MAY 2017 SUPPLEMENT TO THE
FEASBILITY STUDY ADDENDUM (REVISION 1, AUGUST 2016)
DEVELOPENT OF ALTERNATIVES S-6A AND S-6B
SITE 1 –FORMER DRUM MARSHALLING AREA
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT, BETHPAGE NEW YORK

1.0 INTRODUCTION

This supplement to Feasibility Study (FS) Addendum, Revision 1 for Site 1 – Former Drum Marshalling Area at Naval Weapons Industrial Reserve Plant (NWIRP) Bethpage, New York was prepared by Tetra Tech, Inc. for Naval Facilities Engineering Command (NAVFAC) – Mid-Atlantic under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62470-16-D-9008, Contract Task Order (CTO) WE09. This supplement addresses soil Alternatives. Associated groundwater and soil vapor Alternatives are presented in the August 2016 FS Addendum, Revision 1 and remain unchanged. This supplement was developed in response to New York State Department of Environmental Conservation's (NYSDEC) December 30, 2016 request to develop additional alternatives that are consistent with the remedy established for the nearby Bethpage Community Park.

Initially, to develop this alternative, depth-specific mass estimates for polychlorinated biphenyls (PCBs) were prepared (Table A-1 of Appendix A). This evaluation concluded that an excavation to 20 feet below ground surface (bgs) at Site 1 would remove 95 percent of the PCBs greater than 50 milligrams per kilogram (mg/kg) at Site 1 and an excavation to 30 feet bgs at Dry Well 20-08 would remove 81 percent of PCBs greater than 50 mg/kg. The majority of the PCBs at Dry Well 34-07 are greater than 15 feet below ground surface (bgs) and no excavation is considered at that location. Furthermore, the maintenance or installation of reduced permeability cover (e.g., a permeability of 1×10^{-6} centimeters per second) and/or in-situ solidification were considered as options to further limit the migration of PCBs to groundwater. Based on these considerations, two new alternatives were developed:

- Alternative S-6A – Reduced Permeability Cover, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than a Depth-Dependent 10 mg/kg [Maximum of 10 feet bgs] to 50 mg/kg [Maximum of 20 or 30 feet bgs]), and LUCs (Figure 1).
- Alternative S-6B – Reduced Permeability Cover, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than a Depth-Dependent 10 mg/kg [Maximum of 10 feet bgs] to 50 mg/kg [Maximum of 20 or 30 feet bgs]), In-situ Solidification, and LUCs (Figure 2).

The development and evaluation of Alternatives S-6A and S-6B are presented in in Section 2.0. A comparative analysis of the new alternatives and the soil alternatives developed in the 2016 FS Addendum are presented in Section 3.0 and summarized in Table 1. Volume calculations for Alternatives S-6A and S-6B are presented in Appendix A. The detailed cost estimates are presented in Appendix B.

2.0 DEVELOPMENT AND EVALUATION OF REMEDIAL ALTERNATIVES FOR SOIL

2.1 ALTERNATIVE S-6A

Alternative S-6A includes excavation and onsite consolidation or offsite disposal of PCB-impacted soil with concentrations greater than 1 mg/kg to a depth of 2 feet bgs and 10 mg/kg to a depth of 10 feet bgs; and excavation and offsite disposal of PCB-impacted soil with concentrations greater than 50 mg/kg to a depth of 20 feet bgs at Site 1 and to a depth of 30 feet bgs at Dry Well 20-08. Other soil with site-specific COCs greater than the PRGs would be handled with the PCBs. Alternative S-6A also includes installation of a reduced permeable cover over the residual PCBs and LUCs (Figure 1). This alternative is considered to minimize direct contact with impacted soil and reduce leaching of COCs to groundwater.

Development

Alternative S-6A would include the excavation of PCB-impacted soil greater than 1 mg/kg to a depth of 2 feet bgs, 10 mg/kg to a depth of 10 feet bgs, and 50 mg/kg to a depth of 20 feet bgs at Site 1 and 30 feet bgs at Dry Well 20-08. To excavate the deeper soil at Dry Well 20-08, piling or equivalent measures would be used to support the excavation sidewalls during construction.

Under this alternative, approximately 70,000 cubic yards of impacted soil would be excavated and approximately 30,000 cubic yards would be disposed offsite (Appendix A). Based on testing, a portion of the soil (i.e., PCBs with less than 10 mg/kg to a depth of 10 feet bgs and less than 50 mg/kg at depths over 10 feet bgs), could be reused on site (40,000 cubic yards).

The sidewalls of the excavation would be sampled to confirm that PRGs were delineated with the horizontal extent of contamination. After completion of the excavation and consolidation, the area would be backfilled with clean soil and re-graded.

At Site 1 and Dry Well 20-08, a one-foot thick reduced permeable cover would be constructed at approximately 5 to 10 feet bgs over the area with residual PCBs. The cover would consist of a clay or cement modified soil to achieve the reduced permeability cover. The total volume of cover materials is approximately 3,000 cubic yards. At Dry-Well 34-07, the existing reduced permeability cover would be maintained. LUCs would be implemented at Site 1, Dry Well 20-08, and Dry Well 34-07.

During the design and implementation, optimization steps may be taken and would include consolidation of residual impacted soil to reduce the areal extent of the cover.

Detailed Analysis of Alternative

Overall Protection of Human Health and the Environment:

Alternative S-6A is expected to be protective of human health and the environment because the direct contact to contaminated soil (exposure to COCs) and migration of impacted soil to surface water and sediment would be eliminated via excavation, consolidation or offsite disposal, cover, and LUCs. The excavation and offsite disposal and soil cover would reduce leaching of COCs from soil to groundwater.

LUCs would be used to provide notice of subsurface impacts and help to prevent damage to the cover and restrict access to impacted media.

Compliance with ARARs:

This alternative would comply with chemical-specific ARARs for soil including NYSDEC Soil Cleanup Objectives for Commercial Use (10 NYCRR Part 375-6b), location-specific ARARs, and action-specific ARARs.

Long-term Effectiveness and Permanence:

Alternative S-6A would be effective in the long term. Impacted soil to a depth of approximately 20 feet bgs at Site 1 and 30 feet bgs at Dry Well 20-08 would be removed and replaced with consolidated site soil or clean soil to prevent direct contact to soil or inhalation of fugitive dusts. The removal of the majority of PCBs and the reduced permeability cover installed at approximately 5 to 10 feet bgs to cover all consolidated PCBs greater than 1 mg/kg would effectively reduce the migration of COCs to groundwater. LUCs would be used to restrict use of the area to prevent damage to the cover and exposure to residual impacted soil. The VOC, SVOC, and pesticide COCs would slowly degrade over time. Approximately 114,000 cubic yards of PCB-impacted soil containing approximately 3,400 pounds of PCBs and metals would remain. PCBs remain in some soil at concentrations greater than 50 mg/kg, but would be present at a depth greater than 20 feet or 30 feet bgs. LUCs would be used to restrict use of the area to prevent damage to the cover.

Reduction of Toxicity, Mobility, and Volume through Treatment:

Alternative S-6A would not result in the reduction in toxicity, mobility, or volume through treatment. Approximately 4,100 pounds of PCBs in 30,000 cubic yards of impacted soil would be removed from the site and disposed in an offsite landfill. Remaining VOC-, SVOC- and pesticide-impacted soil would degrade through natural in situ biological activities.

Short-term Effectiveness:

Alternative S-6A would be effective in the short term. Activities would consist of administrative actions, excavation, consolidation or offsite disposal of soil impacted with PCBs, and installation of a reduced permeability cover. The Alternative would involve the transportation of waste soil off site and potential removal and replacement of a portion of 11th Street, which would affect the surrounding community and environment. During excavation, the road would be blocked from vehicle and pedestrian traffic as needed in order to remove contaminated soil. In addition, VOC vapors and PCB-impacted dust would be generated during the excavation, loading, and transportation of the soil. Monitoring and dust suppression activities (such as wetting the soil) would be conducted to be protective of the community.

Compliance with the RAOs for prevention of direct contact with contaminated soil would be achieved upon completion of the soil cover, approximately 7 years after the signing of the ROD. Although there is the

potential for exposure to impacted soils during excavation, the appropriate personal protective equipment (PPE) would mitigate exposure to contaminated material.

Implementability:

Vendors and equipment are available to implement this alternative, including excavation, offsite disposal, and installation of a cover. Site 1 is located in a commercialized area, and trucking removal activities would need to be planned to be considerate of the surrounding community.

Cost:

Detailed cost analysis is provided in Appendix B. The estimated costs associated with Alternative S-6A are as follows.

Capital Cost:	$25,600,000
O&M:	$12,800 per year, over 30 years (Cap Maintenance)
	$30,000 every five years, over 30 years (Five-Year Review and LUCs)

Present Value: $26,000,000 (30 years)

2.2 ALTERNATIVE S-6B

This alternative is similar to Alternative S-6A in that it includes limited excavation of PCB-impacted soils, installation of a reduced permeability cover over residual PCB- and other COC-impacted soil, and LUCs. Alternative S-6B also includes the in-situ solidification of PCB-impacted soil containing greater than 50 mg/kg of PCBs (Figure 2). This treatment would encapsulate the higher concentration deep (approximately 20 to 65 feet bgs) residual PCB-impacted soil within a cement, bentonite, or similar matrix.

Development

Except for the in-situ solidification discussed below, the development of Alternative S-6B is the same as Alternative S-6A. The in-situ solidification construction technique is similar to that for the vertical barriers described in Alternative S-4 in that approximately 3-foot diameter columns would be formed throughout the site via jet grouting. Alternative methods, such as the use of augers, is also potentially feasible.

Because of the ability to treat the soils in three dimensions, an extensive pre-treatment sampling program would be conducted. Approximately one sample will be collected in a grid pattern for each 20-foot by 20-foot by 10-foot thick cell, (or every 150 cubic yards), within the attainment area. For the estimated volume of the attainment area of approximately 64,000 cubic yards, 430 samples would be collected and analyzed for PCBs. The volume of soil for treatment is estimated to represent 10 to 30 percent of the volume of tested soil within the attainment area, or an average of approximately 13,000 cubic yards of soil containing greater than 50 mg/kg of PCBs. The injection of the grout would result in the formation of approximately 2,000 cubic yards of waste material (15 percent of the treatment volume) for offsite disposal or onsite consolidation.

During the design and implementation, optimization steps may be taken and would include consolidation of residual impacted soil to reduce the areal extent of the cover and in-situ solidification.

