Honeywell

HONEYWELL
301 Plainfield Road, Suite 330
Syracuse, NY 13212
www.honeywell.com

September 6, 2022

Mr. Tracy Smith, Project Manager
New York State Department of Environmental Conservation
Remedial Bureau D
625 Broadway - 12th Floor
Albany, New York 12233-7016

RE: Wastebed B/Harbor Brook Consent Order #D-7-0001-00-02 Site #734075
SYW-12/Murphy's Island Feasibility Study, Revised August 2022

Dear Mr. Smith:

Attached please find the Revised Feasibility Study Report for the SYW-12/Murphy's Island, which was revised September 2022. This document now reflects an updated Appendix 1. Please note that we are sending this electronically only unless we hear otherwise from you.

Please contact Clare Leary of Ramboll at (315) 956-6472 or me if you have any questions or comments.

Sincerely,

Shane R. Blauvelt, P.E.
Senior Remediation Manager

Attachment

cc:	Robert Nunes	USEPA
	Joshua Cook	NYSDEC Region 7
	Scarlett McLaughlin	NYSDOH
	Mark Sergott	NYSDOH
	Brian D. Israel, Esq.	Arnold & Porter
	Argie Cirillo, Esq.	USEPA
	Margaret Sheen, Esq.	NYSDEC, Region 7
	Gary Priscott	NYSDEC, Region 7
	Joseph Heath, Esq.(ec)	Onondaga Nation
	Jeanne Shenandoah	Onondaga Nation
	Hazel Powless	HETF
	Alma Lowry(ec)	Onondaga Nation
	Michael Spera	AECOM
	Travis Glazier	Onondaga County
	Edward Glaza	Parsons
	Matt Sausville	Ramboll
	Maureen Markert	Ramboll
	Clare Leary	Ramboll
	Christopher Calkins	Ramboll

On December 23, 2021, the New York State Department of Environmental Conservation (NYSDEC) sent comments regarding the SYW-12 Feasibility Study (FS) Report and Honeywell's responses to NYSDEC's June 25, 2021 comments (RTC) submitted with our letter dated September 17, 2021 for the Wastebed B/Harbor Brook Site. Below are the responses to those comments.

1. **General. A new term was introduced, "COCs of Focus". However, there should only be one set of COCs for a site. COCs are those compounds that are identified in the RI/FS as needing to be addressed by the response action identified in the ROD. It is acceptable to focus on a subset of COCs as sentinel chemicals for evaluating alternatives and optimizing remedy effectiveness. To avoid confusion and be consistent with CERCLA policy and guidance, the term COCs of Focus should be removed from the FS. Please revise accordingly.**

   Response: The term "COCs of focus" has been removed from the FS. To avoid confusion, generic terminology (e.g., representative risk drivers, representative remedy drivers) is used to describe the subset of COCs identified as sentinel chemicals for evaluating alternatives and remedy effectiveness.

2. **Table of Contents. "Table 6 - Percent Improvement Via Alternatives 3, 4/5" is listed in the "TABLES (IN TEXT)," but is not included in the FS. Also, the page number for "Table 1 - Human Health Risk Re-Evaluation Summary" is not included. Please revise accordingly.**

   Response: Table 6 was not included in the Revised FS; reference to it was removed from the Table of Contents. The page number for Table 1 has been included.

3. **Page 6/73, paragraph 2, Executive Summary and page 11/73, last paragraph,Section 1.1. The text in these paragraphs and associated figures in the text should be revised based on the re-designation of the site as New York State Inactive Hazardous Waste Site #734075A instead of operable unit 2 of the Wastebed B/Harbor Brook Site (Site #734075). Please discuss this change.**

   Response: The Executive Summary, Section 1.1 and associated in-text figures have been revised to remove reference to the SYW-12 Site as operable unit 2 of the Wastebed B/Harbor Brook Site. The revised text recognizes the redesignation of the SYW-12 Site as New York State Inactive Hazardous Waste Site No. 734075A, as documented in the October 1, 2021 letter from NYSDEC to Honeywell.

4. **Page 15/73, last bullet, Section 2.2. Disposal of potential dredge materials from Onondaga Lake discussed in RTC #15 was not addressed here. Please revise.**

   Response: Section 2.2, paragraph 2, states "The evaluation of the analytical data and field observations from the RI indicate that the sources of impacted SYW-12 Site media are related to potential historic off-Site sources[1] and *potential historical placement of dredge materials* and fill materials in this area." A footnote will also be added to this sentence to further describe dredge materials[2] consistent with the RI Report. Historic dredge materials from the southern portion of Onondaga Lake are identified as potential historic sources in Section 2.5.

