soils (0-2 in.) across the site with the majority of surface soil chlordane concentrations greater than 3 parts per million (ppm). The only areas that were not observed to have elevated chlordane concentrations were the far eastern and northwestern portions of the site.

The greatest concentrations of *alpha*-chlordane in surface soils were found in the northern portion of the site, in the orchard area. The highest concentration of *alpha*-chlordane was 31 ppm, in sampling location G0G. Surface soil samples that contained total chlordane concentrations were located primarily within the footprints of the former greenhouses and in the northern portion of the site. Incidental ingestion, dermal contact, and/or inhalation of contaminated soils are potential exposure pathways to current site workers, trespassers, and adjacent residents.

### 2.1.2 Pesticides in Subsurface Soils

Subsurface soils that were analyzed in the field using immunoassay field test kits indicated that the chlordane concentrations exceeding 3 ppm were primarily within the footprints of the former greenhouses. With both the field testing and laboratory analysis, chlordane concentrations in subsurface soils generally decreased with increasing depth. The greatest concentration of *alpha*-chlordane from 1 to 1.5 ft bgs was 4.8 ppm located in the northwest area of the former greenhouse footprints. The greatest concentration of *alpha*-chlordane from 2 to 2.5 ft bgs was 6.1 ppm located in the central area of the former greenhouse footprints. The greatest concentration of *alpha*-chlordane from 3 to 3.5 ft bgs was 1.2 ppm in the central area of the former greenhouse footprints. The greatest concentration of *alpha*-chlordane from 4 to 4.5 ft bgs was 0.34 ppm and the greatest concentration from 5 to 5.5 ft bgs was 0.74 ppm, both in the former greenhouse footprints.

In the orchard area, north of the former greenhouse footprints, subsurface concentrations of *alpha*-chlordane were minimal, with only one detection exceeding the Part 375 unrestricted SCOs in each of the 1-1.5, 2-2.5, and 4-4.5 ft sampling intervals. All of the orchard area exceedances were less than the residential use Part 375 SCO value of 0.91 ppm. Field analyses using immunoassay test kits indicated there were nine sample locations in the 1-1.5 ft sampling interval containing chlordane concentrations exceeding 3 ppm. Concentrations diminished at lower intervals, with only one sample exceeding 3 ppm at 2-2.5 ft on the edge of the orchard near the greenhouse area and none within the deeper intervals. Incidental ingestion, dermal contact, and inhalation of contaminated soils is a potential pathway to current workers.

### 2.1.3 Volume of Impacted Soil

Surface and subsurface soil were handled as a single element when creating cost estimates for this FS, but were divided into three depths: 0-2, 2-4, and 4-6 ft bgs. Soil impacts exceeding the Part 375 unrestricted SCOs were observed during the RI from 0 to 2 ft over a 9 acre area, for a total volume of approximately 29,000 $yd^3$. Impacts were observed from 2 to 4 ft bgs in a 4.5 acre area, for a total volume of approximately 16,000 $yd^3$. Additionally, impacts were observed from 4 to 6 ft bgs over a 3 acre area, for a total volume of approximately 12,000 $yd^3$.

When compared with the Part 375 residential SCOs, impacted soil volumes are much smaller. Soil impacts were observed from 0 to 2 ft over a 7 acre area, for a total volume of approximately 23,000 $yd^3$. Impacts were observed from 2 to 4 ft bgs in a 2.5 acre area, for a total volume of approximately 9,000 $yd^3$. Impacts were observed from 4 to 6 ft bgs over a 1 acre area, for a total volume of approximately 2,000 $yd^3$.

## 2.2 PESTICIDES IN GROUNDWATER

The shallow groundwater from monitoring wells at depths ranging between 2.6 and 11 ft bgs was collected and analyzed as part of the RI. The analytical results revealed elevated concentrations of the pesticide chlordane in the groundwater both on-site and downgradient from the site. Chlordane is the most dominant contaminant, as it was detected exceeding the site SCG value in 27 of 43 monitoring wells and 3 of 4 temporary monitoring wells. Dieldrin which is not suspected to be site related was detected exceeding the site SCG value in 4 of 43 monitoring wells located downgradient from the site.

The highest chlordane concentrations were found in temporary monitoring wells on the site and monitoring wells located immediately downgradient and southwest of the site. This information, along with historical groundwater sampling results, indicates that the groundwater contaminant plume tends to follow a south/southwest direction, in line with the interpreted groundwater flow path. Based on interpreted groundwater isopleths developed for the RI report, the length of the plume extends approximately 2,900 ft to the southwest, and is approximately 460 ft at the widest point, along the monitoring wells located just north of South County Road, 300 ft downgradient from the site. The plume does not extend across Abets Creek. Figure 3 depicts monitoring well locations and interpreted contaminated groundwater plume.

Chlordane exhibits low solubility in water (0.009 ppm) and adsorbs strongly to soil. In water, chlordane has an affinity to adsorb to sediment and particles in the water column so it is not expected that chlordane will be lost via the volatilization processes. The most common method of transport for chlordane is via particle transport mechanisms (e.g., surface runoff and erosion, suspended sediments in rivers or streams, and colloidal transport in groundwater), due to its strong affinity for solid matrices. Colloids are very small (from 0.001 to 1 micrometer in diameter) organic, inorganic, or clay particles that move via groundwater flow through the interstitial spaces of subsurface soil. Hydrophobic contaminants (i.e., chlordane) can attach to colloids and migrate with groundwater. Based on the inherent physiochemical characteristics of chlordane, the comparison of the field filtered and unfiltered groundwater samples, the estimated average linear groundwater velocities and retardation factors affecting chlordane transport velocities, and the consistent detections of chlordane in groundwater at monitoring wells located at distances greater than 2,800 ft from the likely on-site source area(s), this scenario would suggest that the transport of chlordane is likely attributable to colloidal movement in the groundwater system. Therefore, it is assumed that the effective concentration of total chlordane reported in groundwater samples collected during this RI is unlikely a dissolved-phase solute.

Groundwater is currently used as a partial private water supply in the vicinity of the site or plume, as it is used for landscape watering and other similar uses. Public water is available to this area and known potable wells do not appear to be located within the plume emanating from the site. Due to shallow groundwater depths, groundwater intrusion is possible in nearby residential homes. Incidental ingestion and dermal contact to contaminated groundwater, temporary ponds, or groundwater upwelling into basements is a potential pathway to area residents and/or workers.

# 3. DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES

Goals for the remedial program have been established through the remedy selection process stated in 6 New York Code of Rules and Regulations (NYCRR) Part 375. The remedial goal for all remedial actions is considered to be the restoration of the site to the pre-disposal/pre-release conditions to the extent practicable and legal. Remedial action objectives (RAOs) are defined as the medium-specific or operable unit-specific cleanup objectives to provide protection of public health and the environment. The RAOs are based on contaminant-specific SCGs. The RAOs for the Bianchi/Weiss Greenhouses site are to meet the SCGs listed in the following table.

## 3.1 CLEANUP STANDARDS, CRITERIA, AND GUIDANCE

Cleanup standards for soil and groundwater are presented in the following table along with the range of contaminant detections.

**SOIL – CLEANUP SCGs**

| Chemical of Potential Concern | Concentration Range Detected (ppm)[a] | Unrestricted Use Soil Cleanup Objectives SCG (ppm) | Restricted Use Soil Cleanup Objectives SCG (ppm) | Frequency of Exceeding Unrestricted Use SCG | Frequency of Exceeding Residential Use SCG |
|---|---|---|---|---|---|
| alpha-chlordane | Non-detect – 31 | 0.094 | 0.91 | 25/55 (surf. soil)<br>17/87 (1-1.5 ft)<br>11/35 (2-2.5 ft)<br>9/37 (3-3.5 ft)<br>9/20 (4-4.5 ft)<br>9/26 (5-5.5 ft) | 19/55 (surface soil)<br>12/87 (1-1.5 ft)<br>7/35 (2-2.5 ft)<br>3/37 (3-3.5 ft)<br>0/20 (4-4.5 ft)<br>0/26 (5-5.5 ft) |
| gamma-chlordane | Non-detect-26 | 0.54[b] | 0.54 | 20/55 (surface soil)<br>13/87 (1-1.5 ft)<br>7/35 (2-2.5 ft)<br>5/37 (3-3.5 ft)<br>0/20 (4-4.5 ft)<br>1/26 (5-5.5 ft) | 20/55 (surface soil)<br>13/87 (1-1.5 ft)<br>7/35 (2-2.5 ft)<br>5/37 (3-3.5 ft)<br>0/20 (4-4.5 ft)<br>1/26 (5-5.5 ft) |

(a) Based on samples collected in June and December 2009.
(b) SCG is restricted use soil cleanup objective from CP-51 Table 1 because there is no SCG listed for Unrestricted Use
NOTE: Alpha-chlordane SCGs are from NYSDEC 6 NYCRR Table 375-6.8(b): Unrestricted Use SCOs and Table 375-6.8(a): Restricted Use SCOs, respectively. Gamma-chlordane SCGs are from CP-51 Table 1: Supplementary SCOs.

**GROUNDWATER – CLEANUP SCGs**

| Chemical of Potential Concern | Concentration Range Detected (µg/L)[a] | Ambient Water Quality Standard[b] (µg/L) | Maximum Contaminant Level[c] (µg/L) | Frequency of Exceeding Ambient Water Quality Standard | Frequency of Exceeding Drinking Water Standard |
|---|---|---|---|---|---|
| Total Chlordane | Non-detect – 25 | 0.05 (s) | 2 | 28/60 | 10/60 |

(a) Based on samples collected in 2009.
(b) NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards (Class GA), June 1998; (g) guidance value, (s) standard value.
(c) USEPA National Primary Drinking Water Regulations Maximum Contaminant Levels

The Ambient Water Quality Standards for Class GA waters and the maximum contaminant levels regulate only total chlordane, and do not break down the guidance to alpha- and gamma-chlordane concentrations. All groundwater samples were analyzed for total chlordane.

## 3.2 REMEDIAL ACTION OBJECTIVES

The medium-specific RAOs for the Bianchi/Weiss Greenhouses site are displayed in the following tables.

| SOIL – RAOs |
|---|
| Prevent ingestion/direct contact with contaminated soil |
| Prevent inhalation of contaminated dust |
| Prevent migration of contaminants that would result in groundwater contamination |
| Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain |

| GROUNDWATER – RAOs |
|---|
| Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards |
| Restore groundwater aquifer to pre-release conditions, to the extent practicable |
| Prevent contact with contaminated groundwater |
| Remove the source of ground or surface water contamination |

## 3.3 OTHER POTENTIALLY APPLICABLE REQUIREMENTS

The NYSDEC Environmental Remediation Programs guidance (6 NYCRR Part 375) requires that site remedies "conform to standards and criteria that are generally applicable, consistently applied, and officially promulgated, that are either directly applicable, or that are not directly applicable but are relevant and appropriate, unless good cause exists why conformity should be dispensed with (6 NYCRR Part 75, 375-1.8[f][2])." The primary requirements are presented in the following table.

| SCGS FOR THE BIANCHI/WEISS GREENHOUSES REMEDY | |
|---|---|
| Requirement | Rationale |
| **FEDERAL** | |
| **CLEAN WATER ACT**<br>**National Pollution Discharge Elimination System 40 Code of Federal Regulations (CFR) Part 122**<br>The National Pollution Discharge Elimination System establishes permitting requirements, technology-based limitations and standards, control of toxic pollutants, and monitoring of effluents to assure discharge permit conditions and limits are not exceeded. | Applicable if groundwater will be extracted from ground and discharged to a surface water body. |
| **SAFE DRINKING WATER ACT**<br>**National Primary and Secondary Drinking Water Regulations) (42 U.S.C. 300f, 40 CFR Part 141, 40 CFR Part 143)**<br>The Safe Drinking Water Act provides a national framework to ensure the quality and safety of drinking water. The primary standards establish maximum contaminant levels and maximum contaminant level goals for chemical constituents in drinking water. Secondary standards pertain primarily to the aesthetic qualities of drinking water. | The removal action is being conducted to reduce chemical concentrations in soil and groundwater, with a goal of meeting unrestricted use levels. |
| **CLEAN AIR ACT, as Amended (42 U.S.C. 7401)**<br>The Clean Air Act is a comprehensive law which is designed to regulate any activities that affect air quality, and provides the national framework for controlling air pollution. The National Primary and Secondary Ambient Air Quality Standards (40 CFR Part 50) set standards for ambient pollutants which are regulated within a region. The National Emissions Standards for Hazardous Air Pollutants (40 CFR Part 61) establishes numerical standards for hazardous air pollutants. | The Clean Air Act will be required if any remediation alternatives produce air emissions. |
| **RESOURCE CONSERVATION AND RECOVERY ACT**<br>Provides the governing regulations for owners and operators of hazardous waste treatment, storage, and disposal facilities; and for the generators and transporters of hazardous waste. | All waste generated during the removal alternative will be characterized and handled per Resource Conservation and Recovery Act regulations, as implemented by WAC 173-303. |
| **OCCUPATIONAL SAFETY AND HEALTH ACT (29 CFR 1910)**<br>Establishes the worker health and safety requirements for operations at hazardous waste sites. | Site activities will be conducted under appropriate Occupational Safety and Health Act standards. |
| **Rules for Transport of Hazardous Waste (49 CFR 107, 171)**<br>The U.S. Department of Transportation establishes requirements for packaging, handling, and manifesting hazardous waste. | Any hazardous waste generated during site activities will be characterized as needed to determine packaging, handling, and transport requirements. |

| STATE | |
|---|---|
| **NYSDEC Environmental Remediation Programs (6 NYCRR Part 375)**<br>This program applies to the development and implementation of remedial programs for environmental restoration sites. | Site cleanup will be conducted in accordance with 6 NYCRR Part 375. |
| **Solid Waste Management Facilities (6 NYCRR Part 360)**<br>Provides standards and regulations for permitting and operating solid waste management facilities. | These regulations will be followed for off-site generation, treatment, and disposal of hazardous waste (if generated during the removal action). |
| **Waste Transporter Permits (NYCRR Part 364)**<br>Provides standards and regulations for waste transporters. | |
| **Land Disposal Restrictions (6 NYCRR Part 376)** | |
| **Hazardous Waste Management System (6 NYCRR Parts 370, 371, 372, 373, 375)**<br>Provides standards and regulations for the state hazardous waste management system, identification and listing of hazardous wastes, and provides standards, regulations, and guidelines for the manifest system, as well as additional standards for generators, transporters, and facilities. | |
| **New York State Department of Transportation Rules for Hazardous Materials Transport (49 CFR, Parts 107, 171.1-500)**<br>Addresses requirements for marking, manifesting, handling, and transport of hazardous materials; applicable if off-site treatment or disposal of wastes is required. | |
| **Water Quality Regulations for Surface Waters and Groundwater (6 NYCRR Part 700-706)**<br>Provides standards, regulations, and guidelines for the protection of waters within the state. | Water discharged from the site will comply with this guidance. |
| **Air Quality Standards (6 NYCRR Part 257)**<br>Air quality standards are designed to provide protection from the adverse health effects of air contamination; and they are intended further to protect and conserve the natural resources and environment. | All substantive requirements of the State air pollution control regulations will be followed if air emissions are created. |
| **LOCAL** | |
| Land development standards, stormwater and surface water regulations, and clearing and grading requirements. | Local permits may be required depending on the selected remedial action. |
| Building permits and building codes. | Local permits may be required depending on the selected remedial action. |

# 4. GENERAL RESPONSE ACTIONS

In general, remedial technologies fit into one or more category of general response actions (GRAs). GRAs are generic, medium-specific, remedial actions that will satisfy the RAOs discussed earlier. GRAs may include no action, institutional controls, containment, removal, treatment, disposal, monitoring, or a combination thereof (USEPA 1988). The development of remedial alternatives for this FS begins with the identification of GRAs that can meet RAOs. These GRAs are then screened based on their effectiveness, implementability, and cost and developed into remedial alternatives to address contaminated media at the site (e.g., soil, on-site groundwater, and soil vapor).

## 4.1 SOIL

Technologies for the remediation of soil will fall into the following GRAs: no further action, removal, treatment, and disposal.

**No Further Action**

The no further action alternative is included to be used as the baseline alternative against which other remedial alternatives are compared.

**Removal**

Physical removal of contaminated soil would be conducted by excavation, using standard construction equipment (i.e., excavators) to remove material from the ground and load it into transport mechanisms (i.e., trucks) for off-site treatment or disposal.

**Disposal**

Disposal involves transporting the soil to a landfill that will either put the soil in a lined landfill or use it for daily cover, based on characterization results.

**Treatment**

Treatment subjects contaminants to processes that alter their state, transform them to innocuous forms, or immobilize them. Potentially applicable treatment technologies for soil at this site include *in situ* bioremediation, *in situ* thermal treatment, *in situ* phytoremediation, and *ex situ* incineration.

Bioremediation involves the mixing of nutrients and/or microbes into the soil matrix to stimulate microbial growth and facilitate the natural breakdown of targeted contaminant compounds. Bioremediation uses indigenous or non-indigenous micro-organisms to degrade contaminants. Soil or groundwater conditions can be altered to allow for more efficient degradation.

Thermal treatment consists of elevating the temperature of the impacted media to destroy or volatilize organic compounds. The gas is then extracted, collected, and treated. This can be accomplished on-site using indirect thermal rods or direct incineration, or off-site using direct or indirect thermal technologies.

Phytoremediation involves the removal of contaminants through uptake and storage, or the transformation of contaminants to less toxic, less mobile, or more stable forms through phytotransformation. When phytoextraction, or uptake and storage occurs, the plants have to be harvested and disposed of at an approved waste facility. Phytotransformation may result in the volatilization of contaminants through plant leaves.

## 4.2 GROUNDWATER

Technologies for the remediation of groundwater will fall into the following GRAs: no further action, long-term monitoring, hazard exposure reduction, and containment with treatment.

### No Further Action

The no further action alternative is included to be used as the baseline alternative against which other remedial alternatives are compared.

### Long-Term Monitoring

For groundwater, monitoring consists of sampling groundwater for contaminant concentrations over a long period of time.

### Hazard Exposure Reduction with Sump and Foundation Upgrades

Exposure to contaminated groundwater could be limited by performing sump and foundation upgrades to homes with basement flooding issues through foundation cracks and/or the sump. This would involve fixing foundation cracks, improving drainage around the foundation, and installation of a sump pump and filter system.

### Containment via Hydraulic Control and Treatment

For groundwater, containment involves physical extraction of groundwater for *ex situ* treatment. Once groundwater is extracted, treatment technologies for groundwater could include air stripping, granular activated carbon, etc.

# 5. IDENTIFICATION AND SCREENING OF TECHNOLOGIES

The potentially applicable technologies identified earlier are screened using the process defined in DER-10. The screening process and summary of results are described below and the detailed technology screening is presented in Table 1.

## 5.1 SCREENING CRITERIA

Two preliminary screening criteria (effectiveness and implementability) were used to screen the remedial technologies identified earlier for each media of concern. Definitions for these criteria are presented below.

### 5.1.1 Effectiveness

Effectiveness is a measure of the ability of an option to: (1) reduce toxicity, mobility, or volume of contamination; (2) minimize residual risks; (3) afford long-term protection; (4) comply with applicable or relevant and appropriate requirements; (5) minimize short-term impacts; and (6) achieve protectiveness in a limited duration. Technologies that offer significantly less effectiveness than other proposed technologies may be eliminated from the alternative development process. Options that do not provide adequate protection of human health and the environment likewise may be eliminated from further consideration.

### 5.1.2 Implementability

Implementability is a measure of the technical feasibility and availability of the option and the administrative feasibility of implementing it (e.g., obtaining permits for off-site activities, right-of-ways, or construction). Options that are technically or administratively infeasible or that would require equipment, specialists, or facilities that are not available within a reasonable period may be eliminated from further consideration.

## 5.2 SCREENING SUMMARY

The results of the technology screening are summarized in the following two sections. The first section discusses technologies that were not retained for further analysis, and the reasons for exclusion. The second section lists technologies that were retained for further analysis as individual components in remedial alternatives. The screening is presented in greater detail in Table 1.

### 5.2.1 Technologies Not Retained for Further Analysis

From the list of technologies potentially applicable for remediation of the chemicals and media of concern at this site, a few technologies were excluded from further consideration because they were considered ineffective, not implementable at this site, or too costly relative to the other technologies under consideration. The reasons for exclusion are explained below.

**Technologies Not Retained for Soil Remediation**

Phytoremediation was not retained because it was not considered effective. The phytoremediation of soil containing chlordane is still an experimental technology, and effectiveness is unknown. Based on preliminary research, it would take a minimum of 56 years to remediate the site to the standards required, but this is not certain.

**Technologies Not Retained for Groundwater Remediation**

All technologies considered for groundwater remediation were retained.

### 5.2.2 Technologies Retained for Further Analysis

Technologies that will be retained for further evaluation for the site are listed below for each media of concern. Since the soil and groundwater will be addressed separately, each technology is also an alternative.

The following remedial technologies are considered in this FS for soil:

- **Alternative 1**—No Further Action
- **Alternative 2—**Excavation and Off-site Disposal
- **Alternative 3—**On-site Incineration
- **Alternative 4—***In-Situ* Bioremediation
- **Alternative 5—***In-Situ* Thermal Treatment.

The focused list of remedial technologies considered in this FS for groundwater is:

- **Alternative 1**—No Further Action
- **Alternative 2**—Long-Term Monitoring
- **Alternative 3—**Sump and Foundation Upgrades
- **Alternative 4—**Containment via Hydraulic Control and Treatment.

# 6. SCOPING AND DEVELOPMENT OF REMEDIAL ALTERNATIVES

The scoping for the FS was completed based on discussions between EA and NYSDEC. EA has completed the alternative comparison in accordance with DER-10 and the 1988 USEPA publication *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA l540lG-891004). The screening of alternatives was designed to provide a basis for an overall assessment of applicable technologies based on impacted media identified at the site during the RI.

The FS is focused and, based on discussions with NYSDEC, the following limitations were placed on the evaluation:

- Remedial alternatives were developed to address chlordane impacts.

- The detections of semivolatile organic compounds (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene), metals (arsenic, iron, lead, magnesium, manganese, mercury, sodium, and zinc), pesticides (dichlorodiphenyltrichloroethane, dichlorodiphenyldichloroethylene, dichlorodiphenyldichloroethane, dieldrin, and heptachlor epoxide) in soils and/or groundwater are not considered to be a result of disposal at the site, but from proper application of a product, another source, sporadic, and/or natural conditions. The RI Report (EA 2011) has additional information regarding the findings of these chemicals. The alternatives discussed in this section will not address these constituents.

The scoping and development of the technologies/alternatives selected during the previous step of the FS process are described below.