Detailed Analysis of Alternative

Overall Protection of Human Health and the Environment:

Alternative S-6B is expected to be protective of human health and the environment because the direct contact to contaminated soil (exposure to COCs) and migration of impacted soil to surface water and sediment would be eliminated via excavation, capping, and LUCs. The excavation, in-situ solidification, and reduced permeability cover would prevent leaching of contamination from soil to groundwater and the in-situ solidification would reduce horizontal migration of groundwater in contact with saturated soil. Monitoring would be conducted to ensure the integrity of the cover and solidification. LUCs would be used to provide notice of subsurface contamination and help to prevent damage to the cover and restrict access to impacted media.

Compliance with ARARs:

This alternative would comply with chemical-specific ARARs for soil. Although COCs would remain at the site at concentrations that would not allow unrestricted use (e.g., NYSDEC Soil Clean Up Objectives Table 375-6.8a), the use of the cover, removal of soils containing more than 10 mg/kg PCBs to a depth of approximately 10 feet bgs, in-situ solidification of soils containing more than 50 mg/kg PCBs at depths of approximately 20 or 30 to 65 feet bgs, and LUCs would effectively minimize the potential for risk to human health. The removal or solidification of PCB-impacted soil, and the reduced permeability cover would also reduce leaching of COCs from unsaturated soil to groundwater and migration of impacted groundwater. There are no location specific ARARs for soil. This alternative would also comply with action-specific ARARs for management and characterization of impacted wastes on site and the Underground Injection Control (UIC) (40 C.F.R. 144.81 and 0.82).

Long-term Effectiveness and Permanence:

Alternative S-6B would be moderately effective in the long term. Impacted soil to a depth of approximately 20 or 30 feet bgs would be removed and replaced with consolidated site soil or clean soil and covered to prevent direct contact to soil or inhalation of fugitive dusts. The reduced permeability cover and in-situ solidification would effectively control infiltration of groundwater and leaching of contamination from unsaturated soil to groundwater. LUCs would be used to restrict use of the area to prevent damage to the cap and exposure to residual impacted soil. The pesticide, VOC, and SVOC COCs would slowly degrade over time. A calculated 114,000 cubic yards of PCB- and metal-impacted soil containing approximately 3,400 pounds of PCBs would remain at the site of which 400 pounds would be treated. The remaining untreated PCBs would be present in soil at concentrations less than 50 mg/kg at Site 1 and Dry Well 20-08. LUCs would be used to restrict use of the area to prevent damage to the cover.

Reduction of Toxicity, Mobility, and Volume through Treatment:

Alternative S-6B would reduce the mobility of 400 pounds of PCBs in 13,000 cubic yards of impacted soil through solidification. Also, approximately 4,100 pounds of PCBs in 30,000 cubic yards of impacted soil would be removed from the site and disposed in an offsite landfill. An additional 2,000 cubic yards of treated soil from the solidification process would be generated and require either on site reuse or offsite disposal. Remaining VOC-, SVOC-, and pesticide-impacted soil would degrade through natural in situ biological activities.

Short-term Effectiveness:

Alternative S-6B would be effective in the short term. Activities would consist of administrative actions, excavation and offsite disposal of the top 20 or 30 feet of soil impacted with PCBs, and installation of a reduced permeability cover and in-situ solidification. The alternative would involve the transportation of waste soil off site and potential removal and replacement of a portion of 11th Street similar to Alternative S-6A, which would affect the surrounding community and environment. In addition, VOC vapors and PCB-impacted dust would be generated during the excavation, loading, and transportation of the soil. Monitoring and dust suppression activities (such as wetting the soil) would be conducted to be protective of the community.

Compliance with the RAOs for prevention of direct contact to contaminated soil would be achieved upon completion of the excavation, in-situ solidification, and installation of the cap, approximately 8 years after the signing of the ROD. Initially, because in-situ solidification disturbs saturated soils, leaching of site COCs to groundwater would increase. Over time, the leaching would be expected to decrease to levels below current conditions. Although there is the potential for exposure to impacted soils during excavation, the appropriate PPE would mitigate exposure to contaminated material.

Implementability:

Vendors and equipment are available to implement this alternative, including excavation, consolidation, capping, and offsite disposal. Implementation of the in-situ solidification is less common, with limited vendors available to perform the work. Site 1 is located in a commercialized area, and trucking removal activities would need to be planned to be considerate of the surrounding community.

Cost:

Detailed cost analysis is provided in Appendix B. The estimated costs associated with Alternative S-6B are as follows.

Capital Cost:	$30,500,000
O&M:	$12,800 to $43,000 0 per year, over 30 years (Cap Maintenance)
	$30,000 every five years, over 30 years (Five-Year Review and LUCs)
Present Value:	$31,000,000 (30 years)

3.0 COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES

This section provides a comparative analysis of the soil remedial alternatives. The criteria for comparison are identical to those used for the detailed analysis of the individual alternatives. A comparative analysis of soil alternatives is summarized in Table 1.

3.1 Overall Protection of Human Health and the Environment

Alternative S-1 is not protective of human health and the environment, and would not achieve site-specific remedial action objectives. Soil COCs provide a direct contact to contaminated soil, and soil COC could still migrate to groundwater and soil vapor.

In the long term, Alternatives S-2, S-3, S-4, S-5A, S-5B, S-6, S-6A, S-6B, and S-7 would be protective of human health and the environment and achieve the RAOs. Alternative S-7 achieves each of the RAOs through excavation and offsite disposal, whereas the other alternatives achieve the RAOs through various remedial actions, including containment and treatment.

The remedial actions associated with each of the alternatives focus on the PCBs because they are present throughout much of Site 1, representing the majority of the COC mass, are persistent in the environment, and are detected in groundwater. The pesticide, VOC, and SVOC COCs were detected infrequently and sporadically throughout the site and are subject to degradation through natural mechanisms. The action-alternatives address these COCs through containment and natural degradation. The metals are also present infrequently and sporadically throughout the site, but generally do not degrade. One of the metals, hexavalent chromium can degrade to a more stable and less toxic and mobile trivalent chromium. The alternatives address the metals through containment.

Alternatives S-2 through S-6B would prevent human exposure to impacted soil and erosion of impacted soil to surface water and sediment via containment and LUCs. For Alternative S-2 a permeable cover would be used. Alternatives S-6A and S-6B, the containment is a reduced permeable cover and for Alternatives S-3 through S-5B, an impermeable – RCRA cap would be used.

Each of the alternatives provides a reduction of COC migration to groundwater. Alternatives S-2 through S-5B use an impermeable cap to effectively eliminate migration of COCs from unsaturated soil to groundwater. Alternatives S-6A and S-6B use a reduced permeability cover to limit migration of COCs from unsaturated soil to groundwater. Alternatives S-5A and S-6B (using solidification) and S-5B (using solvent extraction) would further reduce migration of COCs from unsaturated soil to groundwater and from saturated soil to groundwater through treatment. Alternatives S-4 and S-5B would use vertical barriers to limit migration of COC-impacted groundwater. Alternatives S-6 and S-7 would reduce COC migration by excavation and offsite disposal of the majority or all of the COC-impacted soil, respectively.

3.2 Compliance with ARARs

Alternative S-1 would not comply with ARARs. Soils contain PCBs greater than New York State Soil Cleanup Objectives (10 NYCRR Part 375) and there would be no action taken to isolate them from human

contact or the environment. In addition, these soils would continue to leach and result in groundwater with PCBs greater than New York State Public Water Supply Regulations (10 NYCRR Part 5-1) and the New York State Water Classification and Quality Standards (6 NYCRR 701 and 702).

Alternatives S-2, S-3, S-6, S-6A, and S-7 would comply with the chemical-specific ARARs for soil (NYSDEC SCO for Commercial Use, 10 NYCRR Part 375-6b), the location-specific ARAR for management of a contaminated site (6 NYCRR 375 Parts 1.1 to 1.12), and the action-specific ARAR for characterization and identification of wastes (6 NYCRR 371.3, 372.2, and 373-1.1).

Alternatives S-4, S-5A, S-5B, and S-6B would also comply with action-specific ARARs for federal requirements for Underground Injection Control (40 C.F.R. 144.81 and 0.82). Additionally, because of the use of a solvent, Alternative S-5B would comply with action-specific ARARs for federal and State requirements for management of fuels and oil (40 C.F.R. 112.3-.6 and 6 NYCRR Parts 615.8 – 0.14).

3.3 Long-term Effectiveness and Permanence

Alternative S-1 is not effective in the long-term. People could be exposed to impacted soil via direct contact. Impacted soil would also continue to leach to groundwater and erode to surface water and sediment in the recharge basins. In addition, VOCs in soil would continue to impact soil vapor and result in vapor intrusion issues for an extended period of time.

Alternatives S-2, S-3, S-4, S-5A, S-5B, S-6, S-6A, and S-6B would be effective and reliable in the long term because of the containment of impacted soil and LUCs that would reduce or eliminate potential exposure to COCs and migration of COCs to groundwater. Alternative S-2 provides the least reduction in potential COC migration to groundwater. Alternatives S-3 and S-4 are more effective then Alternative S-2, because of the use of impermeable barriers to further limit COC migration from soil to groundwater. Alternatives S-5A, S-5B, and S-6B are more effective than Alternatives S-2 through S-4 by the use of treatment to immobilize the PCBs and other COCs (Alternative S-5A and S-6B) and solvent extraction (Alternative S-5B) to remove PCBs and other COCs from soil. Alternative S-6A and S-6B are more effective because more than half of the PCBs and other COCs are removed from the site. Alternatives S-6 and S-7 are more effective, because the majority or all of the PCBs and other COCs are removed from the site, respectively.

Alternatives S-2, S-3, and S-4, would leave PCB-impacted soil at concentrations over 1,000 mg/kg, but generally at depths greater than 10 feet bgs. Under Alternative S-5A, similar concentrations would remain, but soil with PCBs greater than 50 mg/kg would be solidified to immobilize the PCBs. Under Alternative S-5B, soil with PCBs greater than 50 mg/kg would be treated with solvent extraction to remove approximately 88 percent of the COC mass. Under Alternative S-6, soils with PCBs greater than 10 mg/kg to a depth of 10 feet bgs and 50 mg/kg at depths over 10 feet bgs would be excavated and disposed off site. Under Alternatives S-6A and S-6B, soils with PCBs greater than 10 mg/kg to a depth of 10 feet bgs and 50 mg/kg at depths over 20 or 30 feet bgs would be excavated and disposed off site. Additionally, under Alternative S-6B, residual soil with PCBs greater than 50 mg/kg would be solidified to immobilize PCBs. Under Alternative S-7, soil with PCBs greater than 1 mg/kg, would be excavated and disposed off site.