[1] As stated in the RI Report, potential historic off-Site sources include the former Marley Property, Oil City and Ley Creek. Based on Site groundwater data, off-Site impacts are currently *de minimis*. Additionally, the presence of the CSX railroad tracks, and lack of stormwater conveyance piping preclude surface runoff and overland flow from these off-Site areas based on current conditions.

[2] As stated in the RI Report, dredge materials from the southern portion of Onondaga Lake and Onondaga Creek may have been disposed of on the Site.

5. **Page 19/73, paragraphs 2 and 3, Section 2.3.2. The revised text notes the depths of the sheen net sampling, but inconsistent with Comment #12, a summary of what compounds were detected was not included here. A brief summary should be included. Please revise.**

   Response: Table of compounds analyzed and detected in the sheen net samples were provided in Appendix 4 (Tables 29 and 30, *Sources of Contamination Investigation Revised Report*). Section 2.3.2 was clarified to indicate that PAHs and petroleum biomarkers were detected in the sheen net samples.

6. **Page 19/73, last paragraph, Section 2.3.3. If, as stated here, naphthalene concentrations in subsurface soil may be contributing to localized naphthalene detected in HB-MW-29, then a discussion of why subsurface soil is not being addressed in any of the remedial alternatives other than Alternative 6 should be noted somewhere in this report or how it will be addressed by Alternatives 3 through 5.**

   Also, the sheen data in the new Appendix 4 shows that the concentrations of naphthalene in sheens ranged from 7,310J µg/kg to 569,000 µg/kg. The text in this subsection should be revised to note whether naphthalene in sheens could be mobilizing to groundwater. In addition, as indicated in Comment #12, the FS should discuss how the sheens would be addressed.

   Response: As discussed in Sections 2.3.4 and 3.4, despite the presence of naphthalene in subsurface soil and sheen net samples, groundwater sampling conducted in 2019 indicated that naphthalene was the only organic that exceeded the Class GA SGVs (exceedance in only one well), with lower detected concentrations in 2019 than historical detections. This data and the few exceedances of the groundwater Class GA standards or guidance values for organics (when compared to the constituents detected in the subsurface soil and sheen net samples) suggests that the constituents detected in surface and subsurface soils are generally not mobilizing to groundwater (Appendix 5, Figure 1); however, naphthalene concentrations in subsurface soil may be contributing to localized naphthalene detected in HB-MW-29.

   Alternatives 2, 3, 4 and 5 will address subsurface soil and sheens via institutional controls and a site management plan (SMP). The SMP would require special measures to control water during excavation activities. Groundwater and the potential for contaminants to mobilize from soils to sheens and groundwater will be addressed by groundwater monitoring. The text in Sections 3.6.2 and 4.2.1 was clarified to indicate the potential for exposure to surface and subsurface soil/fill material and groundwater would be addressed through institutional controls and groundwater monitoring.

7. **Page 22/73, paragraph 1, bullet 1, Section 2.6.1. In this bullet "current/future" is included without a receptor included ("…current/future railroad workers, current/future, future commercial/industrial workers…"). Please revise accordingly.**

   Response: The first bullet in Section 2.6.1 text has been revised accordingly.

8. **Page 23/73, paragraph 2, sentence 3, Section 2.6.1. In this sentence should "child residents" be revised to "construction worker" as chromium was not a non-cancer risk driver for the child resident? See RTC #18. Please revise accordingly.**

   Response: Section 2.6.1, paragraph 2, sentence 3 has been revised to indicate the unacceptable hazard posed by chromium is related to construction workers.

9. **Page 24/73, Table 1. In footnote 1 to this table, please clarify if chromium was not detected in groundwater samples collected subsequent to the RI or was only detected**

in groundwater screening samples instead of monitoring wells. See RTC #18 and revise or clarify accordingly.

Response: The footnote in Table 1 (Section 2.6.1) has been updated to clarify the chromium was not detected in groundwater monitoring well samples collected subsequent to the RI.