## 6.1 SOIL ALTERNATIVES

All soil alternatives were evaluated against the Part 375 Unrestricted Use SCOs and the Residential Use SCOs. Institutional controls will be required for alternatives that do not obtain Unrestricted Use SCOs. The soil treatment areas were determined based on data presented in the RI. The treatment areas selected address the area of concern beneath the former greenhouses and in the orchard (Figures 4 and 5). Detailed soil alternatives screening is presented in Table 2.

### 6.1.1 Alternative 1: No Further Action

The no further action alternative is evaluated as a procedural requirement and as a basis for comparison. This alternative would leave the site in its present condition.

### 6.1.2 Alternative 2: Excavation and Off-site Disposal

The second potential remediation alternative to be evaluated is excavation and off-site disposal of soil. This alternative is aimed at removing the soil exceeding the SCGs on the site.

Excavation is a common remedy used to remove contaminated soil from a source area. This approach can be effective and relatively inexpensive if the contaminants are located at a shallow depth, above the water table, and there are no major obstructions on the site.

Off-site treatment and/or disposal can be expensive depending on the location of the site relative to treatment or disposal facilities, the volume of soil involved, the nature of contamination, and the availability of different treatment or disposal options in the area. In addition, the same volume of soil hauled off-site for disposal or treatment must be hauled back to the site as backfill for the excavation. Treatment of the contaminant mass would further eliminate the source of groundwater contamination at and downgradient from the site.

This alternative would be implemented as follows:

- A utility locator would be brought on-site to locate any underground utilities or other obstructions that may prove problematic during excavation.

- The concrete slabs in the excavation area would be demolished and disposed of at a landfill.

- On-site monitoring wells would be removed prior to and replaced following remediation.

- Approximately 57,000 $yd^3$ of soil would be excavated from the site (35,000 $yd^3$ for residential SCOs) to an approximate depth of 6 ft.

- Dust control measures will be utilized to prevent inhalation of contaminated soil particles and a community air monitoring program shall be followed.

- Approximately 1,000 tons of the excavated soil is assumed to be hazardous and would be disposed of at a permitted hazardous waste landfill. The remainder of the soil and the concrete on-site would be disposed of at a general waste landfill, following characterization and acceptance by the disposal facility or facilities.

- It is assumed that a dewatering system would not be needed since the excavation will not extend into the groundwater table.

- Confirmation soil sampling would be conducted during excavation to ensure source removal.

- Once excavation and disposal activities are complete, the site would be restored. This would include restoring grade with an approved backfill source.

### 6.1.3 Alternative 3: On-Site Incineration

The third potential remediation alternative to be evaluated is excavation and on-site incineration of soil. This alternative is aimed at treating the soil exceeding the SCGs on the site for on-site reuse.

Incineration is a common treatment method used for soils impacted with a variety of contaminants, including pesticides. On-site incineration would eliminate the need to transport the soil to a treatment facility and will reduce the need for an off-site backfill source. Treatment of the contaminant mass would further eliminate the source of groundwater contamination at and downgradient from the site.

This alternative would be implemented as follows:

- A utility locator would be brought on-site to locate any underground utilities or other obstructions that may prove problematic during excavation.

- The concrete slabs in the excavation area would be demolished and disposed at a landfill.

- On-site monitoring wells would be removed prior to and replaced following remediation.

- Approximately 57,000 $yd^3$ of soil would be excavated from the site (35,000 $yd^3$ for residential SCOs) to an approximate depth of 6 ft.

- Dust control measures will be utilized to prevent inhalation of contaminated soil particles and a community air monitoring program shall be followed.

- Soil would be fed through an on-site incinerator at a rate of 25 tons/hour.

- Treated soil would be stockpiled on-site until excavation and treatment is complete.

- Confirmation soil sampling would be conducted during excavation to ensure source removal.

- It is assumed that a dewatering system would not be needed since the excavation will not extend into the groundwater table.

- Once excavation and treatment activities are complete, the site would be restored. This would include restoring grade with treated soil and an approved backfill source, if necessary.

### 6.1.4 Alternative 4: *In Situ* Bioremediation

*In situ* bioremediation would be conducted using DARAMEND®, a technology consisting of organic amendments that are mixed with contaminated soil at a specified moisture content. Through a process of microbiological consumption, contaminant concentrations are reduced at a rate of approximately 30 percent per DARAMEND® application. Treatment would protect human health and the environment by removing the contaminant mass from the vadose zone soil. Treatment of the contaminant mass would further eliminate the source of groundwater contamination at and downgradient from the site.

This alternative would be implemented as follows:

- A pre-design investigation would be conducted to develop design parameters. This would include a pilot study.

- Concrete removal. All concrete within the remedial area would be broken up and disposed of prior to implementation.

- On-site monitoring wells would be removed prior to and replaced following remediation.

- Begin applications of Daramend®. Due to the ability of tilling equipment to reach a 2 ft depth, there would be several cycles of applications, in three separate phases: 0-2, 2-4, and 4-6 ft bgs. Table 2 shows the estimated number of cycles per phase.

- In between phases, the treated soils would be stockpiled on-site to allow the next phase to begin. Following treatment, all stockpiled soils would be backfilled into the remediated area and original grades would be restored using compaction methods and some additional fill material, as needed.

- Soils would be tilled twice during each cycle: once for the reductive phase and once for the aerobic phase of the treatment.

- Dust control measures will be utilized to prevent inhalation of contaminated soil particles and a community air monitoring program shall be followed.

- Soils would be sampled at a rate of 12 composite samples per acre per treatment cycle to track the treatment progress. This equates to 9 samples per cycle for the 0- to 2-ft treatment phase, 5 samples per cycle for the 2-4 ft treatment phase, and 3 samples per cycle for the 4-6 ft treatment phase.

### 6.1.5 Alternative 5: On-site Thermal Treatment

On-site thermal treatment of the soil will be conducted using thermal conduction heating to achieve soil temperatures high enough to vaporize contaminants of concern. Treatment of the contaminant mass would further eliminate the source of groundwater contamination at and downgradient from the site.

This alternative would be implemented as follows:

- A utility locator would be brought on-site to locate any underground utilities or other obstructions that may prove problematic to excavation and heater installation.
- Concrete removal. All concrete within the remedial area would be broken up and disposed of prior to implementation.
- On-site monitoring wells would be removed prior to and replaced following remediation.
- Soil would be excavated and consolidated so that it only covers an area of approximately 80,000 $ft^2$ to achieve the required 20 ft treatment depth: 6 ft *in situ* and 14 ft stockpiled on top. Other site material would be used for benching around the treatment pile.
- Dust control measures will be utilized to prevent inhalation of contaminated soil particles and a community air monitoring program shall be followed.
- Six heater rods would be installed surrounding a vertical soil vapor extraction well 14 ft apart. This pattern would repeat over the entire treatment area for a total of 143 soil vapor extraction wells and 472 heater rods.
- There would be 83 temperature monitoring holes and 20 pressure monitoring holes.
- Vapor would be treated using granular activated carbon.
- System components would be installed beneath the surface.
- Soil samples would be collected during three events to evaluate the progress of the remediation.
- Power would be supplied from the grid.
- For this cost estimate, it is assumed the remedial goals would be achieved within 8 months.

## 6.2 GROUNDWATER ALTERNATIVES

Groundwater alternatives retained were limited due to the physiochemical characteristics of chlordane. Detailed groundwater alternatives screening is presented in Table 3.

### 6.2.1 Alternative 1: No Further Action

The no further action alternative is evaluated as a procedural requirement and as a basis for comparison. This alternative would leave the site in its present condition.

### 6.2.2 Alternative 2: Long-Term Monitoring

This alternative includes long-term groundwater monitoring for pesticides, along with the decommissioning of potable wells close to and within the impacted area, connection of those properties to public water supply, and the site groundwater use would be limited.

Monitoring will be implemented as follows:

- Groundwater samples would be collected semiannually for the first 5 years and annually thereafter to measure the concentration of pesticides (monitoring is estimated to be conducted for 30 years). Samples would be collected from 29 existing wells.

- Potable wells within and adjacent to the contaminant plume would be decommissioned and those properties would be connected to public water. For the purpose of this FS, it is assumed that five wells will need to be decommissioned and five homes will need to be connected to the public water supply.

- Irrigation wells on the site would be decommissioned.

- An environmental easement would be placed on the Bianchi-Weiss Greenhouses site limiting groundwater use.

### 6.2.3 Alternative 3: Sump and Foundation Upgrades

This alternative includes upgrading residential sumps by expanding them and installing a pump with a filter. The pump would be activated by the water level within the sump. Foundation upgrades would include patching cracks and improving drainage. In addition, potable wells close to and within the impacted area would be decommissioned, those properties would be connected to the public water supply, and the site groundwater use would be limited.

Sump and foundation upgrades will be completed as follows:

- Area homes will be surveyed to determine how many would need sump and/or foundation upgrades. For the purpose of this FS, it is assumed that five sumps and five foundations will require upgrades.

- It is assumed that sumps will be expanded and a pump will be sized appropriately to send water through a filter and to discharge.

- Foundation cracks will be patched and drainage surrounding the foundations will be improved as necessary.

- Potable wells within and adjacent to the contaminant plume would be decommissioned and those properties would be connected to public water. For the purpose of this FS, it is assumed that five wells will need to be decommissioned and five homes will need to be connected to the public water supply.

- Irrigation wells on the site would be decommissioned.

- An environmental easement would be placed on the Bianchi-Weiss Greenhouses site limiting groundwater use.

### 6.2.4 Alternative 4: Containment via Hydraulic Control and Treatment

Hydraulic control of the on-site plume will be accomplished via conventional groundwater recovery. Groundwater recovery will be conducted by pumping groundwater from wells installed around the southern boundary of the site and along Abets Creek to a central treatment area where the water will be treated and discharged in an approved location. Figure 6 shows the general layout. In addition, potable and irrigation wells close to and within the impacted area would be decommissioned, those properties would be connected to the public water supply, and the site groundwater use would be limited.

This alternative would be implemented as follows:

- A utility locator would be brought on-site to locate any underground utilities or other obstructions that may prove problematic to well installation.

- New extraction wells would be installed to approximately 25 ft bgs along the southern boundary of the site and along Abets Creek recharge zone.

- Sixty-six extraction wells would be installed approximately 25 ft apart along both boundaries. Wells along Abets Creek would be approximately 100 ft from the edges of the creeks.

- Water will be pumped at a rate of 800 $ft^3$ per day. Extracted groundwater will be treated on-site via filter bags and treated effluent will be discharged to the storm sewer, pending permission from the local authority.

- Groundwater samples would be collected from 12 monitoring wells located both downgradient and upgradient of the site.

- For this cost estimate, it is assumed the remedial goals would be achieved within 30 years and post-remediation groundwater monitoring would occur semi-annually for the first 2 years and annually thereafter, for a total of 30 years.

- Potable wells within and adjacent to the contaminant plume would be decommissioned and those properties would be connected to public water. For the purpose of this FS, it is assumed that five wells will need to be decommissioned and five homes will need to be connected to the public water supply.

- Irrigation wells on the site would be decommissioned.

- An environmental easement would be placed on the Bianchi-Weiss Greenhouses site limiting groundwater use.

# 7. COSTING AND EVALUATION CRITERIA

This section describes the process for the detailed analysis of remedial alternatives for the Bianchi/Weiss Greenhouses site and also presents the cost estimates used as part of the analysis.

## 7.1 CRITERIA USED FOR ANALYSIS OF ALTERNATIVES

The criteria to which potential remedial alternatives are compared (and used during this detailed analysis) are defined in 6 NYCRR Part 375 and are listed below:

- Overall protectiveness of public health and the environment
- Conformance to SCGs
- Long-term effectiveness and permanence
- Reduction in toxicity, mobility, or volume of contamination through treatment
- Short-term impacts and effectiveness
- Implementability
- Cost-effectiveness
- Land use
- Community acceptance.

A description of the criteria and how alternatives are evaluated against them follows.

***Overall Protectiveness of Public Health and the Environment*****—**This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

***Conformance to Standards, Criteria, and Guidance*****—**Compliance with SCGs addresses whether a remedy would meet environmental laws, regulations, and other standards and criteria. The SCGs are presented in Section 8.

***Long-Term Effectiveness and Permanence*****—**This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: (1) magnitude of the remaining risks, (2) adequacy of the engineering and/or institutional controls intended to limit the risk, and (3) reliability of these controls.

***Reduction of Toxicity, Mobility, or Volume of Contamination through Treatment*****—**The degree to which the alternative permanently reduces the toxicity, mobility, or volume of hazardous substances including the adequacy of the alternative in destroying the hazardous substances, reduction or elimination of hazardous substance releases and sources of releases, degree of irreversibility of waste treatment process, and characteristics and quantity of treatment residuals generated. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility, or volume of the wastes at the site.

***Short-Term Impacts and Effectiveness*—**Evaluation of the short-term effectiveness for an alternative includes consideration of the risk to human health and the environment associated with the alternative during construction and implementation, and the effectiveness of measures that will be taken to manage such risks. Impacts from remedial action implementation include vehicle traffic; temporary relocation of residences/buildings; temporary closure of public facilities; odor; open excavations; and noise, dust, and safety concerns associated with extensive heavy equipment activity. The greatest short-term risk to human health is related to safety and general construction activity.

***Implementability*—**The technical and administrative feasibility of implementing each alternative is evaluated. Technical feasibility includes the difficulties associated with construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

***Cost-Effectiveness*—**Capital costs and annual operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision.

***Land Use*—**The current and anticipated future use of the site will be considered. Land use must comply with applicable zoning laws and maps.

***Community Acceptance*—**Public comments will be considered after the close of the public comment period.

## 7.2 FURTHER TESTING REQUIREMENTS

Pilot tests, bench-scale testing, hydraulic testing, and other field tests are considered for each alternative, as appropriate, to provide details required in the associated remedial design. The alternatives will be evaluated based on the extensiveness of the further testing required. Costs considered include estimated costs for such further testing, along with some contingency for estimated remedial quantities and expenses.

## 7.3 COST ASSUMPTIONS

Cost assumptions were prepared for each alternative using USEPA's *Guide to Developing and Documenting Cost Estimates during the Feasibility Study* (USEPA 1996). Net present value of the project costs was estimated using an interest rate of 5 percent. The cost assumptions were calculated using the most common products and application methods available for a remedial alternative. The USEPA guidance was used in conjunction with *DER-10 Technical Guidance for Site Investigation and Remediation* (NYSDEC 2010).

## 7.4 COSTS

Based on the results of the remedial technology screening in Table 1, the following cost estimates were prepared for each alternative. Appendix A shows the detailed cost estimates developed.

### 7.4.1 Soil

Costs to meet unrestricted cleanup goals are listed first, followed by costs to meet residential cleanup goals for each alternative in parentheses.

**Alternative 1: No Further Action**

*Present Worth ........................................ $0*
*Capital Cost ........................................ $0*
*Annual Costs (Years 0) ........................................ $0*

**Alternative 2: Excavation and Off-site Disposal**

*Present Worth ........................................ $9,720,000 ($6,398,000)*
*Capital Cost ........................................ $9,720,000 ($6,398,000)*
*Annual Costs (Years 0) ........................................ $0*

**Alternative 3: On-site Incineration**

*Present Worth ........................................ $13,616,000 ($9,470,000)*
*Capital Cost ........................................ $13,616,000 ($9,470,000)*
*Annual Costs (Years 0) ........................................ $0*

**Alternative 4: *In Situ* Bioremediation**

*Present Worth ........................................ $12,480,000 ($9,067,000)*
*Capital Cost ........................................ $12,480,000 ($9,067,000)*
*Annual Costs (Years 0) ........................................ $0*

**Alternative 5: *In Situ* Thermal Treatment**

*Present Worth ........................................ $10,976,000 ($10,522,000)*
*Capital Cost ........................................ $10,976,000 ($10,522,000)*
*Annual Costs (Years 0) ........................................ $0*

### 7.4.2 Groundwater

Costs to meet goals assuming no source removal are listed first, followed by costs to meet goals assuming source removal for each alternative in parentheses.

**Alternative 1: No Further Action**

*Present Worth ............................................................ $0*
*Capital Cost ............................................................ $0*
*Annual Costs ............................................................ $0*

**Alternative 2: Long-Term Monitoring**

*Present Worth ............................................................ $740,000 ($661,000)*
*Capital Cost ............................................................ $212,000*
*Annual Costs (Years 1-5) ............................................................ $53,000*
*Annual Costs (Years 6-30) ............................................................ $27,000*

**Alternative 3: Sump and Foundation Upgrades**

*Present Worth ............................................................ $726,000 ($675,000)*
*Capital Cost ............................................................ $431,000*
*Annual Costs (Years 1-5) ............................................................ $23,200*
*Annual Costs (Years 6-30) ............................................................ $17,600*

**Alternative 4: Containment via Hydraulic Control and Treatment**

*Present Worth ............................................................ $4,192,000 ($3,471,000)*
*Capital Cost ............................................................ $1,946,000*
*Annual Costs (Years 1-2) ............................................................ $157,200*
*Annual Costs (Years 3-30) ............................................................ $144,600*

# 8. DETAILED ANALYSIS OF ALTERNATIVES AND RECOMMENDATIONS

The purpose of this FS was to develop, screen, and evaluate potential remedial alternatives for the Bianchi/Weiss Greenhouses site. Remedies were identified and screened in accordance with USEPA and NYSDEC guidance. The comparison of alternatives and recommendations are described below for each media type. Based on comparison of the alternatives a recommended action is provided to obtain remedial action objectives.

Remedial alternatives were developed in this FS, as identified below.

**Soil**

- **Alternative 1—**No Further Action
- **Alternative 2—**Excavation and Off-site Disposal
- **Alternative 3—**On-site Incineration
- **Alternative 4—***In Situ* Bioremediation
- **Alternative 5—***In Situ* Thermal Treatment.

**Groundwater**

- **Alternative 1—**No Further Action
- **Alternative 2—**Long-Term Monitoring
- **Alternative 3—**Sump and Foundation Upgrades
- **Alternative 4—**Containment with *Ex Situ* Treatment.

## 8.1 COMPARISON OF SOIL ALTERNATIVES

Alternative 1 does not meet any of the RAOs. Alternative 2 will meet the RAOs. Alternative 3 will meet RAOs, but is the most expensive of the alternatives. Alternative 4 would require further testing to further evaluate treatability. Alternative 5 may prove difficult to implement in the field. Detailed analysis of the remedial alternatives is presented in Table 4.

Alternative 2 to the Residential Use SCOs is recommended because it achieves RAOs at the lowest cost and in the shortest time frame. Residential Use is recommended as it meets the current zoning and use near the site without incurring the additional cost necessary to obtain Unrestricted Use SCOs.

## 8.2 COMPARISON OF GROUNDWATER ALTERNATIVES

Alternative 1 does not meet any of the RAOs. Alternatives 2 and 3 meet some of the RAOs. Alternative 4 will meet all RAOs, but is the most expensive alternative. The detailed analysis of the remedial alternatives is presented in Table 5. A combination of Alternatives 2 and 3 is recommended.

## 8.3 RECOMMENDED REMEDIAL ACTION

Based on the recommendations made for soil and groundwater, soil Alternative 2 to achieve Residential Use SCO's in combination with groundwater Alternatives 2 and 3 is recommended.

This alternative would be implemented as follows:

- Excavation and off-site disposal of soil and concrete would be implemented as stated in Section 6.1.2.
- Excavation would be backfilled with an approved source of soil, as stated in Section 6.1.2.
- All residential buildings within and adjacent to the shallow contaminant plume would be surveyed to determine the extent of sump and foundation upgrades to be carried out.
- Sump and foundation upgrades would be made as stated in Section 6.2.3.
- Following placement of backfill, monitoring wells would be sampled semiannually for the first 5 years and annually for the next 25 years, as stated in Section 6.2.2.
- Private wells within and adjacent to the contaminant plume would be decommissioned and those properties would be connected to the public water supply, as stated in Section 6.2.2.

The following costs were developed by adding the individual capital costs for soil Alternative 2 to achieve Residential Use SCO's and groundwater Alternatives 2 and 3. Annual long-term monitoring costs for groundwater Alternatives 2 and 3 were added together. The newly calculated capital cost and annual long-term monitoring costs were used to calculate the present worth. Both groundwater alternatives include private well abandonments and public water supply hookups for five homes, so this capital cost was only included once.

*Present Worth*..........$7,733,600
*Capital Cost*..........$7,041,000
*Annual Costs*..........$55,600

# 9. REFERENCES

EA Engineering, P.C. and its Affiliate EA Science and Technology (EA). 2008. *Remedial Investigation/Feasibility Study Work Plan for the Bianchi/Weiss Greenhouses Site (152209), East Patchogue, Suffolk County, New York.*

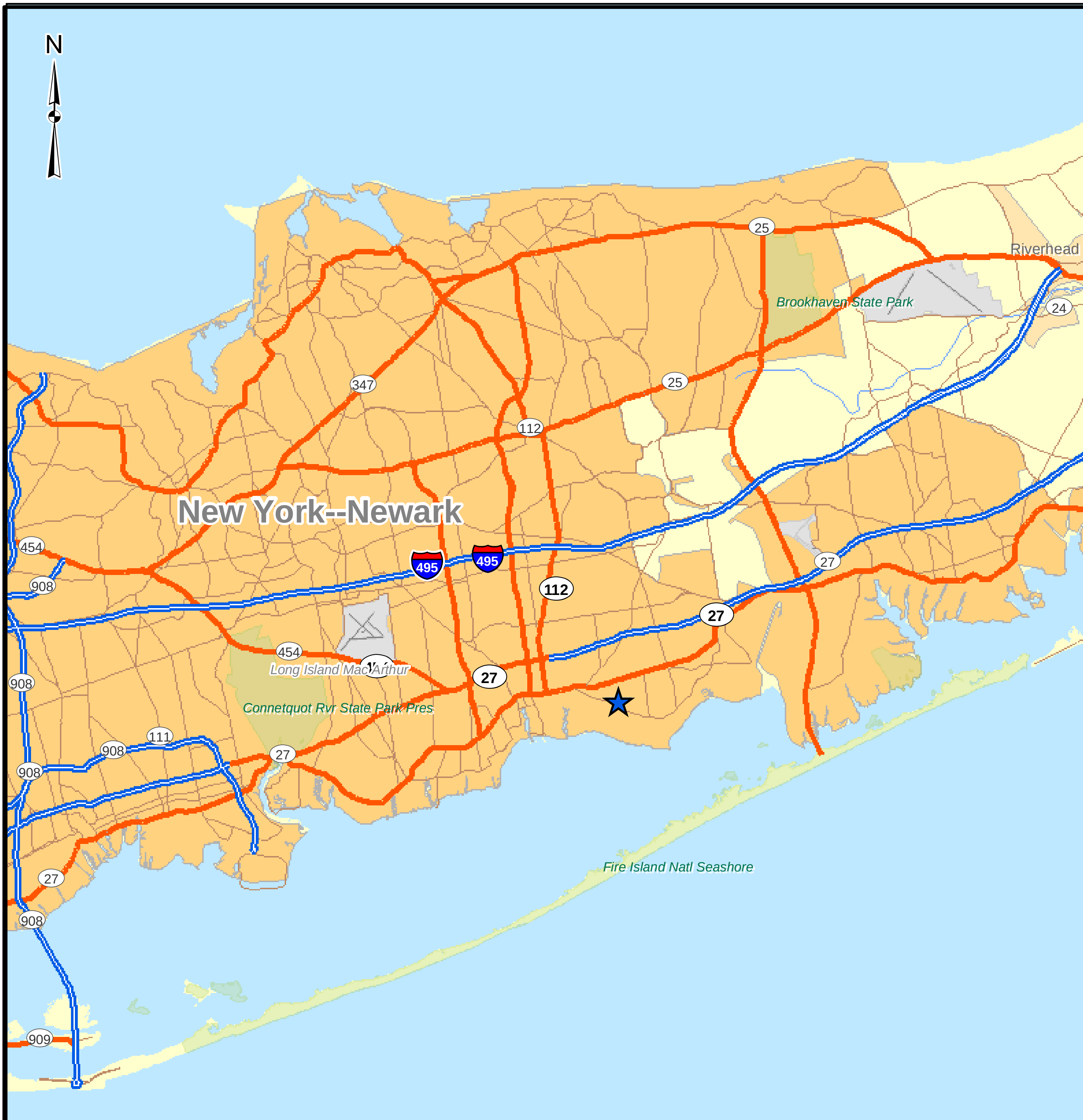
-----. 2011. *Remedial Investigation Report*. Bianchi/Weiss Greenhouses Site (No. 152209), East Patchogue, New York. June.