3.4 Reduction of Toxicity, Mobility, or Volume through Treatment

There would be no reduction of toxicity, mobility, or volume through treatment under Alternatives S-1, S-2, S-3, S-4, S-6, S-6A, or S-7. Under Alternative S-5A, approximately 3,300 pounds of PCBs in 16,000 cubic yards of soil would be treated with in-situ solidification. Under Alternative S-5B, approximately 4,200 pounds of PCBs would be removed from approximately 76,000 cubic yards of soil via solvent extraction and then thermally or chemically treated to permanently destroy the PCBs. Under Alternative S-6B, approximately 400 pounds of PCBs in 13,000 cubic yards of soil would be treated with in-situ solidification.

In addition, Alternatives S-2, S-3, S-4, S-5A, and S-5B would excavate and dispose offsite 1,100 to 1,400 pounds of PCBs in 7,200 to 14,500 cubic yards of soil. Alternatives S-6 and S-7 would excavate and dispose offsite 4,600 pounds of PCBs in 65,000 cubic yards of soil and 7,500 pounds of PCBs in 144,000 cubic yards of soil, respectively. Alternatives S-6A and S-6B would excavate and dispose offsite 4,100 pounds of PCBs in 30,000 cubic yards of soil.

3.5 Short-Term Effectiveness

Alternative S-1 is not effective in the short-term. Impacted soils will remain, local receptors could be exposed to impacted soil, and COC leaching to groundwater would continue. Alternatives S-2 through S-7 would be effective in the short term. Each of these remedial alternatives could expose site workers to contaminated material. The potential impact to workers is proportional to the level of effort conducted. Safe work practices and PPE would be used to protect site workers during implementation of the activities.

The time required to implement each alternative is dependent on the level of effort to be conducted. Alternative S-2 could be implemented within 5 years after signing of the ROD. Alternatives S-3 and S-4, which are containment alternatives, could be implemented within 6 to 7 years after signing of the ROD. Alternatives S-5A and S-5B, which are treatment alternatives, could be implemented within 8 years to 11 after signing of the ROD. Alternatives S-6, S-6A, S-6B, and S-7, which involve extensive excavation and offsite disposal, would require 7 to 10 years after signing of the ROD.

3.6 Implementability

Each of the alternatives are implementable. Since there is no action, Alternative S-1 requires no activities to implement. Alternatives S-2, S-3, S-4, S-6A, and S-6B that use conventional excavation above the water table, offsite disposal, and covering/capping are moderately easy to implement. Alternatives S-6 and S-7 that involve excavation below the water table would be more difficult to implement. Alternative S-5A and S-6B that involves treatment would be moderately difficult to implement, whereas Alternative S-5B that involves an innovative technology may be difficult to implement.

Multiple venders, equipment, and offsite landfills are available for the excavation, capping, transportation, and disposal aspects of each of the alternatives. Vendors and equipment are available for installation of a vertical barrier or solidification; however, specialized equipment would be required for solidification of soils to a depth of 65 feet bgs. The availability of vendors to conduct the solvent/air sparging system is very

limited. Site 1 is located in an area of commercial and residential development that would prevent horizontal development.

3.7 Cost

There are no costs associated with Alternative S-1. Alternative S-7 is the most expensive to implement. A full summary of costs associated with the alternatives is provided in Table 1.

TABLES

TABLE 1
COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES
SITE 1 - FORMER DRUM MARSHALLING AREA
BETHPAGE, NEW YORK

Criteria	Alternative S-1: No Action	Alternative S-2: Permeable Cover, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than 10 mg/kg [Approximately 9 feet bgs]), and LUCs	Alternative S-3: RCRA Cap, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than 25 mg/kg [Maximum of 10 feet bgs]), and LUCs	Alternative S-4: RCRA Cap, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than 25 mg/kg [Maximum of 10 feet bgs]), Vertical Barriers, and LUCs	Alternative S-5A: RCRA Cap, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than 25 mg/kg Maximum of [10 feet bgs]), In-situ Solidification of PCB-Contaminated Soil (Greater than 50 mg/kg), and LUCs	Alternative S-5B: RCRA Cap, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than 25 mg/kg [Maximum of 10 feet bgs]), Vertical Barrier, In-situ Solvent Extraction of PCB-Contaminated Soil (Greater than 50 mg/kg), and LUCs	Alternative S-6: Soil Cover, Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than a Depth-Dependent 10 mg/kg [Maximum of 10 feet bgs] or 50 mg/kg [65 feet bgs]), and LUCs	Alternative S-6A: Reduced Permeability Cover, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than a Depth-Dependent 10 mg/kg [Maximum of 10 feet bgs] to 50 mg/kg [Maximum of 20 or 30 feet bgs]), and LUCs	Alternative S-6B: Reduced Permeability Cover, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than a Depth-Dependent 10 mg/kg [Maximum of 10 feet bgs] to 50 mg/kg [Maximum of 20 or 30 feet bgs]), In-situ Solidification, and LUCs	Alternative S-7: Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than 1 mg/kg [65 feet bgs])
Overall Protection of Human Health and the Environment	Alternative S-1 is not protective of human health and the environment. Workers and potential future residents could be exposed to contaminated soil through direct contact, ingestion, and inhalation. Contaminated soil could also erode and migrate into the nearby recharge basins. COCs in soil would continue to leach and impact groundwater for an extended period of time.	Alternative S-2 would be protective by providing a barrier between contaminated soil and potential receptors. Leaching of PCBs and other COCs to groundwater would be reduced by excavation and offsite disposal of a portion of the contaminated soil. LUCs would be used to limit exposure and reuse of contaminated soil and to maintain the cover.	Alternative S-3 provides similar direct exposure and erosion protection as Alternative S-2, but would further reduce leaching of PCBs and other COCs to groundwater by effectively eliminating vertical migration of precipitation. LUCs would be the same as Alternative S-2.	Alternative S-4 is similar to Alternative S-3, except that a vertical barrier would also be used to control migration of PCBs and other COCs from saturated soil to groundwater.	Alternative S-5A is similar to Alternative S-3, except that contaminated soil would be treated to encapsulate contaminants and thereby limit the migration of PCBs and other COCs from soil to groundwater.	Alternative S-5B is similar to Alternative S-5A, except that contaminated soil would be treated to extract PCBs and other COCs from soil and thereby limit the migration of PCBs and other COCs from soil to groundwater.	Alternative S-6 is similar to Alternative S-2, except that excavation and offsite disposal of contaminated soil would target soils greater than 50 mg/kg to approximately 65 feet bgs. The supplemental removal would remove PCBs and other COCs that could leach to groundwater.	Alternative S-6A is similar to Alternative S-2, except that excavation and off site disposal of contaminated soil would extend to approximately 20 feet bgs at Site 1 and 30 feet bgs at Dry Well 20-08. A reduced permeability cover would be installed at approximately 10 feet bgs to limit the migration of PCBs and other COCs from soil to groundwater. The existing cover at Dry Well 34-07 would be maintained.	Alternative S-6B is similar to Alternative S-6A, except that in-situ solidification would be used to treat soils below the excavation. Similar to Alternative S-5A, contaminated soil would be treated to encapsulate contaminants and thereby limit the migration of PCBs and other COCs from soil to groundwater.	Alternative S-7 would be protective by removing all the contaminated soil. The need for LUCs or potential for groundwater contamination would be eliminated.
Compliance with ARARs	Alternative S-1 would not comply with NYSDEC Soil Cleanup Objectives (Part 375). There are no location- or action-specific ARARs.	Alternative S-2 would comply with chemical-specific ARARs for soil including NYSDEC Soil Cleanup Objectives for Commercial Use (10 NYCRR Part 375-6 and action-specific ARARs for the management and characterization of contaminated wastes on site. There are no location-specific ARARs.	Same as Alternative S-2.	The same chemical- and action-specific ARARs as Alternative S-2. Additionally, this alternative would comply with federal action-specific ARARs for Underground Injection Control (UIC) (40 C.F.R. 144.81 and .82).	Same as Alternative S-4.	Similar to Alternative S-4, except that the solvent would also need to be managed in accordance with 40 C.F.R. 112.3 to .6 and NYCRR Parts 615.8 to .14.	Same as Alternative S-2.	Same as Alternative S-2.	Same as Alternative S-4.	Same as Alternative S-2.
Long-term Effectiveness and Permanence	Alternative S-1 is not effective in the long-term. Direct contact, erosion, and leaching risks from approximately 7,500 pounds of PCBs and other COCs in approximately 144,000 cubic yards of contaminated soil would remain, without barriers or restrictions in place. Residual PCB concentrations exceed 50 mg/kg.	Alternative S-2 would be moderately effective in the long term. Potential exposure to approximately 6,100 pounds of PCBs and other COCs in approximately 130,000 cubic yards of contaminated soil would be controlled through the cover and LUCs. Residual PCB concentrations exceed 50 mg/kg. The LUCs and cover would be adequate and reliable. Residuals could continue to impact groundwater for an extended period of time.	Similar to Alternative S-2, except the RCRA Cap would further reduce the potential for continued impact to groundwater. Potential exposure to approximately 6,400 pounds of PCBs and other COCs in approximately 137,000 cubic yards of contaminated soil would be controlled through the cap and LUCs.	Similar to Alternative S-3, except that potential impacts to groundwater from saturated soil would be further reduced.	Similar to Alternative S-4, except untreated soils would be limited to those with PCBs less than 50 mg/kg.	Similar to Alternative S-3, except that potential exposure to approximately 3,300 pounds of PCBs and other COCs in approximately 68,000 cubic yards of contaminated soil would be controlled through the cap and LUCs. PCB-contaminated soil with more than 50 mg/kg would be treated to reduce concentrations by approximately 80 to 90 percent.	Similar to Alternative S-2, except that potential exposure to 2,900 pounds of PCBs and other COCs in approximately 79,000 cubic yards of contaminated soil would be controlled through the cover and LUCs. Residual PCB concentrations would be less than 50 mg/kg.	Similar to Alternative S-2, except potential exposure to approximately 3,400 pounds of PCBs and other COCs in approximately 114,000 cubic yards of contaminated soil would be controlled through the cover and LUCs. Approximately 400 pounds of PCBs, with concentrations greater than 50 mg/kg would remain.	Similar to Alternative S-6A except soils below the excavation depth of 20 or 30 feet bgs with residual PCBs greater than 50 mg/kg would be treated similar to Alternative S-5A.	There would be no residual contaminated soil at the site.