10. **Page 26/73, paragraph 1, Section 2.6.2. This paragraph should be revised to state "Based on the ecological exposure assessment, effects characterization, and risk characterization for SYW-12, the *Revised BERA Report* concluded that select metals and organic compounds, namely chromium, cadmium and PCBs, pose a potential risk at estimates considerably above the EPA hazard threshold of 1 to communities or organisms and to bird and mammal populations with relatively restrictive home ranges (e.g., American robin, short-tailed shrew)."**

    Response: The text in Section 2.6.2 has been revised accordingly.

11. **Page 26/73, last paragraph, Section 2.7. Although the factors that were used to determine the targeted COCs (i.e., benzo(a)pyrene, 4,4'-DDT, total PCBs, mercury, chromium and cadmium) are significant, it is still important to evaluate and explain in the text whether these chemicals follow the same spatial distribution as the remaining COCs. Therefore, please explain whether the extent of contamination posed by the 6 COCs indicated above sufficiently represents the extent of the remaining COCs as well. In addition, add the word "targeted" after "resultant" in the second sentence of this paragraph (on page 27/73).**

    Response: The text in Section 2.7 has been revised to clarify that the extent of the targeted COCs (i.e., representative risk and remedy drivers) is representative of the distribution of the remaining FS COCs as they are generally co-located.

12. **Page 29/73, bullet 1, sub-bullet 3, Section 3.1.2. It should be noted here that naphthalene subsurface soil concentrations exceeded the Protection of Groundwater SCO for naphthalene (as noted on page 18 in Section 2.3.1) and that naphthalene exceeded the NYS guidance value at HB-MW-29. The guidance value exceedance should be acknowledged in this section to be consistent with the groundwater text in Section 2.3.3. Otherwise, the text as written is not clear, and conflicts with the Section 2 subsurface soil and groundwater text and Appendix 5. Please revise accordingly.**

    Response: The text in Section 3.1.2 has been revised to acknowledge the naphthalene exceedance of the Class GA Guidance Value at HB-MW-29.

    It should be noted that as presented in the *Revised SYW-12 2019 Groundwater Investigation Report*, the naphthalene detections at BH-MW-29, though above the Class GA Guidance Value, were lower than previously detected. Naphthalene exceedances of the Class GA Guidance Value in 2019 were limited to this one location. Locations of soil concentrations above the naphthalene SCO for the Protection of Groundwater are not co-located with groundwater exceedances. For these reasons, remedial alternatives address naphthalene in groundwater through continued monitoring.

13. **Page 30/73, paragraph 2, sentence 5, Section 3.1.3. This sentence should be revised ("…current and future Site current/future workers and…").**

    Response: The text in Section 3.1.3 has been revised to remove the words "current/future" from sentence 5.

14. **Page 31/73, Section 3.2. The PRG section will need to be revised to remove the narrative PRGs since they are presented more like RAOs and it is also not clear how it can be determined that the objectives of the remedy have been met. Please revise.**

    Response: The text in Section 3.2 has been revised to remove the narrative PRGs.

15. **Page 32/73, last paragraph, Section 3.2. This paragraph and associated bullets should be deleted.**

    Response: The text in Section 3.2 has been revised to remove the last paragraph and associated bullets.

16. **Page 34/73, paragraph 2, bullets, Section 3.4 and Figure 1-2. Figures 3-1, 3-2 and 3-3 do not equal the 23.5 acres that are discussed in these bullets and included on Figure 1-2. For Alternative 3 there are 14.7 acres of undisturbed forest/non-forested habitat and 8.2 acres of engineered cover for a total of 22.9 acres; and for Alternatives 4 and 5, there are 12.9 acres of undisturbed forest habitat and 9.5 acres of engineered cover for a total of 22.4 acres. Please confirm the area and revise the text and/or figures as necessary.**

    Response: The acreages in the text, tables and presented on the alternative figures have been reviewed and revised, as appropriate.

17. **Section 3.6.3 and 3.6.4. These alternatives should be combined to form one alternative that includes flexibility to address the interior wetland areas, include potential limited excavation to provide additional water to mitigated/restored wetlands (e.g., from Ley Creek, ponded areas for precipitation storage). Planting of trees should also be included as part of restoration. Please revise the text, associated figures, and Appendix 8 accordingly.**

    Response: The text in Section 3.6.3 has been revised to present a new Alternative 3 that provides flexibility in addressing the interior wetland areas and allows for potential limited excavation. The topography of the restored wetlands would be determined during remedial design based on input from hydrological evaluations. A new figure has been developed for Alternative 3. Associated text in Section 4 has been revised to reflect this new alternative. Associated figures in Appendix 8 have been revised. Original text in Section 3.6.4 has been deleted.