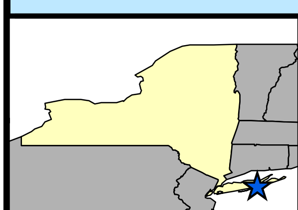
New York State Department of Environmental Conservation (NYSDEC). 1998. *NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards (Class GA)*. June.

-----. 2010. *DER-10 Technical Guidance for Site Investigation and Remediation.* May.

U.S. Environmental Protection Agency (USEPA). 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA l540lG-891004).

-----. 1996. *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*. USEPA 542-F-96-007. USEPA Office of Solid Waste and Emergency Response. April.



**Legend**

★ Site Location

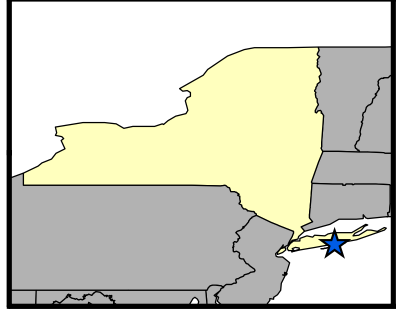
Miles
0 2 4 8
1 in = 4 miles

Source: ESRI StreetMaps USA 2005

BIANCHI/WEISS GREENHOUSES (152209)
FEASIBILITY STUDY REPORT
EAST PATCHOGUE, NEW YORK

FIGURE 1
Site Location Map

| PROJECT MGR: | DESIGNED BY: | CREATED BY: | CHECKED BY: | SCALE: | DATE: | PROJECT NO: | FILE NO: |
|---|---|---|---|---|---|---|---|
| JCH | RSC | JCP | RSC | AS SHOWN | SEPTEMBER 2011 | 14368.33 | GIS/PROJECTS/ FIGURE1.MXD |

**Legend**

- Subsurface Drainage Structure
- Former Private Wells
- Unknown Drainage Structure
- Fenceline
- Property Boundaries
- Existing Trench
- Existing Concrete Foundations
- Existing Generator House Pit
- Existing Greenhouse Walkways
- Existing Asphalt Driveways

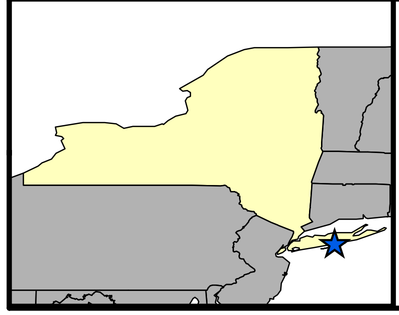
Source: NYS GIS Clearing House

BIANCHI WEISS GREENHOUSES (152209)
FEASIBILITY STUDY REPORT
EAST PATCHOGUE, NEW YORK

Feet: 0, 125, 250, 500 — 1 inch = 125 feet

FIGURE 2
Existing Site Features

| PROJECT MGR: | DESIGNED BY: | CREATED BY: | CHECKED BY: | SCALE: | DATE: | PROJECT NO: | FILE NO: |
|---|---|---|---|---|---|---|---|
| RSC | RSC | JCP | RSC | AS SHOWN | SEPTEMBER 2011 | 14368.33 | GIS/PROJECTS/ FIGURE2.MXD |

**Legend**

**Chlordane (total) Interpreted Isopleths**

- 0.05 (ug/L)
- 0.5 (ug/L)
- 2 (ug/L)
- Fenceline
- Property Boundaries
- Mointoring Well
- Piezometer
- Temporary Monitoring Well
- Former Potable Well

Source: NYS GIS Clearing House

BIANCHI WEISS GREENHOUSES (152209)
FEASIBILITY STUDY REPORT
EAST PATCHOGUE, NEW YORK

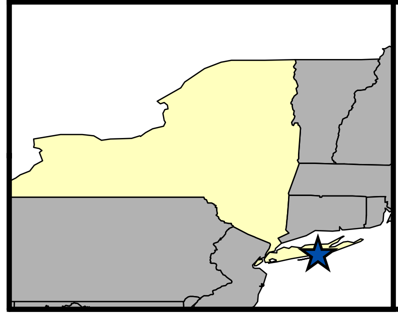
0 500 1,000 2,000 Feet

1 in = 500 ft

FIGURE 3
Groundwater Monitoring Well Locations and Interpreted Chlordane Plume

| PROJECT MGR: | DESIGNED BY: | CREATED BY: | CHECKED BY: | SCALE: | DATE: | PROJECT NO: | FILE NO: |
|---|---|---|---|---|---|---|---|
| RSC | RSC | JCP | RSC | AS SHOWN | SEPTEMBER 2011 | 14368.33 | GIS/PROJECTS/ FIGURE3.MXD |

DEPARTMENT OF ENVIRONMENTAL CONSERVATION NEW YORK STATE

**Legend**

**alpha-Chlordane - Depth of Impacts (Approximate)**

- Areas Impacted above Unrestricted Use SCO - 0-2 ft bgs
- Areas Impacted above Unrestricted Use SCO - 2-4 ft bgs
- Areas Impacted above Unrestricted Use SCO - 4-6 ft bgs

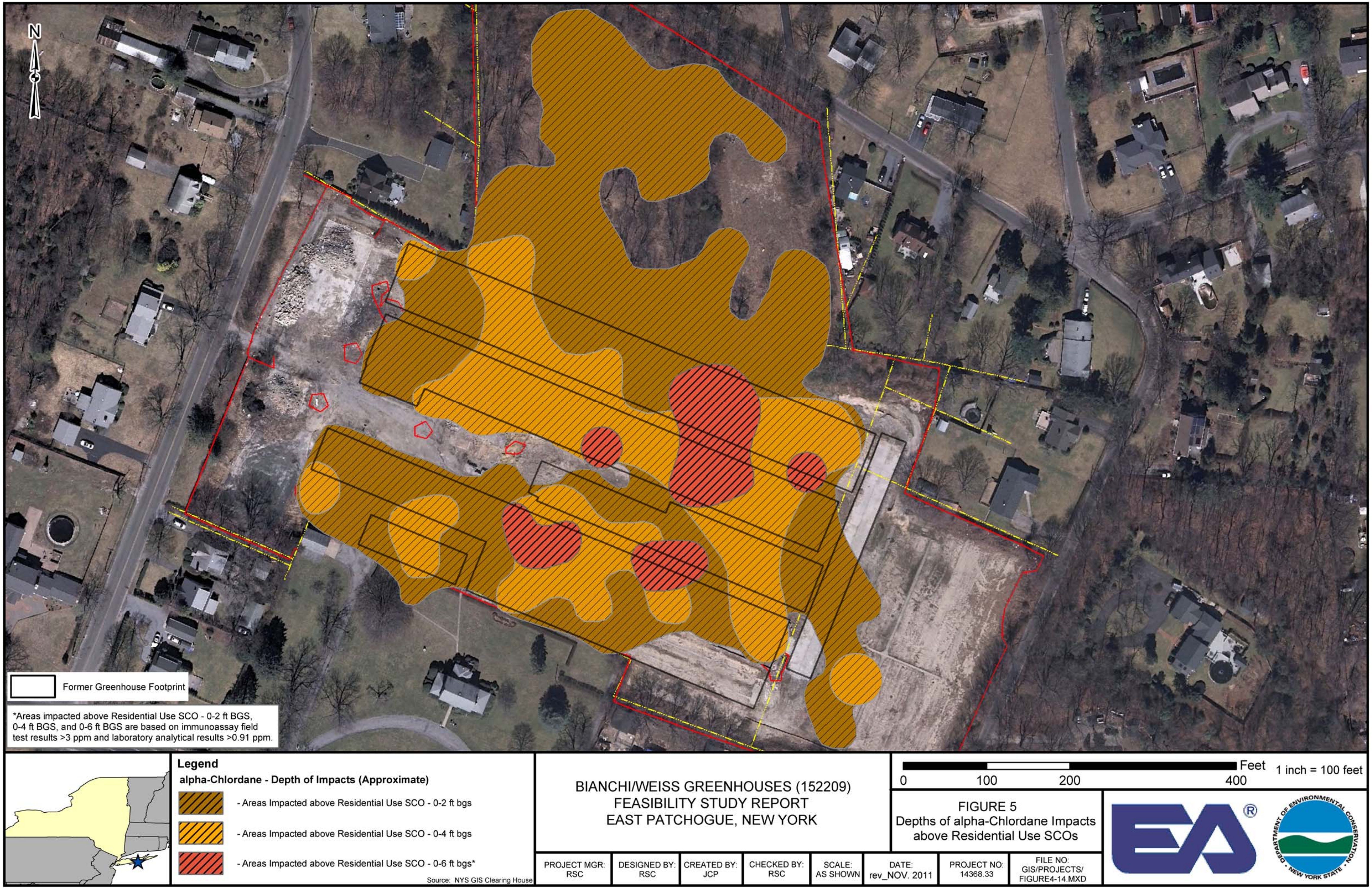
Source: NYS GIS Clearing House

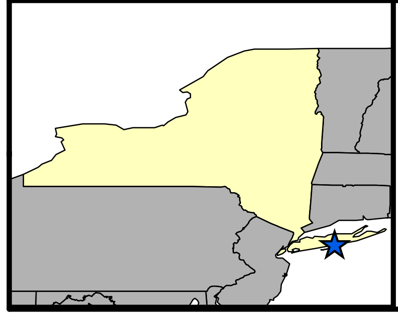
BIANCHI/WEISS GREENHOUSES (152209)
FEASIBILITY STUDY REPORT
EAST PATCHOGUE, NEW YORK

Feet: 0, 100, 200, 400 — 1 inch = 100 feet

FIGURE 4
Depths of alpha-Chlordane Impacts above Unrestricted Use SCOs

| PROJECT MGR: | DESIGNED BY: | CREATED BY: | CHECKED BY: | SCALE: | DATE: | PROJECT NO: | FILE NO: |
|---|---|---|---|---|---|---|---|
| RSC | RSC | JCP | RSC | AS SHOWN | SEPTEMBER 2011 | 14368.33 | GIS/PROJECTS/ FIGURE4-13.MXD |


N
Former Greenhouse Footprint
*Areas impacted above Residential Use SCO - 0-2 ft BGS, 0-4 ft BGS, and 0-6 ft BGS are based on immunoassay field test results >3 ppm and laboratory analytical results >0.91 ppm.
Legend
alpha-Chlordane - Depth of Impacts (Approximate)
- Areas Impacted above Residential Use SCO - 0-2 ft bgs
- Areas Impacted above Residential Use SCO - 0-4 ft bgs
- Areas Impacted above Residential Use SCO - 0-6 ft bgs*
Source: NYS GIS Clearing House
BIANCHI/WEISS GREENHOUSES (152209)
FEASIBILITY STUDY REPORT
EAST PATCHOGUE, NEW YORK
0 100 200 400 Feet
1 inch = 100 feet
FIGURE 5
Depths of alpha-Chlordane Impacts above Residential Use SCOs
PROJECT MGR: RSC
DESIGNED BY: RSC
CREATED BY: JCP
CHECKED BY: RSC
SCALE: AS SHOWN
DATE: rev_NOV. 2011
PROJECT NO: 14368.33
FILE NO: GIS/PROJECTS/ FIGURE4-14.MXD

**Legend**

**Chlordane (total) Interpreted Isopleths**

- 0.05 (ug/L)
- 0.5 (ug/L)
- 2 (ug/L)
- Extraction Line
- Discharge Line
- Fenceline
- Property Boundaries
- Extraction Wells Placed 25 ft Apart
- Pump Station
- Treatment System

Source: NYS GIS Clearing House

BIANCHI WEISS GREENHOUSES (152209)
FEASIBILITY STUDY REPORT
EAST PATCHOGUE, NEW YORK

Feet: 0 | 500 | 1,000 | 2,000

FIGURE 6
General Layout of
Groundwater Alternative 4

| PROJECT MGR: | DESIGNED BY: | CREATED BY: | CHECKED BY: | SCALE: | DATE: | PROJECT NO: | FILE NO: |
|---|---|---|---|---|---|---|---|
| RSC | RSC | MEM | RSC | AS SHOWN | SEPTEMBER 2011 | 14368.33 | GIS/PROJECTS/ FIGURE6.MXD |

# TABLE 1 REMEDIAL TECHNOLOGY SCREENING

| General Response Action | Technology | Effectiveness | Implementability | Status |
|---|---|---|---|---|
| **Media: Soil** | | | | |
| **Target Contaminant of Concern: Chlordane** | | | | |
| No Further Action | No Further Action | Not effective | Easy to implement | Retained |
| Removal | Excavation-Off Site Disposal | Effective at removing contamination from the site, thus reducing human health and ecological risks | Would require characterization and acceptance from disposal facilities. | Retained |
| Treatment | *In-situ* Bioremediation | Technology is well proven in treating pesticides in soils. | Would require treatability study to determine effectiveness and collect design parameters. | Retained |
| Treatment | *In-situ* Thermal Treatment | Potentially effective in removing pesticides from soils. | Would require treatability study to determine effectiveness and collect design parameters. | Retained |
| Treatment | *In-situ* Phytoremediation | May marginally reduce chlordane concentrations in upper 2 ft of soil. True effectiveness is unknown. | Would require further research and testing to determine effectiveness on chlordane. | Not Retained due to experimental status of technology with chlordane. |
| Treatment | *Ex-situ* Incineration | Technology is well proven in treating pesticides. | Would require characterization and acceptance from treatment facilities or benchscale testing for on-site treatment. | Retained |
| **Media: Groundwater** | | | | |
| **Target Contaminant of Concern: Volatile Organic Compounds** | | | | |
| No Further Action | No Further Action | Not effective | Easy to implement | Retained |
| Monitoring | Long-Term Monitoring | Not effective as stand alone option. | Implementable | Retained |
| Exposure Reduction | Sump and Foundation Upgrades | Effective at reducing exposure to contaminated groundwater | Easy to implement | Retained |
| Removal and Treatment | Groundwater Extraction and Treatment | Effective at removing contamination from extracted groundwater. | Implementable. Requires long-term operation and maintenance | Retained |

NOTE: Shaded technologies are retained for further screening.

TABLE 2 SOIL ALTERNATIVES SCREENING

| Media: Soil | | | | | |
|---|---|---|---|---|---|
| | **Alternative 1**<br>**No Further Action** | **Alternative 2**<br>**Excavation and Off-site Disposal** | **Alternative 3**<br>**On-Site Incineration** | **Alternative 4**<br>***In-Situ* Bioremediation** | **Alternative 5**<br>***In-Situ* Thermal Treatment** |
| **Size and Configuration of Process Options** | NA | Approximately 58,000 $yd^3$ of soil (35,000 $yd^3$ for residential SCGs) and concrete would be excavated from the site, to a 6 ft maximum depth. 1,000 tons of the excavated soil (assumed to be hazardous) would be disposed of at a permitted hazardous waste landfill. Remaining soils would be transported to a general waste landfill. Or soils would be transported to a treatment facility. An approved source of fill would be used to return the site to pre-remediation grades. | Concrete foundations would be removed from the site and transported to an accepting disposal facility. Approximately 74,000 tons of soil (45,000 tons for residential SCGs) would be placed through an on-site incineration chamber at a rate of 25 tons per hour. Treated soil would be stockpiled onsite until it could be placed back to pre-remediation grades. | Treatment would be completed in phases: 0-2 ft depth with 11 treatment cycles (7 for residential), 2-4 ft depth with 9 treatment cycles (6 for residential), and 4-6 ft depth with 3 treatment cycles (2 for residential). Chemical would be applied and mixed in the soil using tillers. Soil would be irrigated as necessary to maintain required moisture content. Samples would be collected and analyzed at a rate of 12 per acre per treatment cycle. Following inital two phases, soils would be excavated and stockpiled onsite to allow next cycle to begin. | Soil would be excavated and consolidated so that it only covers an area approximately 80,000 SF, to achieve the required 20 ft treatment depth. A total of 472 heater rods and 143 SVE wells would be installed. Six heater rods would surround each SVE wells, with 14 ft between SVE wells and heater rods. Granular activated carbon would be used to treat vapor. |
| **Time for Remediation** | NA | Approximately 10 months (7 months for residential SCGs) | Approximately 17 months (11 months for residential SCGs) | Approximately 18 months (12 months for residential SCGs) | Approximately 13 months (11 months for residential SCGs) |
| **Spatial Requirements** | None | Area of excavation will be inaccessible during remedial activities. Area for equipment storage and loading and unloading for contaminated/clean soil (~ 100 X 400 ft). | Area of excavation will be inaccessible during remedial activities. Area for on-site treatment equipment (~100 X 400 ft) and stockpiling treated soil (~250 X 250 ft) | Area of excavation will be inaccessible during remedial activities. Area for equipment storage (~100 X 400 ft) and stockpiling treated soil (~250 X 250 ft). | Area of treatment (~80,000 $ft^2$) will be inaccessible during remedial activities. Area for treatment and utilities equipment (~100 X 100 ft). |
| **Options for Disposal** | NA | Off-site disposal through approved hazardous waste and general waste facilities. Consideration for treatment and reuse of soils would be handled by the facility. | Off-site disposal for limited amount of concrete through approved facilities. | Off-site disposal for limited amount of concrete through approved facilities. | Off-site disposal for limited amount of concrete through approved facilities. |
| **Substantive Technical Permit Requirements** | None | None | Air permit may be required for air treated with afterburner and scrubbers. | None | Air permit may be required for vapor treated by carbon. |
| **Limitations or Other Factors Necessary to Evaluate Alternatives** | None | Disposal facilities will require TCLP analysis for waste characterization prior to acceptance. | Pilot test will be required for full evaluation. | Pilot test will be required for full evaluation. Sampling between cycles will indicate whether or not an additional treatment cycle is required. Treatment wil have to occur during low groundwater conditions. | Pilot test will be required for full evaluation. Sampling during treatment will indicate how long treatment must go on. |
| **Public Impacts** | Will not reduce exposure to contaminants. | Noise, dust, and traffic may disturb local residents. | Noise, dust, and traffic may disturb local residents. | Noise, dust, and traffic may disturb local residents. | Noise, dust, and traffic may disturb local residents. |
| **Beneficial and/or Adverse Impacts on Fish and Wildlife Resources** | Because soil would be left untreated, the soil could contribute to further groundwater contamination. | No known impacts on fish and wildlife resources. The potential source of groundwater contamination will be removed. | No known impacts on fish and wildlif resources. The potential source of groundwater contamination will be removed. | No known impacts on fish and wildlife resources. The potential source of groundwater contamination will be treated. | No known impacts on fish and wildlife resources. The potential source of groundwater contamination will be treated. |
| **Net Present Worth** | $0.00 | $9,720,000 (Unrestricted)<br>$6,398,000 (Residential) | $13,616,000 (Unrestricted)<br>$9,470,000 (Residential) | $12,480,000 (Unrestricted)<br>$9,067,000 (Residential) | $10,976,000 (Unrestricted)<br>$10,522,000 (Residential) |

NOTE: NA = Not Applicable
SCG = Standards, Criteria, and Guidance
SVE = Soil Vapor Extraction
TCLP = Toxicity Characteristic Leaching Procedure

TABLE 3 GROUNDWATER ALTERNATIVES SCREENING

| Media: Groundwater | | | | |
|---|---|---|---|---|
| | **Alternative 1** | **Alternative 2** | **Alternative 3** | **Alternative 4** |
| | **No Further Action** | **Long-Term Monitoring** | **Sump and Foundation Upgrades** | **Containment via Hydraulic Control and Treatment** |
| **Size and Configuration of Process Options** | None | Groundwater samples would be collected semiannually. In addition, potable wells within and adjacent to the groundwater contaminant plume would be decommissioned and those homes would be connected to public water. | Sumps and foundations which increase exposure of residents to contaminated groundwater would be upgraded to reduce exposure. Sumps would be expanded and fit with a pump and filter system, which would be triggered when the sump water reaches a certain point. Cracks in foundations would be patched and drainage around foundations would be improved as necessary. In addition, potable wells within and adjacent to the groundwater contaminant plume would be decommissioned and those homes would be connected to public water. | Approximately 66 extraction wells would be installed along the downgradient edge of the site and throughout the contaminated groundwater plume. Contaminated groundwater would be pumped to a central location for treatment, then discharged to the storm sewer. In addition, potable wells within and adjacent to the groundwater contaminant plume would be decommissioned and those homes would be connected to public water. |
| **Time for Remediation** | NA | 30 years | 30 years (Approximately 2 months construction time) | Approximately 30 years |
| **Time for Remediation Assuming Source Removal** | NA | 20 years | 20 years (Approximately 2 months construction time) | Approximately 15 years |
| **Spatial Requirements** | None | None | None | Area for equipment and treatment area (~20,000 $ft^2$). |
| **Options for Disposal** | NA | NA | Water would be treated and sampled prior to discharge. | Water would be treated and sampled prior to discharge to storm sewer. |
| **Substantive Technical Permit Requirements** | None | None | SPDES equivalency permit would be required for discharging treated water. | SPDES equivalency permit would be required for discharging treated water. |
| **Limitations or Other Factors Necessary to Evaluate Alternatives** | Will not remove contaminants from groundwater. | Will not remove contaminants from groundwater. | Survey will have to be performed on all area homes to determine how many sumps and foundations require upgrades. | Pilot test will be required to finalize design. |
| **Public Impacts** | None | Access to properties will be necessary to decommission potable wells and connect homes to public water supply. | Access to properties will be necessary to decommission potable wells, connect homes to public water supply, and upgrade sumps and foundations. | Access to properties will be necessary to decommission potable wells and connect homes to public water supply. Excavation along public roads will disturb local residents. Extraction wells will need to be installed on private properties to achieve hydraulic control of the plume. |
| **Beneficial and/or Adverse Impacts on Fish and Wildlife Resources** | No known impacts on fish and wildlife resources. | No known impacts on fish and wildlife resources. | No known impacts on fish and wildlife resources. | May have adverse impacts on hyporheic zone of Abets and Moss Creek due to shallow groundwater pumping. |
| **Net Present Worth** | $0.00 | $740,000 (No Source Removal)<br>$661,000 (Source Removal) | $726,000 (No Source Removal)<br>$675,000 (Source Removal) | $4,192,000 (No Source Removal)<br>$3,471,000 (Source Removal) |