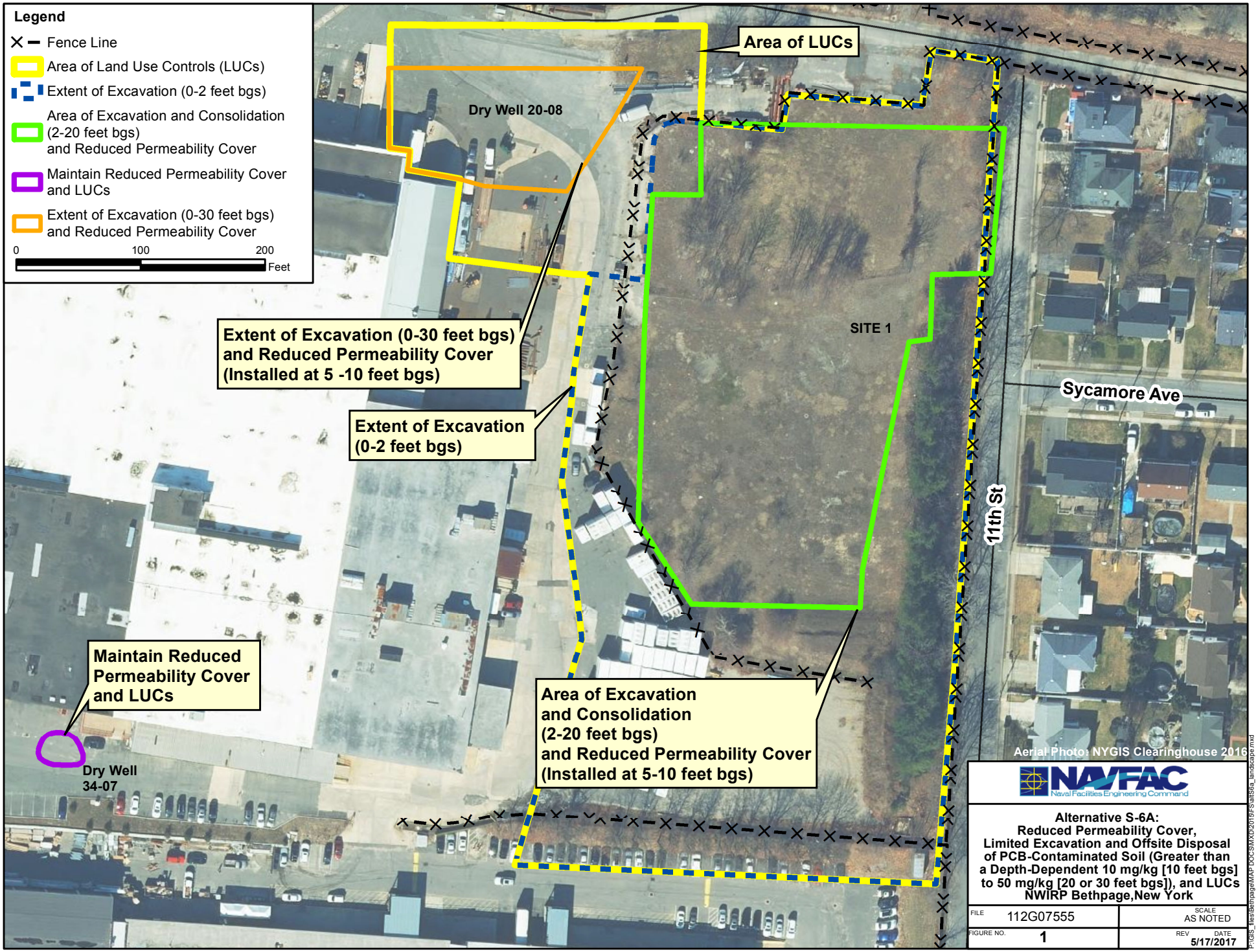
TABLE 1
COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES
SITE 1 - FORMER DRUM MARSHALLING AREA
BETHPAGE, NEW YORK

Criteria	Alternative S-1: No Action	Alternative S-2: Permeable Cover, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than 10 mg/kg [Approximately 9 feet bgs]), and LUCs	Alternative S-3: RCRA Cap, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than 25 mg/kg [Maximum of 10 feet bgs]), and LUCs	Alternative S-4: RCRA Cap, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than 25 mg/kg [Maximum of 10 feet bgs]), Vertical Barriers, and LUCs	Alternative S-5A: RCRA Cap, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than 25 mg/kg Maximum of [10 feet bgs]), In-situ Solidification of PCB-Contaminated Soil (Greater than 50 mg/kg), and LUCs	Alternative S-5B: RCRA Cap, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than 25 mg/kg [Maximum of 10 feet bgs]), Vertical Barrier, In-situ Solvent Extraction of PCB-Contaminated Soil (Greater than 50 mg/kg), and LUCs	Alternative S-6: Soil Cover, Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than a Depth-Dependent 10 mg/kg [Maximum of 10 feet bgs] or 50 mg/kg [65 feet bgs]), and LUCs	Alternative S-6A: Reduced Permeability Cover, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than a Depth-Dependent 10 mg/kg [Maximum of 10 feet bgs] to 50 mg/kg [Maximum of 20 or 30 feet bgs]), and LUCs	Alternative S-6B: Reduced Permeability Cover, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than a Depth-Dependent 10 mg/kg [Maximum of 10 feet bgs] to 50 mg/kg [Maximum of 20 or 30 feet bgs]), In-situ Solidification, and LUCs	Alternative S-7: Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than 1 mg/kg [65 feet bgs])
Reduction of Toxicity, Mobility or Volume through Treatment	There would be no reduction in toxicity, mobility or volume through treatment. Pesticide, SVOC, VOC, and hexavalent chromium concentrations would slowly attenuate naturally. PCBs and other metals would remain indefinitely.	There would be no reduction in toxicity, mobility, or volume through treatment. Pesticide, SVOC, VOC, and hexavalent chromium concentrations would slowly attenuate naturally. PCBs and other metals would remain indefinitely. Approximately 1,400 pounds of PCBs in 14,000 cubic yards would be removed via excavation and offsite disposal.	Similar to Alternative S-2, except that approximately 1,100 pounds of PCBs in 7,000 cubic yards would be removed via excavation and offsite disposal.	Same as Alternative S-3.	Approximately 16,000 cubic yards of contaminated soil would be treated by solidification to encapsulate approximately 3,300 pounds of PCBs to limit mobility. COC attenuation and excavation and offsite disposal would be the same as Alternative S-3.	Approximately 76,000 cubic yards of contaminated soil would be treated by solvent extraction to remove 4,200 pounds of PCBs to limit mobility. Approximately 740,000 gallons of waste solvent would be generated for offsite disposal or onsite treatment and reuse. COC attenuation and excavation and offsite disposal would be the same at Alternative S-3.	Similar to Alternative S-2, except that approximately 4,600 pounds of PCBs in 65,000 cubic yards would be removed via excavation and offsite disposal.	Similar to Alternative S-2, except that approximately 4,100 pounds of PCBs in 30,000 cubic yards would be removed via excavation and offsite disposal.	Similar to Alternative S-6A except approximately 13,000 cubic yards of contaminated soil would be treated by solidification to encapsulate approximately 400 pounds of PCBs to limit mobility.	Similar to Alternative S-2, except that approximately 7,500 pounds of PCBs in 144,000 cubic yards would be removed via excavation and offsite disposal.
Short-term Effectiveness	Because there is no action being taken, Alternative S-1 would be effective in the short-term.	Alternative 2 would be effective in the short term. A portion of the excavation may extend beyond the fence line to the east into the residential neighborhood. There is a potential for COC-contaminated dust being generated during excavation and loading activities, which would need to be addressed through monitoring and dust-suppression procedures. Monitoring and PPE would be used to protect workers during implementation. This remedy could be implemented within 5 years after signing the ROD.	Similar to Alternative S-2, except that the remedy would be implemented within 6 years after signing the ROD.	Similar to Alternative S-3, except that the remedy would be implemented within 7 years after signing the ROD, and an additional 3,500 cubic yards of waste material from the vertical barriers would need to be handled.	Similar to Alternative S-4, except that the remedy would be implemented within 8 years after signing the ROD.	Similar to Alternative S-4, except that the remedy would be implemented within 11 years after signing the ROD.	Similar to Alternative S-2, except that the remedy would be implemented within 7 years after signing the ROD.	Similar to Alternative S-6.	Similar to Alternative S-6A, except that the in-situ solidification would be implemented within 8 years after signing the ROD.	Similar to Alternative S-2, except that the remedy would be implemented with 10 years after signing the ROD.
Implementability	This is no activity to implement.	Alternative S-2 employs a technically straight forward approach and no permits are required. Vendors are readily available to conduct this work.	Same as Alternative S-2.	Similar to Alternative S-2, except the installation of vertical barriers is a less common practice, but vendors are available.	The same as Alternative S-4.	Most of the elements are similar to Alternative S-4. The solvent extraction step is innovative and would need to be developed specifically for this site.	Similar to Alternative S-2, except that the excavation would be very deep and extend below the water table.	Similar to Alternative S-2, except that the excavation would extend to approximately 20 feet bgs at Site 1 and 30 feet bgs at Dry Well 20-08.	Similar to S-6A, except in-situ solidification is a less common practice, but vendors are available.	Same as Alternative S-6.
Cost	$0	Capital: $12,900,000 O&M: $12,800 to $43,000 per year over 30 years. PV: $13,400,000	Capital: $14,600,000 O&M: $12,800 to $43,000 per year over 30 years. PV: $15,000,000	Capital: $24,000,000 O&M: $12,800 to $43,000 per year over 30 years. PV: $24,500,000	Capital: $23,600,000 O&M: $12,800 to $43,000 per year over 30 years. PV: $24,000,000	Capital: $41,900,000 O&M: $12,800 to $140,000 per year over 30 years. PV: $42,800,000	Capital: $55,400,000 O&M: $12,800 to $43,000 per year over 30 years. PV: $55,400,000	Capital: $25,600,000 O&M: $12,800 to $43,000 per year over 30 years. PV: $26,000,000	Capital: $30,500,000 O&M: $12,800 to $43,000 per year over 30 years. PV: $31,000,000	Capital: $99,700,000 O&M: $0 PV: $99,700,000

1 - State and Community Acceptance are to be determined based on a review of this FS and development of a Proposed Plan and Statement of Basis.

NYSDEC - New York State Department of Environmental Conservation.
RCRA - Resource Conservation and Recovery Act.
ARARs - Applicable or Relevant and Appropriate Requirements.
NYCRR - New York Codes, Rules, and Regulations.
PPE- Personal Protective Equipment.
mg/kg - milligram per kilogram.
LUC - Land Use Controls.
PV - Present Value.
PCB- Polychlorinated Biphenyl.
ROD - Record of Decision.
COC- Contaminant of Concern.
PRGs - Preliminary Remediation Goals.
O & M - Operation and maintenance.