18. **Page 47/73, last paragraph, Section 3.6.5. The last sentence of this paragraph should be deleted since this is discussed in the detailed analysis of alternatives section.**

    Response: The text in Section 3.6.4 (former Section 3.6.5) has been revised to remove the last sentence in the first paragraph under the “Surface Soil/Fill Material Removal” heading.

19. **Page 48/73, footnote 8, Section 3.6.5. In this footnote, an additional bullet should be included that states “Mitigation would be planned where wetland construction results in loss of wetland acreage or function.” Please revise.**

    Response: Footnote 9 in Section 3.6.4 (former footnote 8 in Section 3.6.5) has been revised to include the following bullet: “Mitigation would be considered where wetland construction results in loss of wetland acreage or function.”

20. **Page 54/73, Section 4.1.1 and Appendix 8. In addition to Area-Weighted Average Concentrations (AWACs), it would also be useful to compare the contaminants to**

Soil Cleanup Objectives (SCOs) on a point-by-point basis to show how the alternatives would reduce the number of SCO exceedances.

Response: Given that pre-design investigation (PDI) sampling is planned, a comparison of soil sample results remaining post-remediation is more appropriate following an evaluation of PDI soil sampling results. A comparison of surface soil analytical results for select constituents to SCOs is presented in Appendix 3 for reference.

21. **Page 54/73, paragraph 1, Section 4.1.1. Similar to comment 1, please note whether cadmium, chromium, mercury, benzo[a]pyrene, 4,4'-DDT and total PCBs are collocated with the remaining COCs.**

    Response: Consistent with the response to Comment 11, the text in Section 4.1.1 has been updated to indicate that the targeted COCs (i.e., representative risk and remedy drivers) are generally co-located with the remaining FS COCs.

22. **Page 54/73, last paragraph, Section 4.1.1. In the second sentence of this paragraph, please indicate that the assumed topsoil concentrations and their source is provided in Appendix 8.**

    Response: The text in the last paragraph of Section 4.1.1 has been revised to include that the assumed topsoil concentration and the source are provided in Appendix 8.

23. **Page 55/73, paragraph 3, Section 4.2.1. Please include details comparing the AWAC for benzo[a]pyrene to the SCO for Commercial Use.**

    Response: Paragraph 2 of Section 4.2.1 was revised to include a statement comparing the AWAC for benzo(a)pyrene to the SCO for Commercial Use. Implementation of Alternatives 3 or 4 would reduce AWAC values for benzo(a)pyrene to concentrations marginally exceeding the Commercial Use SCO. Potential exposure risks for human receptors to residual contamination would be addressed through engineering and institutional controls.

24. **Page 55/73, last paragraph, Section 4.2.1. The post-remediation AWACs for mercury and 4,4-DDT under Alternatives 3 through 5 exceed the corresponding ecological SCOs by a factor of about 5. Please include a discussion on protectiveness for these COCs.**

    Response: Biota monitoring is an element of Alternatives 3 through 5. This element was added to the remedial alternatives to assess the protectiveness of the remedies, given that post-remediation AWACs for some COCs may remain over the corresponding ecological SCOs. The eighth paragraph in Section 4.2.1 was revised to clarify that biota monitoring is included under Alternatives 3 and 4 for the purpose of assessing protectiveness.

25. **Page 56/73, paragraph 1, Section 4.2.1. Please clarify if this text is indicating that the AWACs were used as the exposure point concentrations for the short-tailed shrew. Also, in the third sentence of this paragraph, please also include the results of the lowest observed adverse effect level-based hazard quotients analysis for PCBs and benzo(a)pyrene.**

    Response: As described in the text for Section 4.2.1, AWACs associated with Alternatives 3 and 4 were used as exposure point concentrations for the short-tailed shrew. Alternatives 3 and 4 would reduce the lowest observed adverse effect level (LOAEL)-based HQ result for benzo(a)pyrene to less than one. LOAEL-based HQs for total PCBs in Alternatives 3 and 4 are 5.2E+03 and 4.9E+03, respectively. Because it was explained in the text that the post-remedy AWACs would meet the SCOs for the Protection of Ecological Resources, these will not be added to the text to avoid confusion. The text was revised to clarify the post remedy evaluation of risk using the AWACs as

exposure point concentrations for the short-tailed shrew was for cadmium, chromium, mercury, and 4,4-DDT (the constituents that would potentially exceed the SCOs for the Protection of Ecological Resources).