NOTE: NA = Not Applicable
SPDES = State Pollutant Discharge Elimination System

TABLE 4 SOIL ALTERNATIVE EVALUATION SUMMARY

| Media: Soil | | | | | |
|---|---|---|---|---|---|
| | **Alternative 1** **No Further Action** | **Alternative 2** **Excavation and Off-site Disposal** | **Alternative 3** **On-site Incineration** | **Alternative 4** **In-Situ Bioremediation** | **Alternative 5** **In-Situ Thermal Treatment** |
| **(1) Overall Protection of the Public Health and the Environment** | | | | | |
| | There is no reduction of risk with this alternative. The soil pathways would continue to pose unacceptable risk to all receptors. | Removal of source reduces potential migration of contaminants to groundwater. | Treatment of impacted area reduces potential migration of contaminants to groundwater. | Treatment of impacted area reduces potential migration of contaminants to groundwater. | Treatment of impacted area reduces potential migration of contaminants to groundwater |
| **(2) Standards, Criteria and Guidance (SCGs)** | | | | | |
| | Does not meet SCG criterion. | Will meet SCG criteria. | Will meet SCG criteria. | Will meet SCG criteria. | Will meet SCG criteria. |
| **(3) Long-Term Effectiveness and Permanence** | | | | | |
| | This alternative will not provide long-term effectiveness or permanence. This alternative offers no controls. | This alternative is effective and permanent. | This alternative is effective and permanent. | This alternative is effective and permanent. Monitoring will provide a means to recognize remedy failure and implement a more aggressive remedy, if necessary. | This alternative is effective and permanent. Monitoring will provide a means to recognize remedy failure and implement a more aggressive remedy, if necessary. |
| **(4) Reduction of Toxicity, Mobility, or Volume of Contamination Through Treatment** | | | | | |
| Amount of Hazardous Materials Destroyed, Treated, or Removed | None | Excavation will remove soil exceeding allowable risks at the impacted area. | Incineration will treat soil exceeding allowable risks at the impacted area. | Bioremediation will treat soil exceeding allowable risks at the impacted area. | In-situ thermal treatment will treat/destroy contaminants of concern in the treatment area. |
| Degree of Expected Reductions in Toxicity, Mobility, or Volume | None | Contaminated soil will be disposed of in permitted facilities that use measures to reduce or eliminate the risk of toxic mobility. | Contaminant toxicity and volume will be reduced. | Contaminant toxicity and volume will be reduced. | Contaminant toxicity and volume will be reduced. |
| Irreversible Treatment? | No | Yes | Yes | Yes | Yes |
| Residuals Remaining After Treatment | Yes | Trace residuals may remain after excavation is complete. | Trace residuals may remain in soils not treated. | Residuals may remain in areas outside of the treatment area. | Residuals may remain in areas outside of the treatment area. |
| **(5) Short-Term Impact and Effectiveness** | | | | | |
| Community Protection | There is no action and therefore, no additional risk to the community. | Increased short-term risks to the public during excavation activities and transport of equipment and materials to and from site. Dust will be produced during excavation activities. These can be mitigated through standard construction practices and permitting. | Increased short-term risks to the public during excavation activities and transport of equipment and materials to and from site. Dust will be produced during excavation activities. These can be mitigated through standard construction practices and permitting. | Increased short-term risks to the public during implementation. Dust may be produced during tilling activities. These can be mitigated through standard construction practices and permitting. | Increased short-term risks to the public during installation activities and transport of equipment and materials to and from site. Dust may be produced during earthwork activities. These can be mitigated through standard construction practices and permitting. |
| Worker Protection | There is no action and therefore no workers will be present on site. | Workers can potentially be exposed to contaminated media during excavation activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing health and safety controls. | Workers can potentially be exposed to contaminated media during excavation activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing health and safety controls. | Workers can potentially be exposed to contaminated media during activities. Work around heavy equipment carries potential risk to workers. Risks can be minimized by implementing health and safety controls. | Workers can potentially be exposed to contaminated media during activities. Work around heavy equipment and electrical power carries potential risk to workers. Risks can be minimized by implementing controls. |
| Environmental Impacts | There are no short-term impacts associated with this alternative. | Wastes produced will include contaminated PPE. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions. | Wastes produced will include contaminated PPE. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions. | Wastes produced will include contaminated PPE. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions. | Wastes produced will include contaminated PPE and extracted vapors. Wastes will be managed in compliance with ARARs. Limited short term environmental impacts associated with implementation and air emissions. |
| Time Until Action Complete (Field Construction Time) | No action taken | Approximately 10 months | Approximately 10 months | Approximately 18 months | Approximately 10 months |
| **(6) Implementability** | | | | | |
| Ability to Construct and Operate | Not Applicable. | Excavation alternatives can be implemented, and have been used nationally. | Excavation alternatives can be implemented, and have been used nationally. | Bioremediation can be implemented, and has been used nationally for persistent organic pollutants. Pilot study would need to be completed to fully evaluate effectiveness. | In-situ thermal treatment system would be difficult to implement on the site due to shallow groundwater and shallow treatment depth. Soil would need to be stockpiled on-site to accommodate required treatment depth. |
| Monitoring Requirements | Not Applicable. | Soil shall be sampled and analyzed to confirm removal of impacted area. | Treated soil shall be sampled and analyzed to confirm treatment success, and untreated soil shall be sampled shall be sampled and analyzed to confirm all contaminated soil was treated. | Monitoring of soil is necessary to track the treatment process and confirm the impacted area was sufficiently treated. | Monitoring of soil is necessary to track the treatment process and ensure the impacted area was sufficiently treated. Soil temperatures outside of the treatment area should also be monitored. |
| Availability of Equipment and Specialists | Not Applicable. | Equipment and specialists are available for the implementation of all of these technologies. | | | |
| Ability to Obtain Approvals and Coordinate with Other Agencies | Not Applicable. | Ability to obtain approvals and coordinate with other agencies assumed to be possible. | | | |
| **(7) Cost Effectiveness** | | | | | |
| **Cost** | **$0** | **$9,720,000 (Unrestricted)** **$6,398,000 (Residential)** | **$13,616,000 (Unrestricted)** **$9,470,000 (Residential)** | **$12,480,000 (Unrestricted)** **$9,067,000 (Residential)** | **$10,976,000 (Unrestricted)** **$10,522,000 (Residential)** |
| **(8) Land Use** | | | | | |
| | NA | Unrestricted (Residential) | Unrestricted (Residential) | Unrestricted (Residential) | Unrestricted (Residential) |
| **(9) Community Acceptance** | | | | | |
| | TBD | TBD | TBD | TBD | TBD |

NOTE: PPE = Personal protective equipment
ARAR = Applicable or Relevant and Appropriate Requirement
TBD = To be determined

TABLE 5 GROUNDWATER ALTERNATIVE EVALUATION SUMMARY

| Media: Groundwater | | | | |
|---|---|---|---|---|
| | **Alternative 1** | **Alternative 2** | **Alternative 3** | **Alternative 4** |
| | **No Further Action** | **Long-Term Monitoring** | **Sump and Foundation Upgrades** | **Containment via Hydraulic Control and Treatment** |
| **(1) Overall Protection of the Public Health and the Environment** | | | | |
| | There is no reduction of risk with this alternative. The groundwater pathways would continue to pose unacceptable risk to all receptors. | There is no reduction of risk with this alternative. The groundwater pathways would continue to pose unacceptable risk to all receptors. After on-site source removal groundwater concentrations are anticipated to decrease. | Risk is reduced because exposure to public is limited by sump and foundation upgrades. | No risk remains because entire plume will be treated. |
| **(2) Standards, Criteria and Guidance (SCGs)** | | | | |
| | Does not meet SCG criterion. | Does not meet SCG criterion. | Does not meet SCG criterion. | Will meet SCG criterion for groundwater in the treated area. |
| **(3) Long-Term Effectiveness and Permanence** | | | | |
| | This alternative will not provide long-term effectiveness or permanence. This alternative offers no controls. The plume may expand and contaminate previously uncontaminated portions of the aquifer. | This alternative will only track long-term migration of the plume. It will not prevent the plume from expanding and and contaminating previously uncontaminated portions of the aquifer. | This alternative will be effective in the long-term at reducing exposure to the public. It will not prevent the plume from expanding and contaminating previously uncontaminated portions of the aquifer. | Ex-situ treatment will provide long-term effectiveness and permanence for groundwater within plume. Monitoring will provide a means to recognize remedy failure and implement a more aggressive remedy, if necessary. |
| **(4) Reduction of Toxicity, Mobility, or Volume of Contamination Through Treatment** | | | | |
| Amount of Hazardous Materials Destroyed, Treated, or Removed | None | None | None | Ex-situ filtration treatment will remove cotaminants of concern from groundwater within plume. |
| Degree of Expected Reductions in Toxicity, Mobility, or Volume | None | None | None | Contaminant toxicity and volume will be reduced. |
| Irreversible Treatment? | No | No | No | Yes |
| Residuals Remaining After Treatment | Yes | Yes | Yes | Trace residuals may remain. Since the whole plume is not being treated, residuals will remain after treatment. |
| **(5) Short-Term Impact and Effectiveness** | | | | |
| Community Protection | There is no action and therefore, no additional risk to the community. | No additional risk to the community. | Risk to the individuals receiving sump and/or foundation upgrades will be reduced. There will be no additional risk to others in the community. | Increased short-term risks to the public during installation activities and transport of equipment and materials to and from site. These can be mitigated through standard construction practices and permitting. |
| Worker Protection | Workers can potentially be exposed to contaminated groundwater by trenching activities south of the site. | Workers can potentially be exposed to contaminated water during groundwater sampling activities. Risks can be minimized by implementing health and safety controls. | Workers can potentially be exposed to contaminated groundwater by trenching activities south of the site. | Workers can potentially be exposed to contaminated vapors or water during activities. Work around heavy equipment and electrical power carries potential risk to workers. Risks can be minimized by implementing health and safety controls. |
| Environmental Impacts | None | None | None | Wastes produced will include contaminated personal protective equipment. Wastes will be managed in compliance with Applicable or Relevant and Appropriate Requirement. Groundwater pumping may impact the hyporheic zone of Abets and Moss Creeks. |
| Time Until Action Complete (Field Construction Time) | No action taken | 30 years | 30 years (Approximately 2 months construction time) | 30 years (Approximately 2 months construction time) |

TABLE 5 GROUNDWATER ALTERNATIVE EVALUATION SUMMARY

| Media: Groundwater | | | | |
|---|---|---|---|---|
| | **Alternative 1** | **Alternative 2** | **Alternative 3** | **Alternative 4** |
| | **No Further Action** | **Long-Term Monitoring** | **Sump and Foundation Upgrades** | **Containment via Hydraulic Control and Treatment** |
| **(6) Implementability** | | | | |
| Ability to Construct and Operate | Not Applicable. | Not Applicable. | Sump and foundations upgrades are easy to implement if access to properties is granted by property owners. | Ex-situ treatment of groundwater is implementable. |
| Monitoring Requirements | Not Applicable. | Monitoring would take place semiannually. | Not Applicable. | Groundwater requires monitoring until cleanup confirmed. Monitoring would take place semiannually for the first 2 years and annually for the following 28 years. |
| Availability of Equipment and Specialists | Not Applicable. | Equipment and specialists are available for the implementation of this alternative. | Equipment and specialists are available for the implementation of this alternative. | Equipment and specialists are available for the implementation of this technology. |
| Ability to Obtain Approvals and Coordinate with Other Agencies | Not Applicable. | Ability to obtain approvals and coordinate with other agencies assumed to be possible. | Ability to obtain approvals and coordinate with property owners assumed to be possible. | Ability to obtain approvals and coordinate with other agencies assumed to be possible. |
| **(7) Cost Effectiveness** | | | | |
| **Cost** | **$0** | **$740,000 (No Source Removal)**<br>**$661,000 (Source Removal)** | **$726,000 (No Source Removal)**<br>**$675,000 (Source Removal)** | **$4,192,000 (No Source Removal)**<br>**$3,471,000 (Source Removal)** |
| **(8) Land Use** | | | | |
| | NA | Restrict Groundwater Use | Restrict Groundwater Use | Restrict Groundwater Use |
| **(9) Community Acceptance** | | | | |
| | TBD | TBD | TBD | TBD |
| NOTE: TBD = To be determined | | | | |

# Appendix A

# Cost Estimates

| TECHNOLOGY | LOCATION | MEDIA | Estimated Cost to Implement | $9,720,000 | |
|---|---|---|---|---|---|
| **Soil Alternative 2**<br>**Excavation and Offsite Disposal**<br>**Unrestricted** | **Bianchi/Weiss Greenhouses**<br>**East Patchogue, NY** | **Soil** | **Construction Time:**<br>**Operation Time:**<br>**Post Remediation Monitoring** | **10**<br>**-**<br>**0** | **months**<br>**months**<br>**years** |

| Description | Data Source (Means[1] or Other) | Quantities: Quantity Amount | Quantity Unit | Cost Breakdown (if available): Material Unit Cost | Material Total Cost | Labor Unit Cost | Labor Total Cost | Equipment Unit Cost | Equipment Total Cost | Combined Unit Costs: Unit Cost | Option Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **REMEDIAL ACTION** | | **TOTAL CAPITAL COST (totals rounded to nearest thousand)** | | | | | | | | | **$9,720,000** |
| **Construction Activities** | | **1** | | | **$2,839,251** | | **$379,296** | | **$396,508** | **$45,717** | **$7,704,295** |
| **Site Preparation** | | | | | | | | | | | |
| Utility Locator (based on recent bids) | *recent quote* | 0.5 | day | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,475.00 | $1,238 |
| Erosion & Sediment Control Plan | | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 10,000 | $10,000 |
| Silt Fence | *31 25 13.10 1000* | 3,200 | lf | $ 0.55 | $ 1,760 | $ 0.45 | $ 1,440 | $ - | $ - | $ - | $3,200 |
| Monitoring Well Abandonment | *recent quote-EnviroTrac* | 80 | lf | $ - | $ - | $ - | $ - | $ - | $ - | $ 26.40 | $2,112 |
| Monitoring Well Installation | *recent quote-EnviroTrac* | 80 | lf | $ - | $ - | $ - | $ - | $ - | $ - | $ 112.80 | $9,024 |
| Soil Characterization Sampling (1 sample per 500 CY, per CWM) | *Chemtech* | 114 | sample | $ - | $ - | $ - | $ - | $ - | $ - | $612.00 | $69,471 |
| **Excavation** | | | | | | | | | | | |
| Community Air Monitoring (Dust) | *recent quote - Pine Environmental* | 10 | mo | | | $ 8,500 | $ 85,000 | $ 3,420 | $ 34,200 | | $119,200 |
| Dust Control, Heavy | *31 23 23.20 2510* | 200 | day | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,583.24 | $516,648 |
| Concrete demolition - Break up into small pieces, minimum reinforcing | *03 05 05.10 0060* | 926 | cy | $ - | $ - | $ 116 | $ 107,120 | $ 19 | $ 17,917 | $ - | $125,037 |
| Soil-Excavator, hydraulic, crawler mtd. 1 CY cap = 100 CY/hr | *31 23 16.42 0200* | 56,757 | bcy | $ - | $ - | $ 1.31 | $ 74,381 | $ 1.38 | $ 78,196 | $ - | $152,577 |
| **Confirmation Soil Sampling** | | | | | | | | | | | |
| Grab Samples- 12 per acre | | 128 | sample | $ - | $ 50 | $ 21 | $ 2,730 | $ 67 | $ 8,571 | $ - | $11,351 |
| Lab Analyses - TCL Pesticides | *Chemtech* | 128 | sample | $ - | $ - | $ - | $ - | $ - | $ - | $ 115.50 | $14,836 |
| **Hazardous Soil Disposal** | | | | | | | | | | | |
| Hazardous Soil Disposal | *CWM* | 1,000 | ton | $ - | $ - | $ - | $ - | $ - | $ - | $65 | $65,000 |
| Transportation using dumps | *CWM* | 1,000 | ton | $ - | $ - | $ - | $ - | $ - | $ - | $82 | $82,000 |
| Demurrage (assume 2 hours per week of loading) | *CWM* | 2 | hour | $ - | $ - | $ - | $ - | $ - | $ - | $85 | $155 |
| Fuel Surcharge- 36% of Transportation | *CWM* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 29,520.00 | $29,520 |
| **Non-Hazardous Soil Disposal** | | | | | | | | | | | |
| Soil transportation and disposal | *recent quote - EnviroTrac* | 74,330 | ton | $ - | $ - | $ - | $ - | $ - | $ - | $39.87 | $2,963,532 |
| **Backfill and Compaction** | | | | | | | | | | | |
| Supply and Transportation of NYS Certified Clean Back Fill Material | *110 Sand Company* | 65,271 | lcy | $ 43.47 | $ 2,837,441 | $ - | $ - | $ - | $ - | $ - | $2,837,441 |
| Dozer backfilling, bulk, up to 300' haul, no compaction | *31 23 23.17 0020* | 65,271 | lcy | $ - | $ - | $ 0.81 | $ 52,639 | $ 1.64 | $ 107,011 | $ - | $159,650 |
| Compacting backfill, 6" to 12" lifts, vibrating roller | *31 23 23.13 1600* | 56,757 | bcy | $ - | $ - | $ 0.99 | $ 55,986 | $ 2.65 | $ 150,613 | $ - | $206,599 |
| **Site Restoration** | | | | | | | | | | | |
| Topsoil | *A&R Materials* | 14,247 | cy | $ 20 | $ 278,673 | | | | | | $278,673 |
| Finishing grading slopes, gentle | *31 22 16.10 3300* | 44,000 | sy | $ - | $ - | $ 0.12 | $ 5,175 | $ 0.10 | $ 4,243 | $ - | $9,418 |
| Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer | *32 92 19.14 5400* | 396 | msf | $ 64.75 | $ 25,642 | $ 18.31 | $ 7,252 | $ 11.92 | $ 4,719 | $ - | $37,614 |
| **Mobilization and Demobilization** | | | | | | | | | | | **$61,156** |
| **5%** of Total Costs of Site Work, Treatment | | | | | | | | | | $1,223,117 | $61,156 |
| **Contingency** | | | | | | | | | | | **$1,164,818** |
| **15%** of Total Construction Activities | | | | | | | | | | $7,765,451 | $1,164,818 |
| **Professional/Technical Services** | | | | | | | | | | | **$789,835** |
| **5%** Project Management | | | | | | | | | | $4,646,088 | $232,304 |
| **6%** Remedial Design | | | | | | | | | | | $278,765 |
| **6%** Construction Management | | | | | | | | | | | $278,765 |
| **TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring)** | | | | | | | | | | | **$9,720,000** |

**Assumptions:**

Working condition is Safety Level: **D** **(Labor productivity: 82% ; Equipment productivity: 100% )**

Weighted Average of city cost index (Riverhead, NY) **121.6%** **(not applicable for costs derived from vendor quotes).**

Costs are loaded with a profit factor **10%**

Inflation **3%** per year

**Estimated number of soil samples** **107** samples; **1** sampling event; **20%** added for QA/QC samples; **0.25** hrs/sample; **1** worker sampling; Labor **$85** Cost per hr

Characterization Cost — Table A (per CWM) — **$612.00** per sample

Analytical cost — TCLP Pesticides — **$105.00** per sample

For each sampling event, assumed: **$50** for materials (gloves, notebooks, etc.)