FIGURES



NAVFAC
Naval Facilities Engineering Command

Alternative S-6A:
Reduced Permeability Cover, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than a Depth-Dependent 10 mg/kg [10 feet bgs] to 50 mg/kg [20 or 30 feet bgs]), and LUCs
NWIRP Bethpage,New York

FILE	SCALE
112G07555	AS NOTED
FIGURE NO. 1	REV DATE 5/17/2017

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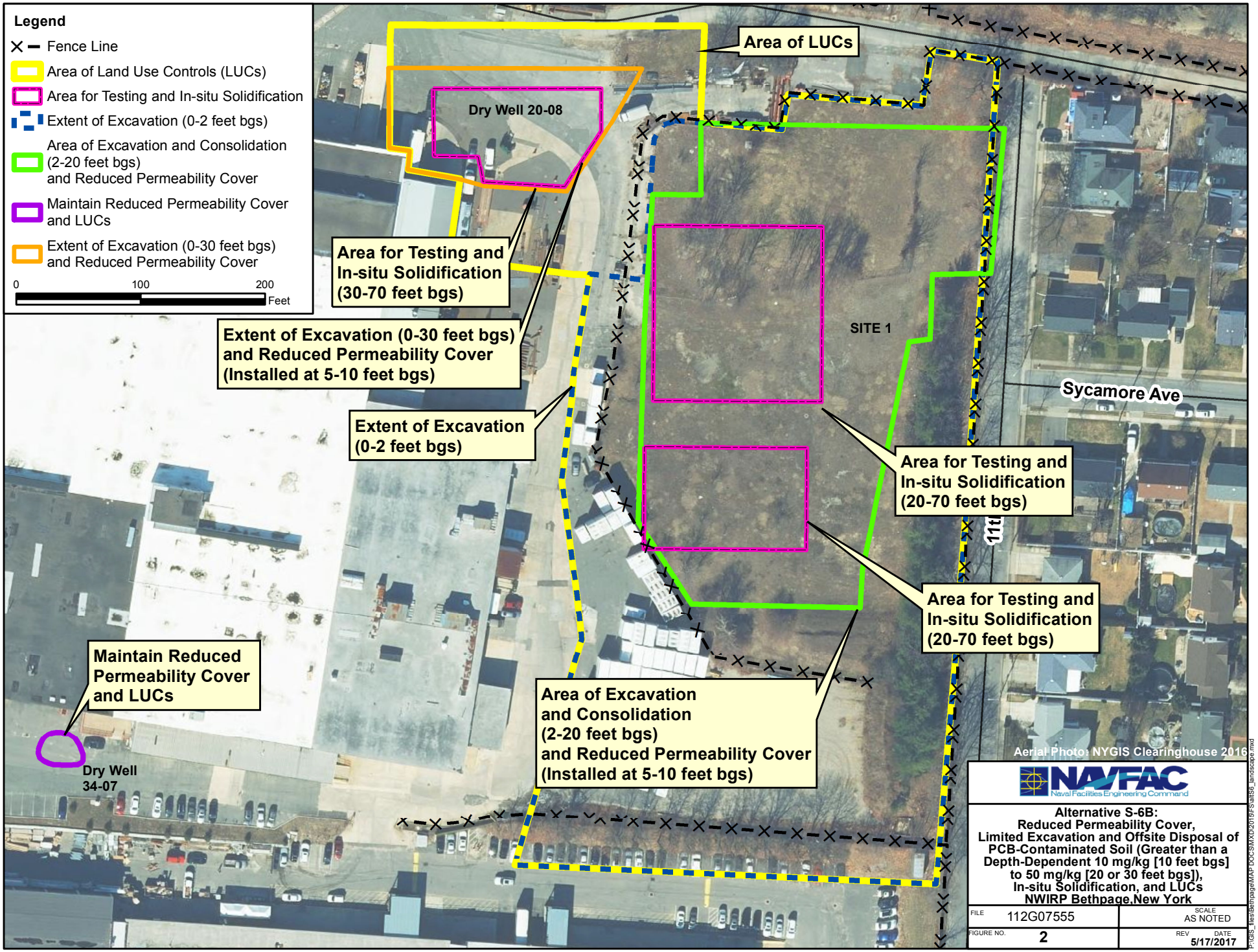
Legend
Fence Line
Area of Land Use Controls (LUCs)
Area for Testing and In-situ Solidification
Extent of Excavation (0-2 feet bgs)
Area of Excavation and Consolidation (2-20 feet bgs) and Reduced Permeability Cover
Maintain Reduced Permeability Cover and LUCs
Extent of Excavation (0-30 feet bgs) and Reduced Permeability Cover
0
100
200
Feet
Area of LUCs
Dry Well 20-08
Area for Testing and In-situ Solidification (30-70 feet bgs)
Extent of Excavation (0-30 feet bgs) and Reduced Permeability Cover (Installed at 5-10 feet bgs)
Extent of Excavation (0-2 feet bgs)
SITE 1
Sycamore Ave
Area for Testing and In-situ Solidification (20-70 feet bgs)
Area for Testing and In-situ Solidification (20-70 feet bgs)
Maintain Reduced Permeability Cover and LUCs
Dry Well 34-07
Area of Excavation and Consolidation (2-20 feet bgs) and Reduced Permeability Cover (Installed at 5-10 feet bgs)
Aerial Photo: NYGIS Clearinghouse 2016
NAVFAC
Naval Facilities Engineering Command
Alternative S-6B:
Reduced Permeability Cover,
Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (Greater than a Depth-Dependent 10 mg/kg [10 feet bgs] to 50 mg/kg [20 or 30 feet bgs]),
In-situ Solidification, and LUCs
NWIRP Bethpage,New York
FILE 112G07555
SCALE AS NOTED
FIGURE NO. 2
REV
DATE 5/17/2017
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APPENDIX A

ALTERNATIVE-SPECIFIC CALCUATIONS

Table A1
PCB Mass by Depth Evaluation and Alternative Development
Site 1 - Former Drum Marshalling Area
NWIRP Bethpage, New York

Location and Depth	Mass of PCBs Greater than 1 mg/kg[1] (pounds)	Contamination Level Targeted for Removal for Alternative S6A	Mass of PCBs in Contamination Level Targeted for Removal[1] (pounds)	Percent of Mass by Area	Volume of Soil[2] (CY)	Volume of Excavated Soil Required to Access PCB Contamination[3] (CY)
Site 1 (0 to 2 feet)	421	Greater than 1 mg/kg	421	14.3%	11,300	14,000
Site 1 (2 to 10 feet)	1,300	Greater than 10 mg/kg	991	33.7%	7,300	19,500
Site 1 (10 to 20 feet)	2,326	Greater than 50 mg/kg	1,384	47.0%	857	18,000
Site 1 (20 to 30 feet)	276	Greater than 50 mg/kg	40	1.4%	159	7,000
Site 1 (30 to 40 feet)	57	Greater than 50 mg/kg	13	0.4%	56	1,800
Site 1 (40 to 50 feet)	60	Greater than 50 mg/kg	5	0.2%	25	6,000
Site 1 (50 to 60 feet)	216	Greater than 50 mg/kg	86	2.9%	553	18,000
Site 1 (60 to 65 feet)	47	Greater than 50 mg/kg	4	0.1%	700	5,800
Total:	**4,703**	**Total:**	**2,944**	**100%**	**20,950**	**90,100**
DW 20-08 (20 to 30 feet)	2,019	Greater than 50 mg/kg	1,269	81.5%	625	18,200
DW 20-08 (30 to 40 feet)	363	Greater than 50 mg/kg	239	15.3%	510	6,000
DW 20-08 (40 to 50 feet)	44	Greater than 50 mg/kg	3	0.2%	13	1,300
DW 20-08 (50 to 60 feet)	19	Greater than 50 mg/kg	47	3.0%	193	1,300
DW 20-08 (60 to 65 feet)	11	Greater than 50 mg/kg	0	0.0%	0	0
Total:	**2,456**	**Total:**	**1,558**	**100%**	**1,341**	**26,800**
DW 34-07 (2 to 15 feet)	35	Greater than 50 mg/kg	17	12.1%	36	110
DW 34-07 (15 to 50 feet)	264	Greater than 50 mg/kg	123	87.9%	257	860
	299	**Total:**	**140**	**100%**	**293**	**970**
Total of Three Areas:	**7,458**	**Total of Three Areas:**	**4,642**	**62%**	**22,584**	**117,870**

CY - cubic yards
mg/kg - milligram per kilogram
PCBs - polychlorinated biphenyl
1. Weight calculation from Appendix A of the August 2016 Feasibility Study Addendum.
2. Volume calculation from Appendix A of the August 2016 Feasibility Study Addendum.
3. Volume calculated from attainment areas. See figures.

Alternative S-6A			
Area	Depth of Excavation (feet bgs)	Mass of PCBs (lbs)	Percent of Greater than 50 mg/kg of PCBs Removed
Site 1	**20**	**2,796**	**95%**
Dry Well 20-08	**30**	**1,269**	**81%**
Dry Well 34-07	**0**	**0**	**0%**

Tetra Tech, Inc.		***STANDARD CALCULATION SHEET***	
CLIENT:	FILE No:	BY: KF	PAGE:
SUBJECT: Appendix A Alternative Calculations Soil Alternative S-6A Calculations Site 1 Bethpage, New York		CHECKED BY:	DATE: 4/25/2017

A.S6A-1 Purpose: Calculate the volume of soil to be excavated if soils are removed greater than a depth-dependent 10 mg/kg to 50 mg/kg and volume of material required to install a reduced permeability cover.

B.S6A-2 Approach: Use volume estimates from previous calculations (Appendix A Mass and Volume Calculations) to estimate soil to be removed.

A.S6A-3 Estimate the volume of soil to be removed. Soil will be excavated to 20 feet bgs at Site 1 and 30 feet bgs at Dry Well 20-08.

A.S6A-3A Volume of soil to be excavated that is unsaturated (Site 1) =

Area is shown on Figure A-1.

Volume of soils in 0 - 2 feet bgs =

Volume = 389,154 ft^3 = 14,413 cy

Soil Density = 112 lb/ft^3 = 3,024 lb/yd^3

Total Soils = ($V_{contaminated}$*soil density)/2,000 pounds/ton = 21,793 tons

A.S6A-3B Volume of soil to be excavated that is unsaturated (Site 1) =

Area is shown on Figure A-2.