26. Page 60/73, paragraph 1, Section 4.2.3. In the second sentence please remove the reference to NYSDEC 2016 as this document does not specifically address remediation.

Response: The text in Section 4.2.3 has been revised to clarify the reference to NYSDEC 2016 by removing the reference to remediation activities. The NYSDEC's March 2016 *Conservation Plan for Bald Eagles in New York State* recommended that forestry activities and tree clearing be performed outside the December 1 to March 31 winter roosting season.

27. Page 61/73, paragraph 2, Section 4.2.4. The second, third and fourth sentences should be deleted as covers and off-site management are not considered treatment, so there would be no reduction in mobility through treatment with Alternatives 3 through 6.

Response: As stated in the first sentence of Section 4.2.4 no reduction in toxicity, mobility or volume is achieved for any of the alternatives evaluated in the detailed analysis. The text was revised to further clarify that reduction in mobility or volume achieved in the alternatives discussed in Section 4.2.4 is not due to treatment.

28. Page 62/73, last paragraph, Section 4.2.5. Several of the truck trip estimates do not appear to be consistent with those provided in the alternatives in Section 3.6. Please confirm and revise as necessary.

Response: The truck trip estimates were reviewed and revised where appropriate.

29. Page 66/73, last paragraph, Section 4.2.8. Please include details related to the analysis of benzo(a)pyrene. In addition, please explain how the post-remediation AWAC for benzo(a)pyrene is believed to be protective.

Response: Benzo(a)pyrene was analyzed using USEPA Method 8270. As described in Section 4.2.8, the post-remediation AWAC for benzo(a)pyrene would exceed the Commercial Use SCO. Protection related to potential risks associated with benzo(a)pyrene concentrations above the Commercial Use SCO would be addressed through institutional controls. The post-remediation AWAC for benzo(a)pyrene would be below the SCO for the Protection of Ecological Resources. No changes were made to the text to address this comment.

30. Figure 1-2. The last sentence in the note ("WL2 AND WL3 WETLAND DELINEATION BASED ON A 2008 JURISDICTIONAL WETLAND DELINEATION (OBG AND PARSONS 2010).") should be deleted.

Response: The Figure 1-2 note was revised as requested.

31. Appendix 3. Qualifiers (e.g., U, J, JN) should be discussed in the notes and/or removed as appropriate. Also, in Figure 5, locations HB-WSD-03 and -04, which are designated as "ND," should be indicated as less than the Eco SCO and ND should be defined.

Response: Definitions for the qualifiers J and JN have been added to the Appendix 3 figure notes where appropriate. On Figure 5, non-detect ("ND") results have been changed to indicate less than the SCO for the Protection of Ecological Resources. On Figure 6, the results showing a U (non-detect) were changed to show "ND". "ND" was defined on Figures 5 and 6.

32. Appendix 4. Table 30 from the SYW-12 Sources of Contamination Investigation Report should also be included in this appendix.

Response: Table 30 from the *SYW-12 Sources of Contamination Investigation Report* has been added to Appendix 4.

33. Appendix 5. HB-29 should be indicated as a monitoring well and other monitoring well locations should be included on the figure. Please revise.

Response: Monitoring well locations have been added to the Appendix 5 figure.

34. Appendix 8, page 1/3, paragraph 4. The text states that where the detection limit of the "non-detect value(s) was greater than the nearest detected concentration, the non-detected value was considered inconsistent with the measured results, and excluded from the AWAC calculations", consistent with the approach in the 2005 Geddes Brook/Nine Mile Creek FS. Please indicate how many samples and what percent of the data set was not considered useable based on this approach.

Response: Evaluation of the dataset in a manner consistent with the approach in the 2005 Geddes Brook/Nine Mile Creek FS yielded 9 samples that were considered inconsistent with the measured results and excluded from the AWAC calculations. These excluded results occurred only for 4,4-DDT and constituted approximately 14% percent of the available data for this constituent.