**Disposal**

Pesticide contaminated soil as a haz — Disposal **$65** per ton; Transportation **$82** per ton; Demurrage **$85** per hour; Fuel Surcharge **36%** of transportation costs; **1,000** tons soil hazardous; **22** tons per load; **45** loads for incineration

T&D Pesticide contaminated soil as non-haz **$39.87** per ton; **74,330** tons soil for non-haz disposal (assume 2-6 ft is non-haz); **3,379** loads for disposal

Concrete **3,300** lbs per cy; **1,546** tons concrete for disposal

**Typical Rental Rates - Includes G&A and 10% Profit**

Mini-Rae Survey Mode PID **$96.08** per day

Truck/SUV (1/2 ton or smaller) **$70.74** per day

20 loads per day

20 working days per month

1 months for site prep/restoration

10 months to completion

**Work day consists of:** **10** hrs

**Excavation With Concrete and Asphalt:**

| | | | |
|---|---|---|---|
| Concrete and Asphalt: | **5.0%** | % of excavation volume | |
| Excavation Area: | **388,557** | sf | |
| Excavation Volume: | **56,757** | cy | **65,271** lcy |
| Excavated Weight: | **73,784** | tons | |
| Roll-off dumpster can hold approximately: | **5** | tons | |

**Notes**

| | | | |
|---|---|---|---|
| sy | square yard | mo | month |
| cy | cubic yard | ls | lump sum |
| lcy | loose cubic yard | O&M | Operation and maintenance |
| bcy | bank cubic yard | H&S | Health and Safety |
| lf | linear feet | | |
| sf | square feet | | |
| msf | 1,000 square feet | | |

| TECHNOLOGY | | LOCATION | | MEDIA | Estimated Cost to Implement | | | | | $13,616,000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Alternative 3**<br>**On-Site Incineration**<br>**Unrestricted** | | **Bianchi/Weiss Greenhouses**<br>**East Patchogue, NY** | | **Soil** | | | | | **Construction Time:**<br>**Operation Time:**<br>**Post Remediation Monitoring** | 2<br>15<br>0 | months<br>months<br>years |
| | | **Quantities** | | **Cost Breakdown (if available)** | | | | | | **Combined Unit Costs** | |
| Description | Data Source (Means[1] or Other) | Quantity Amount | Quantity Unit | Material Unit Cost | Material Total Cost | Labor Unit Cost | Labor Total Cost | Equipment Unit Cost | Equipment Total Cost | Unit Cost | Option Total Cost |
| **REMEDIAL ACTION** | | **TOTAL CAPITAL COST (totals rounded to nearest thousand)** | | | | | | | | | **$13,616,000** |
| **Construction Activities** | | **1** | | | **$1,810** | | **$311,296** | | **$369,148** | **$133,493** | **$10,934,917** |
| **Site Preparation** | | | | | | | | | | | |
| Bench Scale Testing | *Engineer's Estimate* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 50,000.00 | $50,000 |
| Utility Locator (based on recent bids) | *recent quote* | 0.5 | day | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,475.00 | $1,238 |
| Temporary Electric service- 3 - 480 volt transformers and removal of same | *LIPA* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 12,000.00 | $12,000 |
| Electrician contractor- work required to connect electric service to equipment | *Engineer's Estimate* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 50,000.00 | $50,000 |
| Erosion & Sediment Control Plan | | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 10,000 | $10,000 |
| Silt Fence | *31 25 13.10 1000* | 3,200 | lf | $ 0.55 | $ 1,760 | $ 0.45 | $ 1,440 | $ - | $ - | $ - | $3,200 |
| Monitoring Well Abandonment | *recent quote- EnviroTrac* | 80 | lf | $ - | $ - | $ - | $ - | $ - | $ - | $ 26.40 | $2,112 |
| Monitoring Well Installation | *recent quote- EnviroTrac* | 80 | lf | $ - | $ - | $ - | $ - | $ - | $ - | $ 112.80 | $9,024 |
| **Excavation** | | | | | | | | | | | |
| Community Air Monitoring (Dust) | *recent quote - Pine Environmental* | 2 | mo | | | $ 8,500 | $ 17,000 | $ 3,420 | $ 6,840 | | $23,840 |
| Dust Control, Heavy | *31 23 23.20* | 40 | day | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,583.24 | $103,330 |
| Concrete demolition - Break up into small pieces, minimum reinforcing | *03 05 05.10 0060* | 926 | cy | $ - | $ - | $ 116 | $ 107,120 | $ 19 | $ 17,917 | $ - | $125,037 |
| Transportation using Tri-Axles | *Waste Mngmt* | 1,574 | ton | $ - | $ - | $ - | $ - | $ - | $ - | $ 62.25 | $97,953 |
| Environmental Fee | *Waste Mngmt* | 70 | load | $ - | $ - | $ - | $ - | $ - | $ - | $ 10.00 | $703 |
| Fuel Surcharge- 6.09% of transportation | *Waste Mngmt* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 5,965.33 | $5,965 |
| Concrete Disposal | *Waste Mngmt* | 1,546 | ton | $ - | $ - | $ - | $ - | $ - | $ - | $ 42.25 | $65,309 |
| Soil-Backhoe, hydraulic, crawler mtd. 1 CY cap = 100 CY/hr | *31 23 16.42 0200* | 56,757 | bcy | $ - | $ - | $ 1.31 | $ 74,381 | $ 1.38 | $ 78,196 | $ - | $152,577 |
| **Confirmation Soil Sampling** | | | | | | | | | | | |
| Grab Samples- 12 per acre | | 128 | sample | $ - | $ 50 | $ 21 | $ 2,730 | $ 67 | $ 8,571 | $ - | $11,351 |
| Lab Analyses - TCL Pesticides | *Chemtech* | 128 | sample | $ - | $ - | $ - | $ - | $ - | $ - | $ 115.50 | $14,836 |
| **Soil Incineration** | | | | | | | | | | | |
| Direct-fire incinerator (mob/demob, treatment, emmissions handling, air complia | *Maxymillian* | 73,784 | ton | $ - | $ - | $ - | $ - | $ - | $ - | $100 | $7,378,410 |
| Electrical Consumption | *LIPA* | 9,664,000 | kW-hr | $ - | $ - | $ - | $ - | $ - | $ - | $ 0.22 | $2,126,080 |
| **Backfill and Compaction** | | | | | | | | | | | |
| Dozer backfilling, bulk, up to 300' haul, no compaction | *31 23 23.17 0020* | 65,271 | lcy | $ - | $ - | $ 0.81 | $ 52,639 | $ 1.64 | $ 107,011 | $ - | $159,650 |
| Compacting backfill, 6" to 12" lifts, vibrating roller | *31 23 23.13 1600* | 56,757 | bcy | $ - | $ - | $ 0.99 | $ 55,986 | $ 2.65 | $ 150,613 | $ - | $206,599 |
| **Site Restoration** | | | | | | | | | | | |
| Topsoil | *A&R Materials* | 14,247 | | $ 20 | $ 278,673 | | | | | | $278,673 |
| Finishing grading slopes, gentle | *31 22 16.10 3300* | 44,000 | sy | $ - | $ - | $ 0.12 | $ 5,175 | $ 0.10 | $ 4,243 | $ - | $9,418 |
| Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer | *32 92 19.14 5400* | 396 | msf | $ 64.75 | $ 25,642 | $ 18.31 | $ 7,252 | $ 11.92 | $ 4,719 | $ - | $37,614 |
| **Mobilization and Demobilization** | | | | | | | | | | | **$416,170** |
| **5%** of Total Costs of Site Work, Treatment | | | | | | | | | | $8,323,399 | $416,170 |
| **Contingency** | | | | | | | | | | | **$1,702,663** |
| **15%** of Total Construction Activities | | | | | | | | | | $11,351,087 | $1,702,663 |
| **Professional/Technical Services** | | | | | | | | | | | **$562,446** |
| **5%** Project Management | | | | | | | | | | $3,308,505 | $165,425 |
| **6%** Remedial Design | | | | | | | | | | | $198,510 |
| **6%** Construction Management | | | | | | | | | | | $198,510 |
| **TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring)** | | | | | | | | | | | **$13,616,000** |

**Assumptions:**

Working condition is Safety Level: **D** **(Labor productivity: 82% ; Equipment productivity: 100% )**

Weighted Average of city cost index (Riverhead, NY) **121.6%** **(not applicable for costs derived from vendor quotes).**

Costs are loaded with a profit factor **10%**

Inflation **3%** per year

**Estimated number of soil samples** **107** samples | **1** times sampled | **0.25** hrs/sample | Labor **$85** Cost per hr

**20%** added for QA/QC samples | **1** worker sampling

Analytical cost TCLP Pesticides **$105.00** per sample

For each sampling event, assumed: **$50** for materials (gloves, notebooks, etc.)

**Incineration**

Incineration chamber **$100** per ton- Maxymillian | **73,784** tons soil for incineration

Treatment Time **25** tons per hour

**Typical Rental Rates - Includes G&A and 10% Profit**

Mini-Rae Survey Mode PID **$96.08** per day $1,441.20 **mo**

Truck/SUV (1/2 ton or smaller) **$70.74** per day $1,061.10 **mo**

20 loads per day
20 working days per month
1 months for site prep/restoration
1 months to completion

**Work day consists of:** **10** hrs

**Excavation With Concrete and Asphalt:**

Concrete and Asphalt: **5.0%** % of excavation volume

Excavation Area: **388,557** sf

Excavation Volume: **56,757** cy | **65,271** lcy

Excavated Weight: **73,784** tons

Roll-off dumpster can hold approximately: **5** tons

**Onsite Incineration**

50 Rate of incineration (ton/hour)
500 Rate of incineration (ton/10 hr day)
147.5682 Days of incineration

**Notes**

| | | | |
|---|---|---|---|
| sy | square yard | mo | month |
| cy | cubic yard | ls | lump sum |
| lcy | loose cubic yard | O&M | Operation and maintenance |
| bcy | bank cubic yard | H&S | Health and Safety |
| lf | linear feet | | |
| sf | square feet | | |
| msf | 1,000 square feet | | |

| TECHNOLOGY | LOCATION | MEDIA | Estimated Cost to Implement | $12,480,000 | |
|---|---|---|---|---|---|
| **Soil Alternative 4**<br>**In-Situ Bioremediation using Daramend**<br>**Unrestricted** | **Bianchi/Weiss Greenhouses**<br>**East Patchogue, NY** | **Soil** | **Construction Time:** | **18** | **months** |
| | | | **Operation Time:** | **-** | **months** |
| | | | **Post Remediation Monitoring** | **-** | **years** |

| Description | Data Source (Means[1] or Other) | Quantity Amount | Quantity Unit | Material Unit Cost | Material Total Cost | Labor Unit Cost | Labor Total Cost | Equipment Unit Cost | Equipment Total Cost | Combined Unit Costs: Unit Cost | Option Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Quantities** | | **Cost Breakdown (if available)** | | | | | | | |
| **REMEDIAL ACTION** | | **TOTAL CAPITAL COST (totals rounded to nearest thousand)** | | | | | | | | | **$12,480,000** |
| **Construction Activities** | | **1** | | | **$6,195,923** | | **$186,797** | | **$261,356** | **$108,230** | **$9,911,352** |
| **Site Preparation** | | | | | | | | | | | |
| Utility Locator (based on recent bids) | *recent quote* | 1.0 | day | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,475 | $2,475 |
| Erosion & Sediment Control Plan | | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 10,000 | $10,000 |
| Pilot Study | *Engineer's Estimate* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 75,000 | $75,000 |
| Silt Fence | *31 25 13.10 1000* | 3,200 | lf | $ 0.55 | $ 1,763 | $ 0.45 | $ 1,455 | $ - | $ - | $ - | $3,218 |
| Monitoring Well Abandonment | *recent quote-EnviroTrac* | 80 | lf | $ - | $ - | $ - | $ - | $ - | $ - | $ 26.40 | $2,112 |
| Monitoring Well Installation | *recent quote-EnviroTrac* | 80 | lf | $ - | $ - | $ - | $ - | $ - | $ - | $ 112.80 | $9,024 |
| **Concrete Removal** | | | | | | | | | | | |
| Concrete demolition - Break up into small pieces, minimum reinforcing | *03 05 05.10 0060* | 926 | cy | $ - | $ - | $ 116 | $ 107,120 | $ 19 | $ 17,917 | $ - | $125,037 |
| Concrete - Hauling, 50 MPH ave, cycle 30 miles | *31 23 23.20 1510* | 926 | lcy | $ - | $ - | $ 3.80 | $ 3,520 | $ 9.58 | $ 8,863 | $ - | $12,383 |
| Concrete Disposal | *Waste Mngmt* | 1,527 | ton | $ - | $ - | $ - | $ - | $ - | $ - | $ 82.50 | $125,999 |
| **Daramend** | | | | | | | | | | | |
| Daramend | *Adventus* | 6,002 | ton | $ 1,000.00 | $ 6,001,500 | $ - | $ - | $ - | $ - | $ - | $6,001,500 |
| Shipping Cost | *Adventus* | 201 | loads | $ - | $ - | $ - | $ - | $ - | $ - | $ 3,400.00 | $683,400 |
| Oversight | *Adventus* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 7,000.00 | $7,000 |
| **Applications** | | | | | | | | | | | |
| Labor | *See below for equation* | 2,251 | hrs | $85 | $ 191,309 | $ - | $ - | $ - | $ - | $ - | $191,309 |
| 2 Tillers | *Adventus* | 18 | month | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,000.00 | $36,000 |
| Chemical Spreader, 3 cy | *01 54 33 1000* | 18 | month | $ - | $ - | $ - | $ - | $ - | $ - | $ 537.31 | $9,672 |
| Water tank, engine driven discharge, 5000 gallons | *01 54 33 6900* | 18 | month | $ - | $ - | $ - | $ - | $ - | $ - | $ 1,791.05 | $32,239 |
| Tractor | *01 54 33 4110* | 18 | month | $ - | $ - | $ - | $ - | $ - | $ - | $ 4,649.83 | $83,697 |
| Water Service Charge | *Suffolk County Water Authority* | 6 | qtr | $ - | $ - | $ - | $ - | $ - | $ - | $ 18.23 | $109 |
| Water | *Suffolk County Water Authority* | 1000 | 1,000 gal | $ - | $ - | $ - | $ - | $ - | $ - | $ 1.61 | $1,606 |
| **Soil Sampling** | | | | | | | | | | | |
| Grab Samples - 12 per acre | | 3,515 | sample | $ - | $ 1,350 | $ 21 | $ 74,702 | $ 66.73 | $ 234,576 | $ - | $310,628 |
| Mobilization/Demobilization of Field Sampling Crew | | 27 | event | $ - | $ - | $ - | $ - | $ - | $ - | $ 1,020 | $27,540 |
| Lab Analyses - Pesticides (8081A) | *Chemtech* | 3,515 | sample | $ - | $ - | $ - | $ - | $ - | $ - | $ 115.50 | $406,029 |
| **Soil Excavation and Stockpiling** | | | | | | | | | | | |
| Soil-Backhoe, hydraulic, crawler mtd. 1 CY cap = 100 CY/hr | *31 23 16.42 0200* | 27,608 | bcy | $ - | $ - | $ 1.07 | $ 29,668 | $ 1.38 | $ 38,036 | $ - | $67,705 |
| Community Air Monitoring (Dust) | | 18 | mo | | | $ 8,500 | $ 153,000 | $ 3,420 | $ 61,560 | | $214,560 |
| Dust Control, Heavy | *31 23 23.20 2510* | 360 | day | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,280.13 | $820,847 |
| **Site Restoration** | | | | | | | | | | | |
| Dozer backfilling 0-4', bulk, up to 300' haul, no compaction | *31 23 23.13 1300** | 51,780 | lcy | $ - | $ - | $ 0.66 | $ 34,051 | $ 1.28 | $ 66,131 | $ - | $100,182 |
| Compacting backfill, 6" to 12" lifts, vibrating roller | *31 23 23.13 1600* | 45,026 | bcy | $ - | $ - | $ 0.99 | $ 44,415 | $ 2.65 | $ 119,483 | $ - | $163,897 |
| Topsoil | *A&R Materials* | 18,781 | cy | $ 20 | $ 367,364 | $ - | $ - | $ - | $ - | $ - | $367,364 |
| Finishing grading slopes, gentle | *31 22 16.10 3300* | 44,000 | sy | $ - | $ - | $ 0.12 | $ 5,175 | $ 0.09 | $ 3,973 | $ - | $9,148 |
| Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer | *32 92 19.14 5400* | 396 | msf | $ - | $ - | $ 18.31 | $ 7,252 | $ 11.16 | $ 4,419 | $ - | $11,671 |
| **Mobilization and Demobilization** | | | | | | | | | | | **$495,568** |
| **5%** of Total Costs of Site Work, Treatment | | | | | | | | | | $9,911,352 | $495,568 |
| **Contingency** | | | | | | | | | | | **$1,486,703** |
| **15%** of Total Construction Activities | | | | | | | | | | $10,406,919 | $1,486,703 |
| **Professional/Technical Services** | | | | | | | | | | | **$586,733** |
| **5%** Project Management | | | | | | | | | | $3,088,070 | $154,404 |
| **8%** Remedial Design | | | | | | | | | | | $247,046 |
| **6%** Construction Management | | | | | | | | | | | $185,284 |
| **TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring** | | | | | | | | | | | **$12,480,000** |

**Assumptions:**

Working condition is Safety Level: **D** **(Labor productivity:** **82%** **; Equipment productivity:** **100%** **)**

Weighted average of city cost index (Riverhead, NY) **121.6%** **(not applicable for costs derived from vendor quotes).**

Costs are loaded with a profit factor **10%**

Inflation **3%** per year

Sales Tax **8.25%**

Labor: **$85** Cost per hr; **20%** added for QA/QC samples

**Estimated number of soil samples** **109** samples per event; **27** sampling events; **0.25** hrs/sample; **12** hrs for travel per event; **1** workers per event

Analytical cost — Pesticides **$105.00** per sample

For each sampling event, assumed: **$50** for materials (gloves, notebooks, etc.)

**Typical Rental Rates - Includes G&A and 10% Profit**

Mini-Rae Survey Mode PID **$96.08** per day

Truck/SUV (1/2 ton or smaller) **$70.74** per day

**Concrete Demolition and Disposal** Concrete **3,300** lbs per cy; **2,000** lbs per ton

Thickness **0.75** ft

Concrete Removal Area **33,322** sq ft

**Daramend Application** **11** 0-2' Applications 7-10 days apart; **9** 2-4' Applications 7-10 days apart; **3** 4-6' Applications 7-10 days apart

**Application labor hours calculation:**

9 acres (0-2' area) / (2 tillers) (1 acre per tiller per day) ✖ 11 applications ✖ 3 laborers ✖ 10 hrs per day ➕

4.92 acres (2-4' area) / (2 tillers) (1 acre per tiller per day) ✖ 9 applications ✖ 3 laborers ✖ 10 hrs per day ➕

3.64 acres (4-6' area) / (2 tillers) (1 acre per tiller per day) ✖ 3 applications ✖ 3 laborers ✖ 10 hrs per day

Treatment area **2** ft thick

Water needed **90,338** gal

Water costs based on using a 3" meter on a nearby fire hydrant **$1.46** per 1,000 gallons

**Work day consists of:** **10** hrs; **$1.50** base charge per day for 3" meter

| | | | | | | |
|---|---|---|---|---|---|---|
| **Treatment Area:** | 388,557 | sf | | | | |
| **0-2' Volume** | 29,149 | cy | **393,512** | sf | **9.03** | acres |
| **2-4' Volume** | 15,877 | cy | **214,340** | sf | **4.92** | acres |
| **4-6' Volume** | 11,731 | cy | **158,369** | sf | **3.64** | acres |

**Hours per Application** **Field Crew:** **3** people per day app; **4.5** days per application for 0-2' phase; **2.5** days per application for 2-4' phase; **1.8** days per application for 4-6' phase

2 tillers

1 acres/tiller/day

**Till:** **2** people

**Excavation and Stockpiling**

20 working days per month

| | | | | |
|---|---|---|---|---|
| Area 1: | 214,340 | sf | | |
| Volume 1: | 15,877 | cy | 18,259 | lcy |
| Area 2: | 158,369 | sf | | |
| Volume 2: | 11,731 | cy | 13,491 | lcy |

31,749 lcy for stockpiling

**Notes**

| | | | |
|---|---|---|---|
| sy | square yard | mo | month |
| cy | cubic yard | ls | lump sum |
| lcy | loose cubic yard | O&M | Operation and maintenance |
| bcy | bank cubic yard | H&S | Health and Safety |
| lf | linear feet | | |
| sf | square feet | | |
| msf | 1,000 square feet | | |

| TECHNOLOGY | LOCATION | MEDIA | Estimated Cost to Implement | $10,976,000 |
|---|---|---|---|---|
| **Soil Alternative 5**<br>**In-Situ Thermal**<br>**Unrestricted** | **Bianchi/Weiss Greenhouses**<br>**East Patchogue, NY** | **Soil** | **Construction Time:**<br>**Operation Time:**<br>**Post Remediation Monitoring** | **5** months<br>**8** months<br>**0** years |