Volume of soils in 2 - 10 feet bgs =

Volume = 525,560 ft^3 = 19,465 cy

Soil Density = 112 lb/ft^3 = 3,024 lb/yd^3

Total Soils = ($V_{contaminated}$*soil density)/2,000 pounds/ton = 29,431 tons

Assume sheet piling is not needed for 2 - 10 feet bgs, except for the area along the road for Site 1 (eastern edge) which would require a potential 5 shoring sections to support the road.

A.S6A-3C Volume of soil to be excavated that is unsaturated (Site 1) =

Area is shown on Figure A-3.

Volume of soils in 10 - 20 feet bgs =

Volume = 487,130 ft^3 = 18,042 cy

Soil Density = 112 lb/ft^3 = 3,024 lb/yd^3

Total Soils = ($V_{contaminated}$*soil density)/2,000 pounds/ton = 27,279 tons

A.S6A-3D Volume of soil to be excavated to reach 20 to 30 foot interval (DW 20-08) =

Area is shown on Figure A-3.

A.6.1 + A.6.2 + A.6.3

Volume = 326,720 ft^3 = 12,101 cy

Soil Density = 112 lb/ft^3 = 3,024 lb/yd^3

Total Soils = ($V_{contaminated}$*soil density)/2,000 pounds/ton = 18,296 tons

The required 20 foot X 20 foot sections for sheet piling (DW 20-08) = 5 + 4/2 = 28 sections

Tetra Tech, Inc.		*STANDARD CALCULATION SHEET*	
CLIENT:	FILE No:	BY: KF	PAGE:
SUBJECT: Appendix A Alternative Calculations Soil Alternative S-6A Calculations Site 1 Bethpage, New York		CHECKED BY:	DATE: 4/25/2017

A.S6A-3E Volume of soil to be excavated that is unsaturated (DW 20-08) =

Volume of soils in 20 - 30 feet bgs =
Area is shown on Figure A-3.

Volume = 163,360 ft^3 = 6,050 cy

Soil Density = 112 lb/ft^3 = 3,024 lb/yd^3

Total Soils = ($V_{contaminated}$*soil density)/2,000 pounds/ton = 9,148 tons

The required 20 foot X 20 foot sections for sheet piling (DW 20-08) = 5 + 4/2 = 28 sections

A.S6A-4 Volume of Concrete Cesspools for Removal at Site 1=

Volume of concrete (cesspools,10 Diam, 16' deep) to remove= 45,216 ft^3

Concrete cesspools = 45,216 ft^3 = X 52%X150 lb/ft^3/ 2,000 lbs/ 1,763 tons

Say 1,800 tons

Assume to be hazardouus

A.S6-5 Volume of Windrow to Remove at Site 1 =

= 62,500 ft^3 = 2,315 yd^3 = 3,500 tons

A.S6-6 Volume of Gravel to Remove at Site 1 =

= 0.5 acre = 21,780 ft^3 X 95 lb/ft^3 = 1,035 tons

A.S6-7 Volume of Soil to be excavated and Disposed offsite

	Excavation Volume (cy)	Percent for Offsite Disposal	Offsite Disposal (cy)	Offsite Disposal (tons)	Reused Onsite (cy)	Reused Onsite (tons)
Site 1	51,920	50%	25,960	39,252	25,960	39,252
DW20-08	18,151	20%	3,630	5,489	14,521	21,956
Total	70,071		29,590	44,741	40,481	61,207
		Say	**30,000**	**45,000**	**40,000**	**61,000**

Harardous portion = 20% 6,000

Say 6,000

Residual volume equals total minus removed minus treated.

=144,000 - 30,000 = **114,000 CY**

Average concentration equals mass/residual volume

=(7500-4065/114000CY)= **10 mg/kg**

A.S6-8 Volume of material for the reduced permeable cap

Reduced Permeable Cap = 1 foot cap over Site 1 and Dry Well 20-08 at 10 feet bgs

		Area (sq. feet)				
1 foot	X	82,336	/	27	**3,049**	**CY**
					4,611	**Tons**
				Say	**5,000**	Tons

Tetra Tech, Inc.		***STANDARD CALCULATION SHEET***	
CLIENT:	FILE No:	BY: KF	PAGE:
SUBJECT: Appendix A Alternative Calculations Soil Alternative S-6B Calculations Site 1 Bethpage, New York		CHECKED BY:	DATE: 4/27/2017

A.S6B-1 PURPOSE: Calculate the volume of soil to be excavated if soils are removed greater than a depth-dependent 10 mg/kg to 50 mg/kg, volume of material required to install a reduced permeability cover, and volume of cement required for in-situ solidification.

A.S5B-2 Approach: Use volume estimates from previous calculations to estimate the volume requirements for solidification of soils.

A.S6B-3 Estimate the volume of soil to be removed. See Alternative S-6A calculations for soil removal estimates.

*Note that four groundwater monitoring wells (BPS1-TT-MW301 S, I, and D, and BPS1-HN-MW27I) will be removed and replaced during the excavation.

A.S6B-4 Estimate the amount of material required for a reduced permeability cap.
See Alternative S-6A for the reduced permeability cap material estimate.

A.S6B-6 Estimate the number of vertical columns required for in-situ solidification based on treatment areas (per depth above 50 mg/kg), and length of columns (depth of treatment area).
Value includes Site 1 and Dry Well 20-08.

Treatment Area Thickness (ft)	Treatment Area (ft^2)	Column Diameter 3 feet (sf)	Number of Columns Required (3-foot diam)	Volume Required for Sampling (ft^3)	Volume Required for Treatment (20%) (cy)	Mass of Required Bent/ Cement (ton)
50	29,135	7.069	1,236	1,456,741	10,791	4,316
40	7,081	7.069	300	283,220	2,098	839
		Total	1,537	1,739,961	12,889	5,155

Volume for Testing	64,443	cy
Number of samples (20 ft x 20 ft x 10 feet or 150 cy)	**430**	**samples**

Tetra Tech, Inc.		***STANDARD CALCULATION SHEET***	
CLIENT:	FILE No:	BY: KF	PAGE:
SUBJECT: Appendix A Alternative Calculations Soil		CHECKED BY:	DATE: 4/27/2017

Estimed volume for treatment (10 to 30%, use 20%):		12,889	cy
	Say	**13,000**	**cy**
Time required (@ 840 cy per month)		15	months
Cement neeed equals 40% of treatment volume.		5,200	cy

Areas are from Figure 2
The treatment areas are conservative boundaries for contaminated area and overestimate the horizontal and vertical boundaries of contaminants requiring treatment.

During design, an extensive sampling program would be conducted to delineate the extent of treatment (e.g., 4,000 cf or 150 cy), which is assumed to reduce the volume in half.

Thickness of 50 feet is solidification from 20 to 70 feet (Site 1 within excavation area)

Thickness of 40 feet is solidification from 30 to 70 feet (Dry Well 20-08)

Mass of cement is 50 pounds per CF or 1350 pounds per CY

An average density of 160 lb/ft^3 was used for portland cement.

Additional volume for offsite disposal (15%): **1,950 cy**

B.S6B-7 Estimate the Volume and Mass of PCBs treated via in-situ solidification.

Total Mass of PCBs Treated (considering only 50 mg/kg) = 437 lbs

Google Earth Professional aerial:
Aerial photograph from Google Earth 9/19/2013

A-2

A-1

N

Note:
Areas and mean concentrations were calculated using GIS software

Legend

- Soil Boring Location
- 1 mg/kg contour at 0-2 feet bgs
- Attainment Area

0 50 100 Feet

Location	Attainment Area Area (sq feet)	1 mg/kg contour Area (sq feet)	1 mg/kg contour Mean PCB (mg/kg)
A-1	188,370	151,952	12.36
A-2	6,207	195	1.3

TETRA TECH

PCB
0-2 foot
1 mg/kg ISOCONCENTRATION
NWIRP BETHPAGE
BETHPAGE, NEW YORK

FILE	112G05702	SCALE	AS NOTED
FIGURE NO.	A-1	REV / DATE	3/10/15

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Google Earth Professional aerial:
Aerial photograph from Google Earth 9/19/2013

N

B-1

B-1A

Note:
Areas and mean concentrations were calculated using GIS software

Legend

- Soil Boring Location
- 10 mg/kg contour at 2-10 feet bgs
- 25 mg/kg contour at 2-10 feet bgs
- Attainment Area

0 50 100 Feet

Location	Attainment Area (sq feet)	Area (sq feet)	Mean PCB (mg/kg)	Area (sq feet)	Mean PCB (mg/kg)
B-1 (>10 mg/kg)	65,695	24,599	44.94		
B-1A (>25 mg/kg)	46,854			9,328	91.78

TETRA TECH

PCB
2-10 foot
10 mg/kg & 25 mg/kg ISOCONCENTRATION
NWIRP BETHPAGE
BETHPAGE, NEW YORK

FILE	SCALE
112G05702	AS NOTED
FIGURE NO. A-2	REV DATE 3/9/15

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Location	10 mg/kg Area (sq feet)	10 mg/kg Mean PCB (mg/kg)	25 mg/kg Area (sq feet)	25 mg/kg Mean PCB (mg/kg)	50 mg/kg Area (sq feet)	50 mg/kg Mean PCB (mg/kg)
C-1	1,171	12.0	567	43.0	195	61.0
C-2						
C-3	2,435	17.3	81	42.4		
C-2A	2,088	21.2	1,186	469.2	441	933.3
C-2B	4,837	207.6	1,516	235.0	864	413.0
C-2C	914	52.0	596	83.0	374	118.0
C-2D	124	16.0	50.42	26.0		
C-2E	290.35	16.0	140.66	26.0		
C-2F	1,798	360.1	1,054	583.3	441	933.3
C-3A	2,214	10.5	81	42.4		

Note:
Areas and mean concentrations were calculated using GIS software

Legend

- Soil Boring Location
- 10 mg/kg contour at 10-20 feet bgs
- 25 mg/kg contour at 10-20 feet bgs
- 50 mg/kg contour at 10-20 feet bgs
- Attainment Area 10 mg/kg
- Attainment Area 25 mg/kg
- Attainment Area 50 mg/kg

0 50 100 Feet

Location	Attainment Area Area (sq feet)
C-1	11,703
C-2	37,010
C-3	12,015

TETRA TECH

PCB
10-20 foot
10, 25 and 50 mg/kg ISOCONCENTRATION
NWIRP BETHPAGE, NEW YORK

FILE	112G05702	SCALE	AS NOTED
FIGURE NO.	A-3	REV	DATE 3/10/15

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APPENDIX B

COST ESTIMATES

Alternative S-6A
Site 1 - Former Drum Marshalling Area
NWIRP Bethpage, New York

Alternative S-6A - Reduced Permeability Cover, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (depth dependent 10 mg/kg [10 feet bgs] to 50 mg/kg [20 or 30 feet bgs]), and LUCs