35. Appendix 8. The figures provided are helpful. However, overlaying the proposed extent of remediation by alternatives 3 and 4/5 (e.g., as an outline or in an additional figure) would be useful in showing how the remediation footprints primarily include the areas of highest contamination.

Response: The Appendix 8 figures have been revised to include the proposed extent of remediation under Alternative 3. The extent of forested wetland and upland areas have also been identified on the figures.

36. Appendix 8, figures. These figures insinuate that contamination at the site follows a clean gradient path. Although these gradients utilize the average results calculated, the FS states that contamination is randomly distributed across the site (on a point-by-point basis). Please explain this difference in more detail to avoid confusion.

Response: The methodology used for presentation of data of the figures included in Appendix 8 is explained in paragraph 4 of Appendix 8. This methodology was used as a tool to visualize the data collected at the Site and inform on decisions that may benefit from understanding average concentrations, such as decisions based on exposure of receptors. The figures presented in Appendix 3 present the same data on a point-by-point basis. No changes were made to the text to address this comment.

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SYW-12 SITE
FEASIBILITY STUDY

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SYW-12 SITE
FEASIBILITY STUDY

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Douglas M. Crawford, PE
Vice President

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4 Test Trench PTFE Sheen Net Samples - SIM Forensic PAHs and Petroleum Biomarkers
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8 Supporting Documentation for Area-Weighted Average Concentrations for the SYW-12 Site

LIST OF ACRONYMS

AC	acre or acres
ACO	Administrative Consent Order
ARAR	Applicable or Relevant and Appropriate Requirement
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm/sec	centimeters per second
COC	Constituent of Concern
CPOI	Chemical Parameter of Interest
CSIA	Compound Specific Isotope Analysis
CSM	Conceptual Site Model
cy	cubic yards
DER	Division of Environmental Remediation
Eco-SSL	Ecological Soil Screening Level
EPC	Exposure Point Concentration
FS	Feasibility Study
ft	feet or foot
GRA	General Response Action
GWTP	Groundwater Treatment Plant
HHRA	Human Health Risk Assessment
Honeywell	Honeywell International Inc.
in	inches or inch
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MGP	Manufactured Gas Plant
MNA	monitored natural attenuation
msl	mean sea level
MtCO2e	metric tons of carbon dioxide equivalent
NAPL	Non-Aqueous Phase Liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ng/kg	nanogram per kilogram
6 NYCRR	Title 6 of the New York Codes, Rules and Regulation
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
OBG	O'Brien & Gere Engineers, Inc.
O&M	Operation and Maintenance
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon
PBT	Persistent Bioaccumulative Toxic
PCB	Polychlorinated Biphenyl
PCDD/PCDFs	Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans

PRG	Preliminary Remediation Goal
PTFE	Polytetrafluoroethylene
Ramboll	Ramboll Americas Engineering Solutions, Inc. (formerly known as O'Brien & Gere Engineers, Inc.)
RAO	Remedial Action Objective
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SCI	Sources of Contamination Investigation
SCO	Soil Cleanup Objective
SGV	Standards or Guidance Values
SVOC	Semi-volatile Organic Compound
TAMS	TAMS Consultants, Inc.
TBC	to be considered
TCDD	Tetrachlorodibenzo-p-dioxin
TEF	Toxicity Equivalency Factor
TEQ	Toxicity Equivalent
UCL	Upper Confidence Limit
ULSD	Ultra Low Sulfur Diesel
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VOC	Volatile Organic Compound
WBB/HB	Wastebed B/Harbor Brook

EXECUTIVE SUMMARY

This Feasibility Study (FS) Report was prepared to document the development and evaluation of remedial alternatives to address soil/fill material and groundwater at the SYW-12 Site in Syracuse, New York. The purpose is to identify and evaluate remedial alternatives, with the ultimate objective of selecting a remedy that is protective of human health and the environment.

The SYW-12 Site is within a New York State-regulated wetland and undeveloped property owned by Onondaga County. Honeywell previously completed a remedial investigation (RI) for the site. As documented in the July 2005 Record of Decision (ROD) issued by United States Environmental Protection Agency (USEPA) and NYSDEC for the Onondaga Lake Bottom Subsite (USEPA and NYSDEC 2005), the SYW-12 Site was administratively included in the investigation of the Wastebed B/Harbor Brook (WBB/HB) Site (an Onondaga Lake subsite). The SYW-12 Site was redesignated as New York State Inactive Hazardous Waste Site No. 734075A (NYSDEC 2021). The SYW-12 Site is depicted on Figure ES-1 below and on attached Figure 1-1. This FS addresses SYW-12 Site media between Onondaga Creek to the south, Onondaga Lake to the west, and the railroad tracks to the north and east (herein defined as the SYW-12 Site).