| Description | Data Source (Means[1] or Other) | Quantities: Quantity Amount | Quantity Unit | Cost Breakdown (if available): Material Unit Cost | Material Total Cost | Labor Unit Cost | Labor Total Cost | Equipment Unit Cost | Equipment Total Cost | Combined Unit Costs: Unit Cost | Option Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **REMEDIAL ACTION** | | **TOTAL CAPITAL COST (totals rounded to nearest thousand)** | | | | | | | | | **$10,976,000** |
| **Construction Activities** | | **1** | | | **$840,134** | | **$411,023** | | **$538,077** | **$4,628,173** | **$8,987,281** |
| **Site Preparation** | | | | | | | | | | | |
| Utility Locator (based on recent bids) | *recent quote* | 0.5 | day | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,475.00 | $1,238 |
| Pilot Test | *Engineer's Estimate* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 150,000.00 | $150,000 |
| Conceptual design and cost estimate | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 45,144.00 | $45,144 |
| Detailed design, permitting | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 191,000.00 | $191,000 |
| Procurement | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 144,000.00 | $144,000 |
| Mobilization and Site Setup | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 367,000.00 | $367,000 |
| Erosion & Sediment Control Plan | | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 10,000 | $10,000 |
| Silt Fence | *31 25 13.10 1000* | 3,200 | lf | $ 0.55 | $ 1,760 | $ 0.45 | $ 1,440 | $ - | $ - | $ - | $3,200 |
| Temporary Electric service- 3 - 480 volt transformers and removal of same | *LIPA* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 12,000.00 | $12,000 |
| Electrician contractor- work required to connect electric service to equipment | *Engineer's Estimate* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 50,000.00 | $50,000 |
| Community Air Monitoring (Dust) | *recent quote - Pine Environmental* | 5 | mo | | | $ 8,500 | $ 42,500 | $ 3,420 | $ 17,100 | | $59,600 |
| Dust Suppression | *01 54 33.20 5300* | 5 | mo | | | $ 85 | $ 425 | $ 1,225 | $ 6,125 | | $6,550 |
| Concrete demolition - Break up into small pieces, minimum reinforcing | *03 05 05.10 0060* | 926 | cy | $ - | $ - | $ 116 | $ 107,120 | $ 19 | $ 17,917 | $ - | $125,037 |
| Concrete - Hauling, 50 MPH ave, cycle 30 miles | *31 23 23.20 1510* | 926 | cy | $ - | $ - | $ 3.80 | $ 3,520 | $ 9.58 | $ 8,863 | $ - | $12,383 |
| Concrete Disposal | *Waste Mngmt* | 1,527 | ton | $ - | $ - | $ - | $ - | $ - | $ - | $ 82.50 | $125,999 |
| Soil-Backhoe, hydraulic, crawler mtd. 1 CY cap = 100 CY/hr | *31 23 16.42 0200* | 44,100 | bcy | $ - | $ - | $ 1.31 | $ 57,795 | $ 1.38 | $ 60,758 | $ - | $118,553 |
| Soil -Hauling, 12 cy truck, cycle 0.5 mile, 15 MPH ave, 15 min. wait/Ld./Uld | *31 23 23.20 1014* | 50,715 | lcy | $ - | $ - | $ 1.33 | $ 67,452 | $ 2.74 | $ 138,960 | $ - | $206,412 |
| Monitoring Well Abandonment | *recent quote- EnviroTrac* | 80 | lf | $ - | $ - | $ - | $ - | $ - | $ - | $ 22.00 | $1,760 |
| Monitoring Well Installation | *recent quote- EnviroTrac* | 80 | lf | $ - | $ - | $ - | $ - | $ - | $ - | $ 94.00 | $7,520 |
| **Pre-Operation Site Activities** | | | | | | | | | | | |
| Drilling and Well Installation | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 1,227,000.00 | $1,227,000 |
| Vapor cover installation | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 642,000.00 | $642,000 |
| Well-field piping | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 326,000.00 | $326,000 |
| ISTD power equipment installation | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 108,000.00 | $108,000 |
| Treatment system installation | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 184,000.00 | $184,000 |
| Electrical Installation, well-field and process | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 138,000.00 | $138,000 |
| Instrument and monitoring system installation | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 73,000.00 | $73,000 |
| Pre-startup and shakedown | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 48,000.00 | $48,000 |
| **Operation** | | | | | | | | | | | |
| ISTD Power Equipment Rental | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 85,000.00 | $85,000 |
| Effluent Treatment System Rental | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 20,000.00 | $20,000 |
| Labor, travel, per diem | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 267,000.00 | $267,000 |
| Process monitoring, sampling and analysis | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 49,000.00 | $49,000 |
| Waste and GAC | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 13,000.00 | $13,000 |
| Repair/maintenance | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 58,000.00 | $58,000 |
| Tools, rentals and fees | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 22,000.00 | $22,000 |
| Electrical Consumption | *LIPA* | 9,664,000 | kW-hr | $ - | $ - | $ - | $ - | $ - | $ - | $ 0.22 | $2,126,080 |
| Supply and Transportation of Clean Back Fill Material for 3:1 side slope | *110 Sand Company* | 19,284 | lcy | $ 43.47 | $838,324 | $ - | $ - | $ - | $ - | $ - | $838,324 |
| **Soil Sampling** | | | | | | | | | | | |
| Geoprobe Rig | | 1 | day | $ - | $ - | $ - | $ - | $ - | $ - | $2,200 | $2,200 |
| Sampling Materials, Labor, and Equipment | | 49 | sample | $ - | $ 50 | $ 43 | $ 2,083 | $ 66.73 | $ 3,270 | $ - | $5,402 |
| Mobilization/Demobilization of Field Sampling Crew | | 1 | event | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,040 | $2,040 |
| Lab Analyses - Pesticides (8081) | *Chemtech* | 49 | sample | $ - | $ - | $ - | $ - | $ - | $ - | $ 115.50 | $5,660 |
| **Demobilization and Other** | | | | | | | | | | | |
| Decommissioning | *Terratherm* | 1 | ls | | | | | | | $ 166,000.00 | $166,000 |
| Site Clearance and Demobilization | *Terratherm* | 1 | ls | | | | | | | $ 179,000.00 | $179,000 |
| Reporting | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 47,000.00 | $47,000 |
| Dozer backfilling, bulk, up to 300' haul, no compaction | *31 23 23.13 1300* | 70,000 | lcy | $ - | $ - | $ 0.81 | $ 56,453 | $ 1.64 | $ 114,764 | $ - | $171,217 |
| Compacting backfill, 6" to 12" lifts, vibrating roller | *31 23 23.13 1600* | 60,869 | bcy | $ - | $ - | $ 0.99 | $ 60,043 | $ 2.65 | $ 161,525 | $ - | $221,568 |
| Topsoil | *A&R Materials* | 14,276 | cy | $ 20 | $ 279,247 | | | | | | $279,247 |
| Finishing grading slopes, gentle | *31 22 16.10 3300* | 43,173 | sy | $ - | $ - | $ 0.12 | $ 5,078 | $ 0.10 | $ 4,164 | $ - | $9,241 |
| Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer | *32 92 19.14 5400* | 388.56 | msf | $ 64.75 | $ 25,160 | $ 18.31 | $ 7,116 | $ 11.92 | $ 4,631 | $ - | $36,907 |
| **Contingency** | | | | | | | | | | | **$1,348,092** |
| **15%** of Total Construction Activities | | | | | | | | | | $8,987,281 | $1,348,092 |
| **Professional/Technical Services** | | | | | | | | | | | **$640,475** |
| **5%** Project Management | | | | | | | | | | $5,822,496 | $291,125 |
| **6%** Construction Management | | | | | | | | | | | $349,350 |
| **TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring)** | | | | | | | | | | | **$10,976,000** |

**Assumptions:**

Working condition is Safety Level: **D** **(Labor productivity: 82% ; Equipment productivity: 100% )**

Weighted Average of city cost index (Rochester, NY) **121.6%** **(not applicable for costs derived from vendor quotes).**

Costs are loaded with a profit factor **10%**

Inflation **3%** per year

**Estimated number of soil samples** **41** samples; **1** sampling events; **0** hrs/sample; Labor **$85** Cost per hr

**12** hrs for travel per event; **2** workers per event

Analytical cost — Pesticides **$105.00** per sample

For each sampling event, assumed: **$50** for materials (gloves, notebooks, etc.)

**Typical Rental Rates - Includes G&A and 10% Profit**

Mini-Rae Survey Mode PID **$96.08** per day

Truck/SUV (1/2 ton or smaller) **$70.74** per day

**Work day consists of:** **10** hrs

**Treatment Area:** **148,225** sf

**Treatment Volume:** **55,831** cy; **64,206** lcy; **1,507,448** cf — 20 working days per month

**Excavation Volume:** **44,100** cy; **50,715** lcy

**Notes**

| | | | |
|---|---|---|---|
| sy | square yard | mo | month |
| cy | cubic yard | ls | lump sum |
| lcy | loose cubic yard | O&M | Operation and maintenance |
| bcy | bank cubic yard | H&S | Health and Safety |
| lf | linear feet | | |
| sf | square feet | | |
| msf | 1,000 square feet | | |

| TECHNOLOGY | LOCATION | MEDIA | Estimated Cost to Implement | $6,398,000 | |
|---|---|---|---|---|---|
| Soil Alternative 2<br>Excavation and Off-site Disposal<br>Residential | Bianchi/Weiss Greenhouses<br>East Patchogue, NY | Soil | Construction Time: | 7 | months |
| | | | Operation Time: | - | months |
| | | | Post Remediation Monitoring | 0 | years |

| Description | Data Source (Means[1] or Other) | Quantities: Quantity Amount | Quantity Unit | Cost Breakdown (if available): Material Unit Cost | Material Total Cost | Labor Unit Cost | Labor Total Cost | Equipment Unit Cost | Equipment Total Cost | Combined Unit Costs: Unit Cost | Option Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **REMEDIAL ACTION** | | **TOTAL CAPITAL COST (totals rounded to nearest thousand)** | | | | | | | | | **$6,398,000** |
| **Construction Activities** | | **1** | | | **$1,708,114** | | **$280,841** | | **$252,374** | **$45,717** | **$4,975,727** |
| **Site Preparation** | | | | | | | | | | | |
| Utility Locator (based on recent bids) | *recent quote* | 0.5 | day | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,475.00 | $1,238 |
| Erosion & Sediment Control Plan | | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 10,000 | $10,000 |
| Silt Fence | *31 25 13.10 1000* | 3,200 | lf | $ 0.55 | $ 1,760 | $ 0.45 | $ 1,440 | $ - | $ - | $ - | $3,200 |
| Monitoring Well Abandonment | *recent quote-EnviroTrac* | 80 | lf | $ - | $ - | $ - | $ - | $ - | $ - | $ 26.40 | $2,112 |
| Monitoring Well Installation | *recent quote-EnviroTrac* | 80 | lf | $ - | $ - | $ - | $ - | $ - | $ - | $ 112.80 | $9,024 |
| **Excavation** | | | | | | | | | | | |
| Community Air Monitoring (Dust) | *recent quote - Pine Environmental* | 7 | mo | | | $ 8,500 | $ 59,500 | $ 3,420 | $ 23,940 | | $83,440 |
| Dust Control, Heavy | *31 23 23.20 2510* | 140 | mo | | | $ - | $ - | $ - | $ - | $ 2,583.24 | $361,654 |
| Concrete demolition - Break up into small pieces, minimum reinforcing | *03 05 05.10 0060* | 926 | cy | $ - | $ - | $ 116 | $ 107,120 | $ 19 | $ 17,917 | $ - | $125,037 |
| Soil-Excavator, hydraulic, crawler mtd. 1 CY cap = 100 CY/hr | *31 23 16.42 0200* | 34,131 | bcy | $ - | $ - | $ 1.31 | $ 44,729 | $ 1.38 | $ 47,023 | $ - | $91,753 |
| **Confirmation Soil Sampling** | | | | | | | | | | | |
| Grab Samples- 12 per acre | | 128 | sample | $ - | $ 50 | $ 21 | $ 2,730 | $ 67 | $ 8,571 | $ - | $11,351 |
| Lab Analyses - TCL Pesticides | *Chemtech* | 128 | sample | $ - | $ - | $ - | $ - | $ - | $ - | $ 115.50 | $14,836 |
| **Hazardous Soil Disposal** | | | | | | | | | | | |
| Soil Characterization Sampling (1 sample per 500 CY, per CWM) | *Chemtech* | 68 | sample | $ - | $ - | $ - | $ - | $ - | $ - | $ 612.00 | $41,776 |
| Hazardous Soil Disposal | *CWM* | 1,000 | ton | $ - | $ - | $ - | $ - | $ - | $ - | $ 65.00 | $65,000 |
| Transportation using dumps | *CWM* | 1,000 | ton | $ - | $ - | $ - | $ - | $ - | $ - | $ 82.00 | $82,000 |
| Demurrage (assume 2 hours per week of loading) | *CWM* | 2 | hour | $ - | $ - | $ - | $ - | $ - | $ - | $ 85.00 | $155 |
| Fuel Surcharge- 36% of Transportation | *CWM* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 29,520.00 | $29,520 |
| **Non-Hazardous Soil Disposal** | | | | | | | | | | | |
| Soil transportation and disposal | *Recent quote-EnviroTrac* | 44,916 | ton | $ - | $ - | $ - | $ - | $ - | $ - | $39.87 | $1,790,804 |
| **Backfill and Compaction** | | | | | | | | | | | |
| Supply and Transportation of NYS Certified Clean Back Fill Material | *110 Sand Company* | 39,251 | lcy | $ 43.47 | $ 1,706,304 | $ - | $ - | $ - | $ - | $ - | $1,706,304 |
| Dozer backfilling, bulk, up to 300' haul, no compaction | *31 23 23.17 0020* | 39,251 | lcy | $ - | $ - | $ 0.81 | $ 31,655 | $ 1.64 | $ 64,351 | $ - | $96,006 |
| Compacting backfill, 6" to 12" lifts, vibrating roller | *31 23 23.13 1600* | 34,131 | bcy | $ - | $ - | $ 0.99 | $ 33,667 | $ 2.65 | $ 90,571 | $ - | $124,239 |
| **Site Restoration** | | | | | | | | | | | |
| Topsoil | *A&R Materials* | 14,276 | cy | $ 20 | $ 279,247 | | | | | | $279,247 |
| Finishing grading slopes, gentle | *31 22 16.10 3300* | 44,000 | sy | $ - | $ - | $ 0.12 | $ 5,175 | $ 0.10 | $ 4,243 | $ - | $9,418 |
| Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer | *32 92 19.14 5400* | 396 | msf | $ 64.75 | $ 25,642 | $ 18.31 | $ 7,252 | $ 11.92 | $ 4,719 | $ - | $37,614 |
| **Mobilization and Demobilization** | | | | | | | | | | | **$142,910** |
| **5%** of Total Costs of Site Work, Treatment | | | | | | | | | | $2,858,196 | $142,910 |
| **Contingency** | | | | | | | | | | | **$767,795** |
| **15%** of Total Construction Activities | | | | | | | | | | $5,118,636 | $767,795 |
| **Professional/Technical Services** | | | | | | | | | | | **$511,402** |
| **5%** Project Management | | | | | | | | | | $3,008,248 | $150,412 |
| **6%** Remedial Design | | | | | | | | | | | $180,495 |
| **6%** Construction Management | | | | | | | | | | | $180,495 |
| **TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring)** | | | | | | | | | | | **$6,398,000** |

**Assumptions:**

Working condition is Safety Level: **D** (Labor productivity: **82%** ; Equipment productivity: **100%** )

Weighted Average of city cost index (Riverhead, NY) **121.6%** (not applicable for costs derived from vendor quotes).

Costs are loaded with a profit factor **10%**

Inflation **3%** per year

**Estimated number of soil samples** **107** samples; **1** times sampled; **20%** added for QA/QC samples; **0.25** hrs/sample; **1** worker sampling; Labor **$85** Cost per hr

Characterization Cost — Table A (per CWM) **$612.00** per sample

Analytical cost — TCLP Pesticides **$105.00** per sample

For each sampling event, assumed: **$50** for materials (gloves, notebooks, etc.)

**Disposal**

Pesticide contaminated soil as a "listed" waste- incineration:
- Disposal **$65** per ton; **1,000** tons soil hazardous
- Transportation **$82** per ton; **22** tons per load; **45** loads for incineration
- Demurrage **$85** per hour
- **36%** of transportation costs

T&D Pesticide contaminated soil as non-haz **$39.87** per ton; **44,916** tons soil for non-haz disposal; **2,042** loads for disposal

Concrete **3,300** lbs per cy; **1,546** tons concrete for disposal

**Typical Rental Rates - Includes G&A and 10% Profit**

Mini-Rae Survey Mode PID **$96.08** per day

Truck/SUV (1/2 ton or smaller) **$70.74** per day

20 loads per day
20 working days per month
1 months for site prep/restoration
6 months to completion

**Work day consists of:** **10** hrs

**Excavation With Concrete and Asphalt:**

Concrete and Asphalt: **5.0%** % of excavation volume
Excavation Area: **388,557** sf
Excavation Volume: **34,131** cy; **39,251** lcy
Excavated Weight: **44,370** tons
Roll-off dumpster can hold approximately: **5** tons

**Notes**

| | | | |
|---|---|---|---|
| sy | square yard | mo | month |
| cy | cubic yard | ls | lump sum |
| lcy | loose cubic yard | O&M | Operation and maintenance |
| bcy | bank cubic yard | H&S | Health and Safety |
| lf | linear feet | | |
| sf | square feet | | |
| msf | 1,000 square feet | | |

| TECHNOLOGY | LOCATION | MEDIA | Estimated Cost to Implement | $9,470,000 | |
|---|---|---|---|---|---|
| **Soil Alternative 3**<br>**On-Site Incineration**<br>**Residential** | **Bianchi/Weiss Greenhouses**<br>**East Patchogue, NY** | **Soil** | **Construction Time:**<br>**Operation Time:**<br>**Post Remediation Monitoring** | 2<br>9<br>0 | months<br>months<br>years |

| Description | Data Source (Means[1] or Other) | Quantities: Quantity Amount | Quantity Unit | Cost Breakdown (if available): Material Unit Cost | Material Total Cost | Labor Unit Cost | Labor Total Cost | Equipment Unit Cost | Equipment Total Cost | Combined Unit Costs: Unit Cost | Option Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **REMEDIAL ACTION** | | **TOTAL CAPITAL COST (totals rounded to nearest thousand)** | | | | | | | | | **$9,470,000** |
| **Construction Activities** | | **1** | | | **$1,810** | | **$238,341** | | **$235,274** | **$133,493** | **$7,149,459** |
| **Site Preparation** | | | | | | | | | | | |
| Benchscale Testing | *Engineer's Estimate* | 1 | ls | | | | | | | $50,000 | $50,000 |
| Utility Locator (based on recent bids) | *recent quote* | 0.5 | day | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,475.00 | $1,238 |
| Temporary Electric service- 3 - 480 volt transformers and removal of same | *LIPA* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 12,000.00 | $12,000 |
| Electrician contractor- work required to connect electric service to equipment | *Engineer's Estimate* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 50,000.00 | $50,000 |
| Erosion & Sediment Control Plan | | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 10,000 | $10,000 |
| Silt Fence | *31 25 13.10 1000* | 3,200 | lf | $ 0.55 | $ 1,760 | $ 0.45 | $ 1,440 | $ - | $ - | $ - | $3,200 |
| Monitoring Well Abandonment | *recent quote-EnviroTrac* | 80 | lf | $ - | $ - | $ - | $ - | $ - | $ - | $ 26.40 | $2,112 |
| Monitoring Well Installation | *recent quote-EnviroTrac* | 80 | lf | $ - | $ - | $ - | $ - | $ - | $ - | $ 112.80 | $9,024 |
| **Excavation** | | | | | | | | | | | |
| Community Air Monitoring (Dust) | *recent quote - Pine Environmental* | 2 | mo | | | $ 8,500 | $ 17,000 | $ 3,420 | $ 6,840 | | $23,840 |
| Dust Control, Heavy | *31 23 23.20 2510* | 40 | day | | | | $ - | | $ - | $ 2,583.24 | $103,330 |
| Concrete demolition - Break up into small pieces, minimum reinforcing | *03 05 05.10 0060* | 926 | cy | $ - | $ - | $ 116 | $ 107,120 | $ 19 | $ 17,917 | $ - | $125,037 |
| Transportation using Tri-Axles | *Waste Mngmt* | 1,574 | ton | $ - | $ - | $ - | $ - | $ - | $ - | $ 62.25 | $97,953 |
| Environmental Fee | *Waste Mngmt* | 70 | load | $ - | $ - | $ - | $ - | $ - | $ - | $ 10.00 | $703 |
| Fuel Surcharge- 6.09% of transportation | *Waste Mngmt* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 5,965.33 | $5,965 |
| Concrete Disposal | *Waste Mngmt* | 1,546 | ton | $ - | $ - | $ - | $ - | $ - | $ - | $ 42.25 | $65,309 |
| Soil-Backhoe, hydraulic, crawler mtd. 1 CY cap = 100 CY/hr | *31 23 16.42 0200* | 34,131 | bcy | $ - | $ - | $ 1.31 | $ 44,729 | $ 1.38 | $ 47,023 | $ - | $91,753 |
| **Confirmation Soil Sampling** | | | | | | | | | | | |
| Grab Samples- 12 per acre | | 128 | sample | $ - | $ 50 | $ 21 | $ 2,730 | $ 67 | $ 8,571 | $ - | $11,351 |
| Lab Analyses - TCL Pesticides | *Chemtech* | 128 | sample | $ - | $ - | $ - | $ - | $ - | $ - | $ 115.50 | $14,836 |
| **Soil Incineration** | | | | | | | | | | | |
| Direct-fire incinerator (mob/demob, treatment, emmissions handling, air complia | *Maxymillian* | 44,370 | ton | $ - | $ - | $ - | $ - | $ - | $ - | $ 100.00 | $4,437,030 |
| Electrical Consumption | *LIPA* | 6,764,800 | kW-hr | $ - | $ - | $ - | $ - | $ - | $ - | $ 0.22 | $1,488,256 |
| **Backfill and Compaction** | | | | | | | | | | | |
| Dozer backfilling, bulk, up to 300' haul, no compaction | *31 23 23.17 0020* | 39,251 | lcy | $ - | $ - | $ 0.81 | $ 31,655 | $ 1.64 | $ 64,351 | $ - | $96,006 |
| Compacting backfill, 6" to 12" lifts, vibrating roller | *31 23 23.13 1600* | 34,131 | bcy | $ - | $ - | $ 0.99 | $ 33,667 | $ 2.65 | $ 90,571 | $ - | $124,239 |
| **Site Restoration** | | | | | | | | | | | |
| Topsoil | *A&R Materials* | 14,276 | cy | $ 20 | $ 279,247 | | | | | | $279,247 |
| Finishing grading slopes, gentle | *31 22 16.10 3300* | 44,000 | sy | $ - | $ - | $ 0.12 | $ 5,175 | $ 0.10 | $ 4,243 | $ - | $9,418 |
| Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer | *32 92 19.14 5400* | 396 | msf | $ 64.75 | $ 25,642 | $ 18.31 | $ 7,252 | $ 11.92 | $ 4,719 | $ - | $37,614 |
| **Mobilization and Demobilization** | | | | | | | | | | | **$273,928** |
| **5%** of Total Costs of Site Work, Treatment | | | | | | | | | | $5,478,551 | $273,928 |
| **Contingency** | | | | | | | | | | | **$1,113,508** |
| **15%** of Total Construction Activities | | | | | | | | | | $7,423,387 | $1,113,508 |
| **Professional/Technical Services** | | | | | | | | | | | **$933,517** |
| **5%** Project Management | | | | | | | | | | $5,491,274 | $274,564 |
| **6%** Remedial Design | | | | | | | | | | | $329,476 |
| **6%** Construction Management | | | | | | | | | | | $329,476 |

**TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring)** **$9,470,000**

**Assumptions:**

| | | | | | |
|---|---|---|---|---|---|
| Working condition is Safety Level: | D | **(Labor productivity:** **82%** **; Equipment productivity:** **100%** **)** | | | |
| Weighted Average of city cost index (Riverhead, NY) | 121.6% | **(not applicable for costs derived from vendor quotes).** | | | |
| Costs are loaded with a profit factor | 10% | | | | |
| Inflation | 3% | per year | | | Labor |
| **Estimated number of soil samples** | 107 | samples | 1 times sampled | 0.25 hrs/sample | $85 Cost per hr |
| | | | 20% added for QA/QC samples | 1 worker sampling | |
| Analytical cost (TCLP Pesticides) | $105.00 | per sample | | | |
| For each sampling event, assumed: | $50 | for materials (gloves, notebooks, etc.) | | | |
| **Incineration** | | | | | |
| Incineration Unit | $100 | per ton- Maxymillian | 44,370 tons soil for incineration | | |
| Treatment time | 25 | tons per hour | | | |

**Typical Rental Rates - Includes G&A and 10% Profit**

| | | | | |
|---|---|---|---|---|
| Mini-Rae Survey Mode PID | $96.08 | per day | $1,441.20 **mo** | 20 loads per day |
| Truck/SUV (1/2 ton or smaller) | $70.74 | per day | $1,061.10 **mo** | 20 working days per month |
| | | | | 1 months for site prep/restoration |
| **Work day consists of:** | 10 | hrs | | 1 months to completion |

**Excavation With Concrete and Asphalt:**

| | | | |
|---|---|---|---|
| Concrete and Asphalt: | 5.0% | % of excavation volume | |
| Excavation Area: | 388,557 | sf | |
| Excavation Volume: | 34,131 | cy | 39,251 lcy |
| Excavated Weight: | 44,370 | tons | |
| Roll-off dumpster can hold approximately: | 5 | tons | |