Capital Cost

Item	Description	Quantity	Units	Unit Cost	Extended Cost
1.	**Delineation/Waste-Characterization**				
1.1	Drilling Mob and Demob	1	LS	$6,000	$6,000
1.2	Soil borings (driller)	1,280	foot	$50	$64,000
1.3	Pre-characterization Analysis (PCBs, VOCs, metals)	160	Each	$350	$56,000
1.4	Waste Characterization Analysis (RCRA)	30	Each	$900	$27,000
1.5	SVE and Monitoring Well Protection	16	Each	$500	$8,000
1.6	Geologist	2	Week	$1,500	$3,000
1.7	Reporting (validation, tables, figures)	1	LS	$15,000	$15,000
	Subtotal (Item 1)				**$179,000**
2.	**General Mobilization/Demobilization**				
2.1	Construction Facilities (trailer, utilities)	28	month	$3,000	$84,000
2.2	Utility Clearance	1	LS	$15,000	$15,000
2.3	Site Prep (high vis fence, traffic control, E&S controls)	1	LS	$30,000	$30,000
2.4	Portable Scale	28	Month	$1,000	$28,000
2.5	Material staging area	28	Month	$1,000	$28,000
2.6	Heavy Equipment mob/demob	6	Each	$5,000	$30,000
2.7	Confirmation Sampling	80	Each	$405	$32,400
	Subtotal (Item 2)				**$247,400**

Alternative S-6A
Site 1 - Former Drum Marshalling Area
NWIRP Bethpage, New York

3.	**Excavation and Disposal**				
3a.	**Site 1 and Dry Well 20-08**				
3.1	Site Clearing	1	Week	$10,000	$10,000
3.2	Removal of Windrow	1	Week	$15,000	$15,000
3.3	Demolition Settling Tank, Tops Cesspools	1,800	Tons	$160	$288,000
3.4	Sheet Pile Drive and Equipment	16,700	CY	$75	$1,252,500
3.5	Excavation (soil and concrete) - Inhole & Lift	21	Month	$110,000	$2,310,000
3.6	Soil Transport, and Dispose, Hazardous	6,000	Tons	$480	$2,880,000
3.7	Soil Transport, and Dispose, Non-hazardous	25,000	Tons	$160	$4,000,000
3.8	De-Watering/Treatment and Discharge to Basins	0	LS	$200,000	$0
3.9	Backfill (off-site Source)	24,000	Tons	$24.50	$588,000
3.10	Permeable Cap	5,000	Tons	$60.00	$300,000
3.11	Equipment (Loader) (2)	26	Month	$6,400	$166,400
3.12	Equipment (Dozer/Compactor)	38	Month	$2,900	$110,200
3.13	Equipment (Excavator) (2)	33	Month	$10,975	$362,175
3.14	Equipment (Truck) (2)	38	Month	$6,400	$243,200
3.15	Labor- Operators (3 to 5)	150	Person-Month	$11,867	$1,780,050
3.16	Labor-Laborers (1 to 2)	80	Person-Month	$9,744	$779,520
3b.	**Dry-Well 34-07**				
3.17	Parking Lot Removal and Disposal (350 SQ FT)	0	week	$15,000	$0
3.18	Sheet Pile Drive and Equipment	0	CY	$75	$0
3.19	Excavation (soil and) - Inhole & Lift	0	Month	$110,000	$0
3.20	Soil Transport, and Dispose, Hazardous	0	Tons	$480	$0
3.21	Soil Transport, and Dispose, Non-hazardous	0	Tons	$160	$0
3.22	Backfill (off-site Source)	0	Tons	$24.50	$0
3.23	Equipment (Loader) (2)	0	Month	$3,200	$0
3.24	Equipment (Dozer/Compactor)	0	Month	$2,900	$0
3.25	Equipment (Excavator)	0	Month	$10,975	$0
3.26	Equipment (Truck)	0	Month	$3,200	$0
3.27	Labor- Operators (4)	0	Person-Month	$11,867	$0
3.28	Labor-Laborers (2)	0	Person-Month	$9,744	$0
3c.	**General**				
3.29	Misc Construction Supplies	27	Month	$500	$13,500
3.30	Fuel (2,000 gallons a month)	66,000	Gallons	$5	$330,000
3.31	Fuel Tank	27	Month	$575	$15,525
	Subtotal (Item 3)				**$15,444,070**

Alternative S-6A
Site 1 - Former Drum Marshalling Area
NWIRP Bethpage, New York

4.	**Site Restoration**				
4a.	**Windrow at Site 1**				
4.1	Top Soil (off-site Source) (6 inches)	378	Tons	$22.50	$8,505
4.2	Fill Material (4.5' high mound, 23' wide, 450' long)	1,782	Tons	$24.50	$43,659
4c.	**Parking Lot Repair at Dry Well 34-07**				
4.3	Grading	0	LS	$15,000	$0
4.4	Crushed Concrete (delivered material)	0	SQ FT	$10	$0
4.5	Asphalt (material and install)	0	SQ FT	$15	$0
4b.	**General**				
4.6	Landscaping	1	LS	$20,000	$20,000
4.7	Material Staging Area Removal	1	Week	$18,000	$18,000
4.8	Decon of Equipment	6	Each	$5,000	$30,000
4.9	General Construction Debris Removal	4	Each	$5,000	$20,000
4.10	Re-install Fence, Eastern Edge	700	Foot	$14.00	$9,800
4.11	Establish Vegetation	16	Day	$200	$3,200
4.12	Water for Vegetation	1	LS	$1,000	$1,000
4.13	Materials for Watering Vegetation	1	LS	$5,000	$5,000
	Subtotal (Item 4)				**$159,164**
5	**Labor**				
5.1	Construction Oversight (Supervisor)	38	Month	$23,100	$877,800
5.2	Construction Oversight (QA/QC)	38	Month	$19,900	$756,200
5.3	Oversight (H&S)	38	Month	$19,900	$756,200
5.4	Office Support	38	Month	$19,900	$756,200
	Subtotal (Item 5)				**$3,146,400**
6.	**Construction Close Out Reporting**	1	LS	$50,000	**$50,000**
	Capital (Subtotal)				$19,226,034
	Contingency (20%)				$3,845,207
	Design & Engineering (13%)				$2,499,384
	Total Construction Cost				**$25,570,625**

Alternative S-6A
Site 1 - Former Drum Marshalling Area
NWIRP Bethpage, New York

Annual O&M Cost (S-6A)

Item	Description	Quantity	Units	Unit Cost	Extended Cost
7	**5-Year Review/LUCs**	1	Each	$30,000	**$30,000**
8	**Cover Maintenance**				
8.1	Gravel	13.5	Tons	$44.15	$596
8.2	Mowing	4.5	Acre	$1,000	$4,500
8.3	Fence Repair	50	Foot	$14.00	$700
8.4	Vegetation Repair	1	LS	$2,000	$2,000
8.5	Field Labor	5	Day	$995	$4,975
	Subtotal (Item 2)				**$12,771**

Cost Summary (without discount factor).

		Capital	O&M	Duration (year)	Total Cost
1	Delineation/Waste-Characterization	$179,000		1	$179,000
2	General Mobilization/Demobilization	$247,400		1	$247,400
3	Excavation and Disposal	$15,444,070		1	$15,444,070
4	Site Restoration	$159,164		1	$159,164
5	Labor	$3,146,400		1	$3,146,400
6	Construction Close Out Reporting	$50,000		1	$50,000
	Contingency (20%)	$3,845,207		1	$3,845,207
	Design & Engineering (13%)	$2,499,384		1	$2,499,384
7	5-Year Review/LUCs		$30,000	6	$180,000
8	Cover Maintenance		$12,771	30	$383,130.75
	Total Alternative S-6A	$25,570,625	$42,771		$26,133,756

Alternative S-6A
Site 1 - Former Drum Marshalling Area
NWIRP Bethpage, New York

Present Value Calculation

As of Dec-15

interest rate (OBM) 1.40%

		Capital	Annual Cost	Additional Year Cost	Total Year Cost	Annual Discount Rate - 1.4%	NPW
0	$	25,570,625	0	$ -	$ 25,570,625	1	$25,570,625
1	$	-	$12,771	-	$12,771	0.986	$12,595
2	$	-	$12,771	-	$12,771	0.973	$12,421
3	$	-	$12,771	-	$12,771	0.959	$12,249
4	$	-	$12,771	-	$12,771	0.946	$12,080
5	$	-	$42,771	-	$42,771	0.933	$39,899
6	$	-	$12,771	-	$12,771	0.920	$11,749
7	$	-	$12,771	-	$12,771	0.907	$11,587
8	$	-	$12,771	-	$12,771	0.895	$11,427
9	$	-	$12,771	-	$12,771	0.882	$11,269
10	$	-	$42,771	-	$42,771	0.870	$37,219
11	$	-	$12,771	-	$12,771	0.858	$10,960
12	$	-	$12,771	-	$12,771	0.846	$10,809
13	$	-	$12,771	-	$12,771	0.835	$10,659
14	$	-	$12,771	-	$12,771	0.823	$10,512
15	$	-	$42,771	-	$42,771	0.812	$34,720
16	$	-	$12,771	-	$12,771	0.801	$10,224
17	$	-	$12,771	-	$12,771	0.790	$10,083
18	$	-	$12,771	-	$12,771	0.779	$9,944
19	$	-	$12,771	-	$12,771	0.768	$9,806
20	$	-	$42,771	-	$42,771	0.757	$32,388
21	$	-	$12,771	-	$12,771	0.747	$9,537
22	$	-	$12,771	-	$12,771	0.736	$9,406
23	$	-	$12,771	-	$12,771	0.726	$9,276
24	$	-	$12,771	-	$12,771	0.716	$9,148
25	$	-	$42,771	-	$42,771	0.706	$30,213
26	$	-	$12,771	-	$12,771	0.697	$8,897
27	$	-	$12,771	-	$12,771	0.687	$8,774
28	$	-	$12,771	-	$12,771	0.678	$8,653
29	$	-	$12,771	-	$12,771	0.668	$8,533
30	$	-	$42,771	-	$42,771	0.659	$28,185
						Total Present Worth =	$26,023,847

Alternative S-6B
Site 1 - Former Drum Marshalling Area
NWIRP Bethpage, New York

Alternative S-6B - Reduced Permeability Cover, Limited Excavation and Offsite Disposal of PCB-Contaminated Soil (depth dependent 10 mg/kg [10 feet bgs] to 50 mg/kg [20 or 30 feet bgs]), In-situ Solidification, and LUCs