Figure ES-1: SYW-12 Site Location

Development of this FS follows the completion of the RI for the SYW-12 Site, as part of the WBB/HB Site, in which the nature and extent of contamination and the potential risks posed to public health and the environment were evaluated. Chemical parameters of interest (CPOIs) identified for the SYW-12 Site include benzene, toluene, ethylbenzene, xylene (BTEX), chlorinated benzenes, assorted polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and inorganics. The CPOIs in soil/fill material are randomly distributed across the SYW-12 Site and are likely related to several sources including placement of fill material in the former Onondaga Creek channel/Iron Pier area, potential off-

Site sources of lubricating oil and fuel oil, and potential historic dredging from the Barge Canal and Ley Creek. There are few exceedances of the NYSDEC Class GA groundwater standards and guidance values for organic constituents suggesting that organics detected in surface and subsurface soils are generally not mobilizing to groundwater.

The current, intended, and reasonably anticipated future land use for the SYW-12 Site was considered for soil cleanup objective (SCO) selection and in the development of Remedial Action Objectives (RAOs). Onondaga County has proposed construction of an extension of the Onondaga County Loop the Lake Trail, a multi-use recreational trail, along the lake at the SYW-12 Site. The multi-use recreational trail would involve passive public uses with institutional controls to keep trail users on the trail.

During the RI, potential risks and hazards resulting from exposure of receptors to SYW-12 Site soil/fill materials and groundwater were evaluated and documented in the *Revised Human Health Risk Assessment (HHRA) Report* (O'Brien & Gere Engineers, Inc. (OBG) 2009) and the *Revised Baseline Ecological Risk Assessment (BERA) Report* (OBG 2011). Since completion of the *Revised HHRA Report*, USEPA modified inhalation exposure methodologies and later issued updated toxicity information for carcinogenic PAHs (USEPA 2009a and 2017a). Revised human health hazard and risk calculation tables were developed incorporating the updated information. The revised risk evaluation concluded that risks associated with the multi-use recreational trail are acceptable under current conditions (Appendix 1), though unacceptable risks were identified for construction and utility workers.

Subsequent to publication of the 2011 *Revised BERA*, bald eagle (*Haliaeetus leucocephalus*) utilization of the SYW-12 Site has increased as a winter roost site and concentration area for bald eagle. Bald eagles likely gather at this Site because of the warm water outflow from the nearby Metro Wastewater Treatment Facility which provides open water and the opportunity for bald eagles to forage during winter months [United States Fish and Wildlife Service (USFWS) 2018]. The large trees at the SYW-12 Site serve as roosts for wintering bald eagle. The USFWS has provided recommendations related to applicable, relevant, or appropriate requirements (ARARs) and soil/fill material locations to be addressed that would also preserve trees that serve as roosts for bald eagles (USFWS 2018). USFWS also recommended that remedial activities include minimal tree clearing and be performed outside the December 15 to March 15 winter roosting season to provide continued integrity of this roost site and enable bald eagles to feed and shelter during winter months (USFWS 2018). The NYSDEC's March 2016 *Conservation Plan for Bald Eagles in New York State* provides further guidelines and recommends that work and activities disturbing trees be performed outside the December 1 to March 31 winter roosting season (NYSDEC 2016). This important habitat has been given special consideration during the development of remedial approaches for the Site, including in the context of New York State regulations pertaining to listed species and their habitat (6 NYCRR 182.8) and the value provided overall to SYW-12 Site ecology.

The following RAOs for soil/fill material and groundwater were developed based on consideration of potential ARARs, the nature and extent of contamination, potentially unacceptable risks, the current, intended, and reasonably anticipated future use of the SYW-12 Site and its surroundings, and the recognized use of forested areas of the Site by the bald eagle:

<u>RAOs for Public Health Protection</u>

- Prevent, or reduce to the extent practicable, ingestion/direct contact with contaminated soil/fill material.