**Onsite Incineration**

50 Rate of incineration (ton/hour)
500 Rate of incineration (ton/10 hr day)
88.7406 Days of incineration

**Notes**

| | | | |
|---|---|---|---|
| sy | square yard | mo | month |
| cy | cubic yard | ls | lump sum |
| lcy | loose cubic yard | O&M | Operation and maintenance |
| bcy | bank cubic yard | H&S | Health and Safety |
| lf | linear feet | | |
| sf | square feet | | |
| msf | 1,000 square feet | | |

| TECHNOLOGY | LOCATION | MEDIA | Estimated Cost to Implement | $9,067,000 | |
|---|---|---|---|---|---|
| **Soil Alternative 4**<br>**In-Situ Bioremediation using Daramend**<br>**Residential** | **Bianchi/Weiss Greenhouses**<br>**East Patchogue, NY** | **Soil** | **Construction Time:** | **12** | **months** |
| | | | **Operation Time:** | **-** | **months** |
| | | | **Post Remediation Monitoring** | **-** | **years** |

| Description | Data Source (Means[1] or Other) | Quantities: Quantity Amount | Quantity Unit | Cost Breakdown (if available): Material Unit Cost | Material Total Cost | Labor Unit Cost | Labor Total Cost | Equipment Unit Cost | Equipment Total Cost | Combined Unit Costs: Unit Cost | Option Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **REMEDIAL ACTION** | | **TOTAL CAPITAL COST (totals rounded to nearest thousand)** | | | | | | | | | **$9,067,000** |
| **Construction Activities** | | **1** | | | **$4,176,460** | | **$137,070** | | **$105,207** | **$106,955** | **$6,372,276** |
| **Site Preparation** | | | | | | | | | | | |
| Utility Locator (based on recent bids) | *recent quote* | 1.0 | day | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,475 | $2,475 |
| Erosion & Sediment Control Plan | | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 10,000 | $10,000 |
| Pilot Study | *Engineer's Estimate* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 75,000 | $75,000 |
| Silt Fence | *31 25 13.10 1000* | 3,200 | lf | $ 0.55 | $ 1,763 | $ 0.45 | $ 1,455 | $ - | $ - | $ - | $3,218 |
| Monitoring Well Abandonment | *recent quote-EnviroTrac* | 80 | lf | $ - | $ - | $ - | $ - | $ - | $ - | $ 26.40 | $2,112 |
| Monitoring Well Installation | *recent quote-EnviroTrac* | 80 | lf | $ - | $ - | $ - | $ - | $ - | $ - | $ 112.80 | $9,024 |
| **Concrete Removal** | | | | | | | | | | | |
| Concrete demolition - Break up into small pieces, minimum reinforcing | *03 05 05.10 0060* | 926 | cy | $ - | $ - | $ 116 | $ 107,120 | $ 19 | $ 17,917 | $ - | $125,037 |
| Concrete - Hauling, 50 MPH ave, cycle 30 miles | *31 23 23.20 1510* | 926 | lcy | $ - | $ - | $ 3.80 | $ 3,520 | $ 9.58 | $ 8,863 | $ - | $12,383 |
| Concrete Disposal | *Waste Mngmt* | 1,527 | ton | $ - | $ - | $ - | $ - | $ - | $ - | $ 82.50 | $125,999 |
| **Daramend** | | | | | | | | | | | |
| Daramend | *Adventus* | 4,001 | ton | $ 1,000.00 | $ 4,001,000 | $ - | $ - | $ - | $ - | $ - | $4,001,000 |
| Shipping Cost | *Adventus* | 201 | loads | $ - | $ - | $ - | $ - | $ - | $ - | $ 3,400.00 | $683,400 |
| Oversight | *Adventus* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 7,000.00 | $7,000 |
| **Applications** | | | | | | | | | | | |
| Labor | | 2,039 | hour | $85 | $ 173,276 | $ - | $ - | $ - | $ - | $ - | $173,276 |
| 2 Tillers | *Adventus* | 12 | mo | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,000.00 | $24,000 |
| Chemical Spreader, 3 cy | *01 54 33 1000* | 12 | mo | $ - | $ - | $ - | $ - | $ - | $ - | $ 537.31 | $6,448 |
| Water tank, engine driven discharge, 5000 gallons | *01 54 33 6900* | 12 | mo | $ - | $ - | $ - | $ - | $ - | $ - | $ 1,791.05 | $21,493 |
| Tractor | *01 54 33 4110* | 12 | mo | $ - | $ - | $ - | $ - | $ - | $ - | $ 3,375.00 | $40,500 |
| Water Service Charge | *Suffolk County Water Authority* | 3 | qtr | $ - | $ - | $ - | $ - | $ - | $ - | $ 18.23 | $55 |
| Water | *Suffolk County Water Authority* | 1000 | 1,000 gal | $ - | $ - | $ - | $ - | $ - | $ - | $ 1.61 | $1,606 |
| **Soil Sampling** | | | | | | | | | | | |
| Grab Samples - 12 per acre | | 1,175 | sample | $ - | $ 420 | $ 21 | $ 24,976 | $ 66.73 | $ 78,427 | $ - | $103,823 |
| Mobilization/Demobilization of Field Sampling Crew | | 18 | event | $ - | $ - | $ - | $ - | $ - | $ - | $ 1,020 | $18,360 |
| Lab Analyses - Pesticides (8081A) | *Chemtech* | 1,175 | sample | $ - | $ - | $ - | $ - | $ - | $ - | $ 115.50 | $135,750 |
| **Soil Excavation and Stockpiling** | | | | | | | | | | | |
| Soil-Backhoe, hydraulic, crawler mtd. 1 CY cap = 100 CY/hr | *31 23 16.42 0200* | 11,132 | bcy | $ - | $ - | $ 1.07 | $ 11,963 | $ 1.38 | $ 15,337 | $ - | $27,300 |
| Community Air Monitoring (Dust) | | 12 | mo | | | $ 8,500 | $ 102,000 | $ 3,420 | $ 41,040 | | $143,040 |
| Dust Control, Heavy | *31 23 23.20 2510* | 240 | day | | | $ - | $ - | $ - | $ - | $ 2,583.24 | $619,978 |
| **Site Restoration** | | | | | | | | | | | |
| Dozer backfilling 0-4', bulk, up to 300' haul, no compaction | *31 23 23.13 1300** | 36,799 | lcy | $ - | $ - | $ 0.66 | $ 24,199 | $ 1.28 | $ 46,998 | $ - | $71,197 |
| Compacting backfill, 6" to 12" lifts, vibrating roller | *31 23 23.13 1600* | 31,999 | bcy | $ - | $ - | $ 0.99 | $ 31,564 | $ 2.65 | $ 84,914 | $ - | $116,478 |
| Topsoil | *A&R Materials* | 14,276 | cy | $ 20 | $ 279,247 | | | | | | $279,247 |
| Finishing grading slopes, gentle | *31 22 16.10 3300* | 44,000 | sy | $ - | $ - | $ 0.12 | $ 5,175 | $ 0.09 | $ 3,973 | $ - | $9,148 |
| Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer | *32 92 19.14 5400* | 396 | msf | $ - | $ - | $ 18.31 | $ 7,252 | $ 11.16 | $ 4,419 | $ - | $11,671 |
| **Mobilization and Demobilization** | | | | | | | | | | | **$289,420** |
| **5%** of Total Costs of Site Work, Treatment | | | | | | | | | | $5,788,391 | $289,420 |
| **Contingency** | | | | | | | | | | | **$868,259** |
| **15%** of Total Construction Activities | | | | | | | | | | $6,661,696 | $868,259 |
| **Professional/Technical Services** | | | | | | | | | | | **$1,048,993** |
| **5%** Project Management | | | | | | | | | | $5,521,013 | $276,051 |
| **8%** Remedial Design | | | | | | | | | | | $441,681 |
| **6%** Construction Managemen | | | | | | | | | | | $331,261 |
| **TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring** | | | | | | | | | | | **$9,067,000** |

**Assumptions:**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Working condition is Safety Level: | | **D** | **(Labor productivity:** | **82%** | **; Equipment productivity:** | **100%** | **)** | | |
| Weighted average of city cost index (Riverhead, NY) | | **121.6%** | **(not applicable for costs derived from vendor quotes).** | | | | | | |
| Costs are loaded with a profit factor | | **10%** | | | | | | | |
| Inflation | | **3%** | per year | | | | | | |
| Sales Tax | | **8.25%** | | | | | | | Labor |
| **Estimated number of soil samples** | For 0-2' applications | **86** | samples per application | **8** | samp.events | **0.25** | hrs/sample | **$85** | Cost per hr |
| | For 2-4' applications | **34** | samples per application | **7** | samp. events | | | | |
| | For 4-6' applications | **8** | samples per application | **2** | samp. events | | | | |
| | | **12** | hrs for travel per event | | | **1** | workers per event | **20%** | added for QA/QC samples |
| Analytical cost | Pesticides | **$105.00** | per sample | | | | | | |
| For each sampling event, assumed: | | **$50** | for materials (gloves, notebooks, etc.) | | | | | | |
| **Typical Rental Rates - Includes G&A and 10% Profit** | | | | | | | | | |
| Mini-Rae Survey Mode PID | | **$96.08** | per day | | | | | | |
| Truck/SUV (1/2 ton or smaller) | | **$70.74** | per day | | | | | | |
| **Concrete Demolition and Disposal** | Concrete | **3,300** | lbs per cy | **2,000** | lbs per ton | | | | |
| | Thickness | **0.75** | ft | | | | | | |
| | Concrete Removal Area | **33,322** | sq ft | | | | | | |
| **Daramend Application** | | **7** | 0-2' Applications 7-10 days apart | | | | | | |
| | | **6** | 2-4' Applications 7-10 days apart | | | | | | |
| | | **2** | 4-6' Applications 7-10 days apart | | | | | | |
| Treatment area | | **2** | ft thick | | | | | | |
| Water needed | | **71,278** | gal | | | | | | |
| Water costs based on using a 3" meter on a nearby fire hydrant | | **$1.46** | per 1,000 gallons | | | **$1.50** | base charge per day for 3" meter | | |
| **Work day consists of:** | | **10** | hrs | | | | | | |

**Application Labor hours calculation:**

7.13 acres (0-2' area) / (2 tillers) (1 acre per tiller per day) ✖ 7 applications ✖ 3 laborers ✖ 10 hrs per day ➕

2.79 acres (2-4' area) / (2 tillers) (1 acre per tiller per day) ✖ 6 applications ✖ 3 laborers ✖ 10 hrs per day ➕

0.66 acres (4-6' area) / (2 tillers) (1 acre per tiller per day) ✖ 2 applications ✖ 3 laborers ✖ 10 hrs per day

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Treatment Area:** | **388,557** | sf | | | | | |
| **0-2' Volume** | **22,999** | cy | **310,487** | sf | **7.13** | acres | |
| **2-4' Volume** | **9,000** | cy | **121,500** | sf | **2.79** | acres | |
| **4-6' Volume** | **2,132** | cy | **28,782** | sf | **0.66** | acres | |

| | | | | | |
|---|---|---|---|---|---|
| **Hours per Application** | **Field Crew:** | **3** | people | **3.6** | days per application for 0-2' phase |
| | | | | **1.4** | days per application for 2-4' phase |
| | | | | **0.3** | days per application for 4-6' phase |
| | **Till:** | **2** | people | | |

2 tillers

1 acres/tiller/day

20 working days per month

**Excavation and Stockpiling**

| | | | | |
|---|---|---|---|---|
| Area 1: | **121,500** | sf | | |
| Volume 1: | **9,000** | cy | **10,350** | lcy |
| Area 2: | **28,782** | sf | | |
| Volume 2: | **2,132** | cy | **2,452** | lcy |
| | | | 12,802 | lcy for stockpiling |

**Notes**

| | | | |
|---|---|---|---|
| sy | square yard | mo | month |
| cy | cubic yard | ls | lump sum |
| lcy | loose cubic yard | O&M | Operation and maintenance |
| bcy | bank cubic yard | H&S | Health and Safety |
| lf | linear feet | | |
| sf | square feet | | |
| msf | 1,000 square feet | | |

| TECHNOLOGY | LOCATION | MEDIA | Estimated Cost to Implement | $10,522,000 | |
|---|---|---|---|---|---|
| **Soil Alternative 5**<br>**In-Situ Thermal**<br>**Residential** | **Bianchi/Weiss Greenhouses**<br>**East Patchogue, NY** | **Soil** | **Construction Time:** | **2** | **months** |
| | | | **Operation Time:** | **5** | **months** |
| | | | **Post Remediation Monitoring** | **0** | **years** |

| Description | Data Source (Means[1] or Other) | Quantities: Quantity Amount | Quantity Unit | Cost Breakdown (if available): Material Unit Cost | Material Total Cost | Labor Unit Cost | Labor Total Cost | Equipment Unit Cost | Equipment Total Cost | Combined Unit Costs: Unit Cost | Option Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **REMEDIAL ACTION** | | **TOTAL CAPITAL COST (totals rounded to nearest thousand)** | | | | | | | | | **$10,522,000** |
| **Construction Activities** | | **1** | | | **$676,824** | | **$316,184** | | **$387,589** | **$4,630,780** | **$8,044,016** |
| **Site Preparation** | | | | | | | | | | | |
| Utility Locator (based on recent bids) | *recent quote* | 0.5 | day | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,475.00 | $1,238 |
| Pilot Test | *Engineer's Estimate* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 150,000.00 | $150,000 |
| Conceptual design and cost estimate | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 45,144.00 | $45,144 |
| Detailed design, permitting | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 191,000.00 | $191,000 |
| Procurement | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 144,000.00 | $144,000 |
| Mobilization and Site Setup | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 367,000.00 | $367,000 |
| Erosion & Sediment Control Plan | | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 10,000 | $10,000 |
| Silt Fence | *31 25 13.10 1000* | 3,200 | lf | $ 0.55 | $ 1,760 | $ 0.45 | $ 1,440 | $ - | $ - | $ - | $3,200 |
| Temporary Electric service- 3 - 480 volt transformers and removal of same | *LIPA* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 12,000.00 | $12,000 |
| Electrician contractor- work required to connect electric service to equipment | *Engineer's Estimate* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 50,000.00 | $50,000 |
| Community Air Monitoring (Dust) | *recent quote - Pine Environmental* | 2 | mo | | | $ 8,500 | $ 17,000 | $ 3,420 | $ 6,840 | | $23,840 |
| Dust Control, Heavy | *31 23 23.20 2510* | 40 | day | | | $ - | $ - | $ - | $ - | $ 2,583.24 | $103,330 |
| Concrete demolition - Break up into small pieces, minimum reinforcing | *03 05 05.10 0060* | 926 | cy | $ - | $ - | $ 116 | $ 107,120 | $ 19 | $ 17,917 | $ - | $125,037 |
| Concrete - Hauling, 50 MPH ave, cycle 30 miles | *31 23 23.20 1510* | 926 | cy | $ - | $ - | $ 3.80 | $ 3,520 | $ 9.58 | $ 8,863 | $ - | $12,383 |
| Concrete Disposal | *Waste Mngmt* | 1,527 | ton | $ - | $ - | $ - | $ - | $ - | $ - | $ 82.50 | $125,999 |
| Soil-Backhoe, hydraulic, crawler mtd. 1 CY cap = 100 CY/hr | *31 23 16.42 0200* | 31,073 | bcy | $ - | $ - | $ 1.31 | $ 40,722 | $ 1.38 | $ 42,811 | $ - | $83,533 |
| Soil -Hauling, 12 cy truck, cycle 0.5 mile, 15 MPH ave, 15 min. wait/Ld./Uld | *31 23 23.20 1014* | 35,734 | lcy | $ - | $ - | $ 1.33 | $ 47,527 | $ 2.74 | $ 97,912 | $ - | $145,439 |
| Monitoring Well Abandonment | *recent quote- EnviroTrac* | 80 | lf | $ - | $ - | $ - | $ - | $ - | $ - | $ 26.40 | $2,112 |
| Monitoring Well Installation | *recent quote- EnviroTrac* | 80 | lf | $ - | $ - | $ - | $ - | $ - | $ - | $ 112.80 | $9,024 |
| **Pre-Operation Site Activities** | | | | | | | | | | | |
| Drilling and Well Installation | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 1,227,000.00 | $1,227,000 |
| Vapor cover installation | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 642,000.00 | $642,000 |
| Well-field piping | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 326,000.00 | $326,000 |
| ISTD power equipment installation | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 108,000.00 | $108,000 |
| Treatment system installation | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 184,000.00 | $184,000 |
| Electrical Installation, well-field and process | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 138,000.00 | $138,000 |
| Instrument and monitoring system installation | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 73,000.00 | $73,000 |
| Pre-startup and shakedown | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 48,000.00 | $48,000 |
| **Operation** | | | | | | | | | | | |
| ISTD Power Equipment Rental | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 85,000.00 | $85,000 |
| Effluent Treatment System Rental | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 20,000.00 | $20,000 |
| Labor, travel, per diem | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 267,000.00 | $267,000 |
| Process monitoring, sampling and analysis | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 49,000.00 | $49,000 |
| Waste and GAC | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 13,000.00 | $13,000 |
| Repair/maintenance | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 58,000.00 | $58,000 |
| Tools, rentals and fees | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 22,000.00 | $22,000 |
| Electrical Consumption | *LIPA* | 6,764,800 | kW-hr | $ - | $ - | $ - | $ - | $ - | $ - | $ 0.22 | $1,488,256 |
| Supply and Transportation of Clean Back Fill Material for 3:1 side slope | *110 Sand Company* | 15,528 | lcy | $ 43.47 | $675,014 | $ - | $ - | $ - | $ - | $ - | $675,014 |
| **Soil Sampling** | | | | | | | | | | | |
| Geoprobe Rig | | 1 | day | $ - | $ - | $ - | $ - | $ - | $ - | $2,200 | $2,200 |
| Sampling Materials, Labor, and Equipment | | 32 | sample | $ - | $ 50 | $ 43 | $ 1,350 | $ 66.73 | $ 2,120 | $ - | $3,520 |
| Mobilization/Demobilization of Field Sampling Crew | | 1 | event | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,040 | $2,040 |
| Lab Analyses - Pesticides (8081) | *Chemtech* | 32 | sample | $ - | $ - | $ - | $ - | $ - | $ - | $ 115.50 | $3,669 |
| **Demobilization and Other** | | | | | | | | | | | |
| Decommissioning | *Terratherm* | 1 | ls | | | | | | | $ 166,000.00 | $166,000 |
| Site Clearance and Demobilization | *Terratherm* | 1 | ls | | | | | | | $ 179,000.00 | $179,000 |
| Reporting | *Terratherm* | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 47,000.00 | $47,000 |
| Dozer backfilling, bulk, up to 300' haul, no compaction | *31 23 23.13 1300* | 51,262 | lcy | $ - | $ - | $ 0.81 | $ 41,341 | $ 1.64 | $ 84,044 | $ - | $125,385 |
| Compacting backfill, 6" to 12" lifts, vibrating roller | *31 23 23.13 1600* | 44,576 | bcy | $ - | $ - | $ 0.99 | $ 43,970 | $ 2.65 | $ 118,288 | $ - | $162,258 |
| Topsoil | *A&R Materials* | 14,276 | cy | $ 20 | $ 279,247 | | | | | | $279,247 |
| Finishing grading slopes, gentle | *31 22 16.10 3300* | 43,173 | sy | $ - | $ - | $ 0.12 | $ 5,078 | $ 0.10 | $ 4,164 | $ - | $9,241 |
| Utility mix, 7#/M.S.F., Hydro or air seeding, with mulch and fertilizer | *32 92 19.14 5400* | 388.56 | msf | $ 64.75 | $ 25,160 | $ 18.31 | $ 7,116 | $ 11.92 | $ 4,631 | $ - | $36,907 |
| **Contingency** | | | | | | | | | | | **$1,206,602** |
| 15% of Total Construction Activities | | | | | | | | | | $8,044,016 | $1,206,602 |
| **Professional/Technical Services** | | | | | | | | | | | **$1,271,256** |
| 5% Project Management | | | | | | | | | | $6,690,821 | $334,541 |
| 8% Remedial Design | | | | | | | | | | | $535,266 |
| 6% Construction Management | | | | | | | | | | | $401,449 |
| **TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring)** | | | | | | | | | | | **$10,522,000** |

**Assumptions:**

| | | | | |
|---|---|---|---|---|
| Working condition is Safety Level: | D | (Labor productivity: 82%; Equipment productivity: 100%) | | |
| Weighted Average of city cost index (Rochester, NY) | 121.6% | (not applicable for costs derived from vendor quotes). | | |
| Costs are loaded with a profit factor | 10% | | | |
| Inflation | 3% | per year | | Labor |
| **Estimated number of soil samples** | 26 | samples; 1 sampling events | 0 hrs/sample | $85 Cost per hr |
| | 12 | hrs for travel per event | 2 workers per event | |
| Analytical cost — Pesticides | $105.00 | per sample | | |
| For each sampling event, assumed: | $50 | for materials (gloves, notebooks, etc.) | | |
| **Typical Rental Rates - Includes G&A and 10% Profit** | | | | |
| Mini-Rae Survey Mode PID | $96.08 | per day | | |
| Truck/SUV (1/2 ton or smaller) | $70.74 | per day | | |
| **Work day consists of:** | 10 | hrs | | |

| | | | | |
|---|---|---|---|---|
| **Treatment Area:** | 96,100 sf | | | |
| **Treatment Volume:** | 33,205 cy | 38,186 lcy | 896,546 cf | 20 working days per month |
| **Excavation Volume:** | 31,073 cy | 35,734 lcy | | |

**Notes**

| | | | |
|---|---|---|---|
| sy | square yard | mo | month |
| cy | cubic yard | ls | lump sum |
| lcy | loose cubic yard | O&M | Operation and maintenance |
| bcy | bank cubic yard | H&S | Health and Safety |
| lf | linear feet | | |
| sf | square feet | | |
| msf | 1,000 square feet | | |

| TECHNOLOGY | | LOCATION | | MEDIA | | Estimated Cost to Implement | | | | $740,000 | $661,000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Groundwater Alternative 2**<br>**Long Term Monitoring of GW** | | **Bianchi/Weiss Greenhouses**<br>**East Patchogue, NY** | | **Groundwater** | | | | | **Construction Time:** | **NA** | **days** |
| | | | | | | | | | **Operation Time:** | **NA** | **years** |
| | | | | | | | | | **Post Remediation Monitoring** | **30** | **years** |
| | | **Quantities** | | **Cost Breakdown (if available)** | | | | | | **Combined Unit Costs** | |
| Description | Data Source (Means[1] or Other) | Quantity Amount | Quantity Unit | Material Unit Cost | Material Total Cost | Labor Unit Cost | Labor Total Cost | Equipment Unit Cost | Equipment Total Cost | Unit Cost | Option Total Cost |
| **REMEDIAL ACTION** | | **TOTAL CAPITAL COST** **(totals rounded to nearest thousand)** | | | | | | | | | **$212,000** |
| Abandon five residential wells and connect five homes to public water | | 5 | ea | | | | | | | $ 37,322.20 | $186,611 |
| Institutional Controls | *Engineer's Estimate* | 1 | ls | | | | | | | $ 25,000.00 | $25,000 |
| **LONG TERM MONITORING** | | | | | | | | | **ANNUAL LTM COST (YRS 1-5)** | | **$53,000** |
| | | | | | | | | | **ANNUAL LTM COST (YRS 6-30)** | | **$27,000** |
| | | | | | | | **LIFETIME LTM (NPV) (no source removal)** | | | | **$527,600** |
| | | | | | | | **LIFETIME LTM (NPV) (source removal)** | | | | **$449,000** |
| **Monitoring, Sampling, Testing and Analysis (Per Event)** | | | | | | | | | | | $26,749 |
| **Site Monitoring** | | | | | | | | | | | |
| Sampling for 1 event - Includes collection of field parameters | | 35 | well | $ 100 | $ 11,900 | $ 340 | $ 3,207 | $ 92 | 3206.91 | $ - | $18,314 |
| Mobilization/Demobilization of Field Sampling Crew | | 1 | event | $ - | $ - | $ - | $ - | $ - | $ - | $ 510.00 | $510 |
| Reporting | | 50 | hr | $ 85 | $ 4,250.00 | $ - | $ - | $ - | $ - | $ - | $4,250 |
| **Laboratory analysis** | | | | | | | | | | | |
| Pesticides (8081) | *Chemtech* | 35 | ea | $ - | $ - | $ - | $ - | $ - | $ - | $105.00 | $3,675 |
| **Lifetime Long Term Monitoring (Net Present Value)** | | | | | | | | | | | |
| **5** Years of Semi-Annual Monitoring | | | | | | | | | | | |
| **25** Years of Annual Monitoring | | | | | | | | | | | |
| **5%** Discount Factor (per NYSDEC) | | | | | | | | | | | |
| **TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Long Term Monitoring)** | | | | | | | | | | (no source removal) **$740,000** | (source removal) **$661,000** |

**Assumptions:**

| | | | | | |
|---|---|---|---|---|---|
| Working condition is Safety Level: | **D** | **(Labor productivity:** | **82%** | **; Equipment productivity:** | **100%** **)** |
| Weighted Average of city cost index (Riverhead, NY) | **121.6%** | **(not applicable for costs derived from vendor quotes).** | | | |
| Costs are loaded with a profit factor | **10%** | | | | |
| Inflation | **3%** | per year | | | |
| **Sampling** | **29** | wells | **2** Events per year | **2** hrs/sample | **$85** Cost per hr |
| | **3** | hrs for travel per event | | **2** workers per event | |
| **Long Term Monitoring** | **20%** | added for QA/QC | | | |

First 5 years will be on a semiannual sampling schedule.
After 5 years, monitoring will occur on an annual basis.