Capital Cost

Item	Description	Quantity	Units	Unit Cost	Extended Cost
1.	**Delineation/Waste-Characterization**				
1.1	Drilling Mob and Demob	1	LS	$6,000	$6,000
1.2	Soil borings (driller)	5,000	foot	$50	$250,000
1.3	Pre-characterization Analysis (PCBs, VOCs, metals)	430	Each	$350	$150,500
1.4	Waste Characterization Analysis (RCRA)	30	Each	$900	$27,000
1.5	SVE and Monitoring Well Protection	16	Each	$500	$8,000
1.6	Geologist	10	Week	$1,500	$15,000
1.7	Reporting (validation, tables, figures)	1	LS	$30,000	$30,000
	Subtotal (Item 1)				**$486,500**
2.	**General Mobilization/Demobilization**				
2.1	Construction Facilities (trailer, utilities)	53	month	$3,000	$159,000
2.2	Utility Clearance	1	LS	$15,000	$15,000
2.3	Site Prep (high vis fence, traffic control, E&S controls)	1	LS	$30,000	$30,000
2.4	Portable Scale	53	Month	$1,000	$53,000
2.5	Material staging area	53	Month	$1,000	$53,000
2.6	Heavy Equipment mob/demob	6	Each	$5,000	$30,000
2.7	Confirmation Sampling	80	Each	$405	$32,400
	Subtotal (Item 2)				**$372,400**

Alternative S-6B
Site 1 - Former Drum Marshalling Area
NWIRP Bethpage, New York

3.	**Excavation and Disposal**				
3a.	**Site 1 and Dry Well 20-08**				
3.1	Site Clearing	1	Week	$10,000	$10,000
3.2	Removal of Windrow	1	Week	$15,000	$15,000
3.3	Demolition Settling Tank, Tops Cesspools	1,800	Tons	$160	$288,000
3.4	Sheet Pile Drive and Equipment	16,700	CY	$75	$1,252,500
3.5	Excavation (soil and concrete) - Inhole & Lift	21	Month	$110,000	$2,310,000
3.6	Soil Transport, and Dispose, Hazardous	6,000	Tons	$480	$2,880,000
3.7	Soil Transport, and Dispose, Non-hazardous	25,000	Tons	$160	$4,000,000
3.8	De-Watering/Treatment and Discharge to Basins	0	LS	$200,000	$0
3.9	Backfill (off-site Source)	24,000	Tons	$24.50	$588,000
3.10	Permeable Cap	5,000	Tons	$60.00	$300,000
3.11	Equipment (Loader) (2)	26	Month	$6,400	$166,400
3.12	Equipment (Dozer/Compactor)	38	Month	$2,900	$110,200
3.13	Equipment (Excavator) (2)	33	Month	$10,975	$362,175
3.14	Equipment (Truck) (2)	38	Month	$6,400	$243,200
3.15	Labor- Operators (3 to 5)	150	Person-Month	$11,867	$1,780,050
3.16	Labor-Laborers (1 to 2)	80	Person-Month	$9,744	$779,520
3b.	**Dry-Well 34-07**				
3.17	Parking Lot Removal and Disposal (350 SQ FT)	0	week	$15,000	$0
3.18	Sheet Pile Drive and Equipment	0	CY	$75	$0
3.19	Excavation (soil and) - Inhole & Lift	0	Month	$110,000	$0
3.20	Soil Transport, and Dispose, Hazardous	0	Tons	$480	$0
3.21	Soil Transport, and Dispose, Non-hazardous	0	Tons	$160	$0
3.22	Backfill (off-site Source)	0	Tons	$24.50	$0
3.23	Equipment (Loader) (2)	0	Month	$3,200	$0
3.24	Equipment (Dozer/Compactor)	0	Month	$2,900	$0
3.25	Equipment (Excavator)	0	Month	$10,975	$0
3.26	Equipment (Truck)	0	Month	$3,200	$0
3.27	Labor- Operators (4)	0	Person-Month	$11,867	$0
3.28	Labor-Laborers (2)	0	Person-Month	$9,744	$0
3c.	**General**				
3.29	Misc Construction Supplies	27	Month	$500	$13,500
3.30	Fuel (2,000 gallons a month)	66,000	Gallons	$5	$330,000
3.31	Fuel Tank	27	Month	$575	$15,525
	Subtotal (Item 3)				**$15,444,070**

Alternative S-6B
Site 1 - Former Drum Marshalling Area
NWIRP Bethpage, New York

4.	**Site Restoration**				
4a.	**Windrow at Site 1**				
4.1	Top Soil (off-site Source) (6 inches)	378	Tons	$22.50	$8,505
4.2	Fill Material (4.5' high mound, 23' wide, 450' long)	1,782	Tons	$24.50	$43,659
4c.	**Parking Lot Repair at Dry Well 34-07**				
4.3	Grading	0	LS	$15,000	$0
4.4	Crushed Concrete (delivered material)	0	SQ FT	$10	$0
4.5	Asphalt (material and install)	0	SQ FT	$15	$0
4b.	**General**				
4.6	Landscaping	1	LS	$20,000	$20,000
4.7	Material Staging Area Removal	1	Week	$18,000	$18,000
4.8	Decon of Equipment	6	Each	$5,000	$30,000
4.9	General Construction Debris Removal	4	Each	$5,000	$20,000
4.10	Re-install Fence, Eastern Edge	700	Foot	$14.00	$9,800
4.11	Establish Vegetation	16	Day	$200	$3,200
4.12	Water for Vegetation	1	LS	$1,000	$1,000
4.13	Materials for Watering Vegetation	1	LS	$5,000	$5,000
	Subtotal (Item 4)				**$159,164**
5.	**In-situ Solidification**				
5.1	Mobilization	1	LS	$100,000	$100,000
5.2	Cement, Portland, Type I or II	5,200	CY	$150	$780,000
5.3	Drilling, Grout Mixing, and Injection	15	Month	$100,000	$1,500,000
5.4	Spoil Containment, Collection, and Disposal	15	Month	$20,000	$300,000
	Subtotal (Item 5)				**$2,680,000**
6.	**Labor**				
6.1	Construction Oversight (Supervisor)	53	Month	$23,100	$1,224,300
6.2	Construction Oversight (QA/QC)	53	Month	$19,900	$1,054,700
6.3	Oversight (H&S)	53	Month	$19,900	$1,054,700
6.4	Office Support	53	Month	$19,900	$1,054,700
	Subtotal (Item 5)				**$4,388,400**
7.	**Construction Close Out Reporting**	2	LS	$50,000	**$100,000**
	Capital (Subtotal)				$20,950,534
	Contingency (20%)				$4,190,107
	Design & Engineering (13%)				$2,723,569
	Total Construction Cost				**$27,864,210**

Alternative S-6B
Site 1 - Former Drum Marshalling Area
NWIRP Bethpage, New York

Annual O&M Cost (S-6B)

Item	Description	Quantity	Units	Unit Cost	Extended Cost
8.	**5-Year Review/LUCs**	1	Each	$30,000	**$30,000**
9.	**Cover Maintenance**				
9.1	Gravel	13.5	Tons	$44.15	$596
9.2	Mowing	4.5	Acre	$1,000	$4,500
9.3	Fence Repair	50	Foot	$14.00	$700
9.4	Vegetation Repair	1	LS	$2,000	$2,000
9.5	Field Labor	5	Day	$995	$4,975
	Subtotal (Item 2)				**$12,771**

Cost Summary (without discount factor).

		Capital	O&M	Duration (year)	Total Cost
1	Delineation/Waste-Characterization	$486,500		1	$486,500
2	General Mobilization/Demobilization	$372,400		1	$372,400
3	Excavation and Disposal	$15,444,070		1	$15,444,070
4	Site Restoration	$159,164		1	$159,164
5	In-situ Solidification	$2,680,000		1	$2,680,000
6	Labor	$4,388,400		1	$4,388,400
7	Construction Close Out Reporting	$100,000		1	$100,000
	Contingency (20%)	$4,190,107		1	$4,190,107
	Design & Engineering (13%)	$2,723,569		1	$2,723,569
7	5-Year Review/LUCs		$30,000	6	$180,000
8	Cover Maintenance		$12,771	30	$383,130.75
	Total Alternative S-6B	$30,544,210	$42,771		$31,107,341

Alternative S-6B
Site 1 - Former Drum Marshalling Area
NWIRP Bethpage, New York

Present Value Calculation

As of Dec-15

interest rate (OBM) 1.40%

		Capital	Annual Cost	Additional Year Cost	Total Year Cost	Annual Discount Rate - 1.4%	NPW
0	$	30,544,210	0	$ -	$ 30,544,210	1	$30,544,210
1	$	-	$12,771	-	$12,771	0.986	$12,595
2	$	-	$12,771	-	$12,771	0.973	$12,421
3	$	-	$12,771	-	$12,771	0.959	$12,249
4	$	-	$12,771	-	$12,771	0.946	$12,080
5	$	-	$42,771	-	$42,771	0.933	$39,899
6	$	-	$12,771	-	$12,771	0.920	$11,749
7	$	-	$12,771	-	$12,771	0.907	$11,587
8	$	-	$12,771	-	$12,771	0.895	$11,427
9	$	-	$12,771	-	$12,771	0.882	$11,269
10	$	-	$42,771	-	$42,771	0.870	$37,219
11	$	-	$12,771	-	$12,771	0.858	$10,960
12	$	-	$12,771	-	$12,771	0.846	$10,809
13	$	-	$12,771	-	$12,771	0.835	$10,659
14	$	-	$12,771	-	$12,771	0.823	$10,512
15	$	-	$42,771	-	$42,771	0.812	$34,720
16	$	-	$12,771	-	$12,771	0.801	$10,224
17	$	-	$12,771	-	$12,771	0.790	$10,083
18	$	-	$12,771	-	$12,771	0.779	$9,944
19	$	-	$12,771	-	$12,771	0.768	$9,806
20	$	-	$42,771	-	$42,771	0.757	$32,388
21	$	-	$12,771	-	$12,771	0.747	$9,537
22	$	-	$12,771	-	$12,771	0.736	$9,406
23	$	-	$12,771	-	$12,771	0.726	$9,276
24	$	-	$12,771	-	$12,771	0.716	$9,148
25	$	-	$42,771	-	$42,771	0.706	$30,213
26	$	-	$12,771	-	$12,771	0.697	$8,897
27	$	-	$12,771	-	$12,771	0.687	$8,774
28	$	-	$12,771	-	$12,771	0.678	$8,653
29	$	-	$12,771	-	$12,771	0.668	$8,533
30	$	-	$42,771	-	$42,771	0.659	$28,185
						Total Present Worth =	$30,997,432