**Analytical cost**

| | | | |
|---|---|---|---|
| | Pesticides | **$105.00** | per sample |
| For each sampling event, assumed: | | **$50** | for materials (gloves, notebooks, etc.) |

**Work day consists of:** **10** hrs

**Typical Rental Rates - Includes G&A and 10% Profit**

| | | |
|---|---|---|
| Truck/SUV (1/2 ton or smaller) | **$70.74** | per day |
| Water Quality Analyzer | **$159.00** | per day |
| Water Level Meter | **$31.80** | per day |
| Submersible Pump | **$113.91** | per day |
| Generators: 220 Volt | **$82.68** | per day |

**Notes**

ea each
O&M Operation and maintenance

| TECHNOLOGY | LOCATION | MEDIA | Estimated Cost to | | $726,000 | $675,000 |
|---|---|---|---|---|---|---|
| **Groundwater Alternative 3**<br>**Sump and Foundation Upgrades** | **Bianchi/Weiss Greenhouses**<br>**East Patchogue, NY** | **Groundwater** | **Construction Time:** | | **2** | **months** |
| | | | **Operation Time:** | | **30** | **years** |
| | | | **Post Remediation Monitoring** | | **30** | **years** |

| Description | Data Source (Means[1] or Other) | Quantities: Quantity Amount | Quantity Unit | Cost Breakdown (if available): Material Unit Cost | Material Total Cost | Labor Unit Cost | Labor Total Cost | Equipment Unit Cost | Equipment Total Cost | Combined Unit Costs: Unit Cost | Option Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **REMEDIAL ACTION** | | **TOTAL CAPITAL COST (Cost for upgrades at 5 homes) (totals rounded to nearest thousand)** | | | | | | | | | **$431,000** |
| | | **1** | | | **$7,269** | | **$7,203** | | **$6,657** | **$62,873** | **$291,214** |
| **Site Preparation** | | | | | | | | | | | |
| Utility Locator (based on recent bids) | *recent quote* | 1 | day | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,475.00 | $2,475 |
| Discharge Line | | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 15,000.00 | $15,000 |
| Demo Basement Floor Slab for new Sump (5 homes @2 cy ea) | *02 41 13.33 4310* | 10 | cy | $ 84.73 | $ 847 | $ 54.42 | $ 544 | $ 18.81 | $ 188 | $ 315.91 | $1,580 |
| Install sump | | 5 | ea | $ 150.00 | $ 750 | $ 54.42 | $ 2,177 | $ 75.00 | $ 375 | $ 660.36 | $3,302 |
| **Treatment System** | | | | | | | | | | | |
| Treatment Construction Enclosure for Bag Filter | *Engineer's Estimate* | 5 | ea | $ - | $ - | $ - | $ - | $ - | $ - | $ 6,000.00 | $30,000 |
| 6" PVC pipe (5 homes with 100 ft each) | *33 11 13.25 4530* | 500 | ft | $ 6.38 | $ 3,189 | $ 5.65 | $ 2,824 | $ - | $ - | $ - | $6,014 |
| Supply and Transportation of NYS Certified Clean Back Fill Mate | *110 Sand Company* | 44 | lcy | $ 54.34 | $ 2,415 | $ - | $ - | $ - | $ - | $ - | $2,415 |
| Trenching- 4' deep, 3/8 CY excavator | *31 23 16.13 0050* | 296 | bcy | $ - | $ - | $ 5.59 | $ 1,657 | $ 3.10 | $ 918 | $ - | $2,576 |
| Filter bag housing - Flowline II from Eaton | *Eaton* | 5 | ea | $ - | $ - | | $ - | $ 1,035.00 | $ 5,175 | $ - | $5,175 |
| 0.5 micron, size #2, one year | *Eaton* | 10 | 50 filters | $ 6.95 | $ 66.72 | $ - | $ - | $ - | $ - | $ - | $67 |
| Little Giant Sump Pump w/ Aux Power | *Build.com* | 10 | ea | $ - | $ - | $ - | $ - | $ - | $ - | $ 1,100.00 | $11,000 |
| Abandon five residential wells and connect five homes to public water | | 5 | ea | | | | | | | $ 37,322.20 | $186,611 |
| Institutional Controls | *Engineer's Estimate* | 1 | ls | | | | | | | $ 25,000.00 | $25,000 |
| **Contingency** | | | | | | | | | | | **$43,682** |
| **15%** | of Total Construction Activitie | | | | | | | | | $291,214 | $43,682 |
| **Professional/Technical Services** | | | | | | | | | | | **$96,101** |
| **8%** | Project Management | | | | | | | | | $291,214 | $23,297 |
| **15%** | Remedial Design | | | | | | | | | | $43,682 |
| **10%** | Construction Management | | | | | | | | | | $29,121 |
| **LONG TERM MONITORING (Semiannual monitoring at 5 homes for first 5 years, Annual monitoring for next 25)** | | | | | | | | **ANNUAL LTM COST (YRS 1-5)** | | | **$11,200** |
| | | | | | | | | **ANNUAL LTM COST (YRS 6-30)** | | | **$5,600** |
| | | | | | | | | **LIFETIME LTM (NPV) (no source removal)** | | | **$110,300** |
| | | | | | | | | **LIFETIME LTM (NPV) (source removal)** | | | **$94,000** |
| **Monitoring, Sampling, Testing and Analysis (Per Event)** | | | | | | | | | | | $5,571 |
| **Site Monitoring** | | | | | | | | | | | |
| Sampling for 1 event - | | 5 | sample | $ 170 | $ 850 | $ 170 | $ 850 | $ 92 | $ 458 | $ - | $2,158 |
| Mobilization/Demobil | | 1 | event | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,040.00 | $2,040 |
| Reporting | | 8 | hr | $85 | $ 680.00 | $ - | $ - | $ - | $ - | $ - | $680 |
| **Laboratory analysis** | | | | | | | | | | | |
| Pesticides (8081) | *Chemtech* | 6 | ea | $ - | $ - | $ - | $ - | $ - | $ - | $ 115.50 | $693 |
| **Lifetime Long Term Monitoring (Net Present Value)** | | | | | | | | | | | |
| **5** | Years of Semiannual Monitoring | | | | | | | | | | |
| **25** | Years of Annual Monitoring | | | | | | | | | | |
| **5%** | Discount Factor (per NYSDEC) | | | | | | | | | | |
| **LONG TERM OPERATIONS AND MAINTENANCE** | | | | | | | | **ANNUAL LTOM COST (YRS 1-30)** | | | **$12,000** |
| | | | | | | | | **LIFETIME LTOM (NPV) (no source removal)** | | | **$184,500** |
| | | | | | | | | **LIFETIME LTOM (NPV) (source removal)** | | | **$149,500** |
| **System Operations (per month)** | | | | | | | | | | | $860 |
| Electricity | *LIPA* | 500 | kW-hr | $ - | $ - | $ - | $ - | $ - | $ - | $ 0.22 | $110 |
| General O&M | | 1 | months | $ - | $ - | $ 750.00 | $ 750.00 | $ - | $ - | $ - | $750 |
| **Lifetime Operations and Maintenance (Net Present Value)** | | | | | | | | | | | |
| **30** | Years of Operations and Maintenance | | | | | | | | | | |
| **5%** | Discount Factor (per NYSDEC) | | | | | | | | | | |
| **TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring)** | | | | | | | | | | (no source removal)<br>**$726,000** | (source removal)<br>**$675,000** |

**Assumptions:**

| | | | |
|---|---|---|---|
| Working condition is Safety Level: | **D** | **(Labor productivity:** **82%** **; Equipment productivit** **100%** **)** | |
| Weighted Average of city cost index (Roch | **121.6%** | **(not applicable for costs derived from vendor quotes).** | |
| Costs are loaded with a profit factor | **10%** | | |
| Inflation | **3%** | per year | **23%** for 7 years of inflation |

**Consultant Bill Rates (as of 12/15/2010) - Includes G&A and 10% Profit**

| | | |
|---|---|---|
| Truck/SUV (1/2 ton or smaller) | **$70.74** | per day |
| Water Quality Analyzer | **$159.00** | per day |
| Water Level Meter | **$31.80** | per day |
| Submersible Pump | **$113.91** | per day |
| Generators: 220 Volt | **$82.68** | per day |

**Sampling**

**12** wells; **2** Events per year (yrs 1-5); **1** Event per year (yrs 6-30); **2** hrs/sample; **$85** Cost per hr

**12** hrs for travel per event; **2** workers per event

**Filters**

**8** filter changeouts per housing per month (assumed, based on very limited information available)

**5** filter housings, one per house

**Analytical cost**

Pesticides **$105.00** per sample

For each sampling event, assumed: **$50** for materials (gloves, notebooks, etc.)

**Work day consists of:** **10** hrs

**Notes**

Assume NPDES or equivalent permit is used, no cost for water discharge

| | | | |
|---|---|---|---|
| bcy | bank cubic | O&M | Operation and maintenance |
| ECY | Embankme | sf | square feet |
| H&S | Health and | VOC | Volatile Organic Compound |
| lcy | loose cubic yard | | |
| ls | lump sum | | |

| TECHNOLOGY | LOCATION | MEDIA | Estimated Cost to Implement | $4,192,000 | $3,471,000 |
|---|---|---|---|---|---|
| **Groundwater Alternative 4**<br>**Containment via Hydraulic Control and Treatment** | **Bianchi/Weiss Greenhouses**<br>**East Patchogue, NY** | **Groundwater** | Construction Time: | 6 | months |
| | | | Operation Time: | 30 (15) | years |
| | | | Monitoring: | 30 (15) | years |

| Description | Data Source (Means[1] or Oth | Quantities: Quantity Amount | Quantity Unit | Cost Breakdown (if available): Material Unit Cost | Material Total Cost | Labor Unit Cost | Labor Total Cost | Equipment Unit Cost | Equipment Total Cost | Combined Unit Costs: Unit Cost | Option Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **REMEDIAL ACTION** | | **TOTAL CAPITAL COST (totals rounded to nearest thousand)** | | | | | | | | | **$1,946,000** |
| | | | | | | | | | | | |
| | | **1** | | | **$10,461** | | **$61,111** | | **$32,857** | **$4,322** | **$1,314,891** |
| **Pump Test** | | | | | | | | | | | |
| Equipment Rental- pump, water level meter, generator, filters | | 8 | day | $ 100 | $ 800 | $ - | $ - | $ 228 | $ 1,827 | $ - | $2,627 |
| Filter bag housing rental | | 1 | mo | $ - | $ - | $ - | $ - | $ - | $ - | $ 750.00 | $750 |
| Oversight/Engineering | | 400 | hours | $ - | $ - | $ 85 | $ 34,000 | $ - | $ - | $ - | $34,000 |
| **Drill Rig and Crew for Extraction Well Installation** | | | | | | | | | | | |
| Mobilization/Demobilization | *PEC* | 4 | ea | $ - | $ - | $ - | $ - | $ - | $ - | $ 1,650.00 | $6,600 |
| 4 1/4" Hollow Stem Auger | *PEC* | 100 | lf | $ - | $ - | $ - | $ - | $ - | $ - | $ 13.20 | $1,320 |
| Decontamination Pad | *PEC* | 2 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 220.00 | $440 |
| Steam Generator | *PEC* | 22 | day | $ - | $ - | $ - | $ - | $ - | $ - | $ 82.50 | $1,815 |
| Standby Time (Decontamination) | *PEC* | 66 | hr | $ - | $ - | $ 204 | $ 13,431 | $ - | $ - | $ - | $13,431 |
| **Well Installation** | | | | | | | | | | | |
| Geoprobe Daily Rate - 8 hour day | *PEC* | 22 | day | $ - | $ - | $ - | $ - | $ - | $ - | $ 1,210.00 | $26,620 |
| 4" PVC Piping Monitoring Wells Installed | *33 21 13.10 8340* | 1,650 | lf | $ 5.86 | $ 9,661 | $ 6.13 | $ 10,116 | $ 18.81 | $ 31,030 | $ - | $50,807 |
| Flush Mount Well Covers | *PEC* | 66 | ea | $ - | $ - | $ - | $ - | $ - | $ - | $ 165.00 | $10,890 |
| Well Development | *PEC* | 66 | hr | $ - | $ - | $ - | $ - | $ - | $ - | $ 165.00 | $10,890 |
| Containerized Drill Materials in 55-Gallon Drums | *PEC* | 18 | ea | $ - | $ - | $ 198 | $ 3,564 | $ - | $ - | $ - | $3,564 |
| 55-Gallon Drums | *PEC* | 18 | ea | $ - | $ - | $ - | $ - | $ - | $ - | $ 66.00 | $1,188 |
| **Site Preparation** | | | | | | | | | | | |
| Utility Locator (based on recent bids) | *recent quote* | 10 | day | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,475.00 | $24,750 |
| Discharge Line | | 1 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 15,000.00 | $15,000 |
| Electrical Permit and Utility Connection to PCU | *TRS Group* | 5 | day | $ - | $ - | $ - | $ - | $ - | $ - | $ 44,000.00 | $220,000 |
| **Treatment System** | | | | | | | | | | | |
| Two Treatment Construction Enclosure | *Engineer's Estimate* | 2 | ls | $ - | $ - | $ - | $ - | $ - | $ - | $ 125,000.00 | $250,000 |
| 6" PVC pipe | *33 11 13.25 4530* | 5,000 | ft | $ 6.38 | $ 31,894 | $ 5.65 | $ 28,243 | $ - | $ - | $ - | $60,138 |
| Supply and Transportation of NYS Certified Clean Back Fill Material | *110 Sand Company* | 444 | lcy | $ 54.34 | $ 24,151 | $ - | $ - | $ - | $ - | $ - | $24,151 |
| Trenching- 4' deep, 3/8 CY excavator | *31 23 16.13 0050* | 2,963 | bcy | $ - | $ - | $ 5.59 | $ 16,574 | $ 3.10 | $ 9,185 | $ - | $25,758 |
| Lift Station for plume edge extraction wells | *Engineer's Estimate* | 2 | ea | | | | | | | $ 12,000.00 | $24,000 |
| Filter bag housing - Flowline II from Eaton | *Eaton* | 4 | ea | $ - | $ - | | $ - | $ 1,035.00 | $ 4,140 | $ - | $4,140 |
| Submersible Pumps | *Pine Environmental* | 66 | ea | $ - | $ - | $ - | $ - | $ - | $ - | $ 4,400.00 | $290,400 |
| Abandon five residential wells and connect five homes to public water | | 5 | ea | | | | | | | $ 37,322.20 | $186,611 |
| Institutional Controls | *Engineer's Estimate* | 1 | ls | | | | | | | $ 25,000.00 | $25,000 |
| | | | | | | | | | | | |
| **Contingency** | | | | | | | | | | | **$197,234** |
| 15% of Total Construction Activities | | | | | | | | | | $1,314,891 | $197,234 |
| | | | | | | | | | | | |
| **Professional/Technical Services** | | | | | | | | | | | **$433,914** |
| 8% Project Management | | | | | | | | | | $1,314,891 | $105,191 |
| 15% Remedial Design | | | | | | | | | | | $197,234 |
| 10% Construction Management | | | | | | | | | | | $131,489 |
| **LONG TERM MONITORING** | | | | | | | | **ANNUAL LTM COST (YRS 1-2)** | | | **$25,200** |
| | | | | | | | | **ANNUAL LTM COST (YRS 3-30)** | | | **$12,600** |
| | | | | | | | **LIFETIME LTM (NPV) (no source removal)** | | | | **$217,100** |
| | | | | | | | **LIFETIME LTM (NPV) (source removal)** | | | | **$154,200** |
| | | | | | | | | | | | |
| **Monitoring, Sampling, Testing and Analysis (Per Event)** | | | | | | | | | | | $12,624 |
| **Site Monitoring** | | | | | | | | | | | |
| Sampling for 1 event - Includes | | 16 | well | $ 340 | $ 5,440 | $ 92 | $ 1,466 | $ - | $ 100 | $ - | $7,006 |
| Mobilization/Demobilization of Field | | 1 | event | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,040.00 | $2,040 |
| Reporting | | 16 | hr | $85 | $ 1,360.00 | $ - | $ - | $ - | $ - | $ - | $1,360 |
| **Laboratory analysis** | | | | | | | | | | | |
| Pesticides (8081) | *Chemtech* | 19 | ea | $ - | $ - | $ - | $ - | $ - | $ - | $ 115.50 | $2,218 |
| **Lifetime Long Term Monitoring (Net Present Value)** | | | | | | | | | | | |
| 2 Years of Semiannual Monitoring | | | | | | | | | | | |
| 28 Years of Annual Monitoring | | | | | | | | | | | |
| 5% Discount Factor (per NYSDEC) | | | | | | | | | | | |
| **LONG TERM OPERATIONS AND MAINTENANCE** | | | | | | | | **ANNUAL LTOM COST (YRS 1-30)** | | | **$132,000** |
| | | | | | | | **LIFETIME LTOM (NPV) (no source removal)** | | | | **$2,029,200** |
| | | | | | | | **LIFETIME LTOM (NPV) (source removal)** | | | | **$1,370,100** |
| | | | | | | | | | | | |
| **System Operations (per month)** | | | | | | | | | | | $10,531 |
| Electricity | *LIPA* | 28,500 | kW-hr | $ - | $ - | $ - | $ - | $ - | $ - | $ 0.22 | $6,270 |
| General O&M (labor, filter bags, assume discharge to storm sewer) | | 1 | month | $ - | $ - | $ 4,261.12 | $ 4,261.12 | $ - | $ - | $ - | $4,261 |
| **Lifetime Operations and Maintenance (Net Present Value)** | | | | | | | | | | | |
| 30 Years of Operations and Maintenance | | | | | | | | | | | |
| 5% Discount Factor (per NYSDEC) | | | | | | | | | | | |
| **TOTAL ESTIMATED NPV TECHNOLOGY COST (Capital + Lifetime O&M + Post Remediation Monitoring)** | | | | | | | | | | (no source removal) **$4,192,000** | (source removal) **$3,471,000** |

**Assumptions:**

Working condition is Safety Level: **D** **(Labor productivity: 82% ; Equipment productivity: 100%)**
Weighted Average of city cost index (Rochester, NY) **121.6%** **(not applicable for costs derived from vendor quotes).**
Costs are loaded with a profit factor **10%**
Inflation **3%** per year **23%** for 7 years of inflation

**Pump Test:**

**10** Hours worked to set up pump test
**10** minutes, every 10 minutes for 60-120 minutes, and every 30 minutes for 120 minutes-10 hours
**10** Hours worked (total) second and third day of pump test (measurements taken every 4 hours to 48 hours, then one more time before the end of the test
**2** People working during pump test

**Consultant Bill Rates (as of 12/15/2010) - Includes G&A and 10% Profit**

| | | |
|---|---|---|
| Truck/SUV (1/2 ton or smaller) | **$70.74** | per day |
| Water Quality Analyzer | **$159.00** | per day |
| Water Level Meter | **$31.80** | per day |
| Submersible Pump | **$113.91** | per day |
| Generators: 220 Volt | **$82.68** | per day |

**Extraction Well Installation**
Assumed **66** wells will be installed 25 ft apart
**3** wells per day
**25** ft in length (new wells)
**4,500** ft of pipe from extraction wells to treatment
**500** ft of pipe from treatment to discharge
**1** hour for well development per well

**Sampling**
**16** wells
**2** Events per year (yrs 1-5)
**1** Event per year (yrs 6-30)
**2** hrs/sample
Labor **$85** Cost per hr
**12** hrs for travel per event
**2** workers per event

**Well Development**
**1** hrs per well

**Analytical cost**
Pesticides **$105.00** per sample
For each sampling event, assumed: **$50** for materials (gloves, notebooks, etc.)

**Work day consists of:** **10** hrs per day

**Operations & Maintenance**
**5** days maintenance per month
**20** filter changeouts per housing per month (assumed, based on very limited information available)
**4** filter housings, in parallel
**$6.95** per 50 filters (Eaton)

**Notes**

| | | | |
|---|---|---|---|
| sy | square yard | mo | month |
| cy | cubic yard | ls | lump sum |
| lcy | loose cubic yard | O&M | Operation and maintenance |
| bcy | bank cubic yard | H&S | Health and Safety |
| lf | linear feet | | |
| sf | square feet | | |
| msf | 1,000 square feet | | |