- Prevent, or reduce to the extent practicable, inhalation of or exposure to contaminants volatilizing from contaminated soil/fill material and unacceptable inhalation exposure associated with soil vapor.
- Prevent, or reduce to the extent practicable, potential unacceptable risks to human health associated with ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent, or reduce to the extent practicable, potential unacceptable risks to human health associated with contact with, or inhalation of VOCs from contaminated groundwater.

RAOs for Environmental Protection

- Restore groundwater to levels that meet state and federal standards within a reasonable timeframe.
- Prevent, or reduce to the extent practicable, adverse impacts to biota from ingestion/direct contact with contaminated soil/fill material causing toxicity or impacts from bioaccumulation through the terrestrial food chain.
- Prevent, or reduce to the extent practicable, the migration of contaminants that would result in groundwater, sediment, or surface water contamination.

Recognizing the RAOs developed to address soil, preserving the overall value of the SYW-12 Site forested areas, and the seasonal use of the Site by the bald eagle, implementation of sampling, remedial design, and construction activities would be performed in a manner that minimizes harm to roots, branches, trunks, foliage and baseline density of mature trees. The numerical goals in remediation areas would be the Part 375 SCOs for Protection of Ecological Resources and Commercial Use.

Addressing these remedial goals would be balanced with the ecological benefit of preserving valuable forested habitat, including protected habitat critical to the bald eagle.
The following steps were followed in developing five remedial alternatives:

- Developed general response actions (GRAs), which are medium-specific actions which may, either alone or in combination, form alternatives to satisfy the RAOs
- Identified areas and volumes of media, which describe the material(s) to be addressed
- Identified and screened remedial technologies and process options, which resulted in a series of potential remediation technologies that address Site soil/fill material and groundwater
- Evaluated technologies and process options for effectiveness, implementability, and cost

SUMMARY OF REMEDIAL ALTERNATIVES

Alternative 1
No Action

Alternative 2
Limited Actions and MNA

Alternative 3
Engineered cover on perimeter area (8.2 acres), wetland restoration/ creation, biota monitoring, MNA

Alternatives 4A & 4B
Surface excavation* and engineered cover/restoration on perimeter and interior areas (10 acres), biota monitoring, MNA, Limited tree removal

*Alternatives 4A - on-site consolidation

Alternatives 4B – off-site disposal

Alternative 5
Full removal (including all trees) and offsite disposal (23.5 acres) with MNA

The detailed analysis of alternatives indicates that Alternative 1 is not protective of human health and the environment. In addition, Alternative 2 would not be protective of the environment. Consistent with the NCP, Alternative 2 would not meet one of the threshold criteria and was not considered further in the detailed evaluation. Alternatives 3 and 4A/B would provide varying degrees of protectiveness relative to potential exposure to soil/fill material and groundwater and would support the anticipated future use of the SYW-12 Site for a multi-use recreational trail while preserving trees utilized seasonally by bald eagles for roosting. Alternative 3 would provide protectiveness of the environment through institutional controls and placement of a 2-ft engineered cover system over 8.2 acres (AC). Alternative 3 also includes pre-design soil sampling that may result in the need to address surface soil/fill material in non-forested wetlands that are currently surrounded by forested wetlands. Alternative 4A/B would provide greater protectiveness than Alternative 3 by surface soil/fill material removal and wetland restoration to address additional non-forested wetland areas in conjunction with placement of the engineered cover and institutional controls as in Alternative 3, for a total of 10 AC of cover. Alternative 4A/B would result in restoration of a greater acreage of non-forested wetland than in Alternative 3, however, limited removal of valuable tree habitat would be required to implement this alternative. Alternative 4 is less implementable than Alternative 3, due to geotechnical stability concerns in the vicinity of the CSX railroad. Alternative 4B would result in additional impacts to the community relative to truck traffic and noise compared to Alternative 4A, due to the off-site disposal of excavated soil/fill material, as opposed to on-site reuse of the soil/fill material; however, more impacted material would remain on-site in Alternative 4A. Alternative 4A would provide the same level of protection to human health and the environment as Alternative 4B; however, Alternative 4A could be implemented with limited impacts to the community (*i.e.*, noise, truck traffic and associated roadway safety and emissions), compared to Alternative 4B. While Alternative 5, through Site-wide removal of accessible soil/fill material followed by wetland and upland restoration, would provide the greatest level of protection to human health and the environment with respect to soil/fill material exposures, it has significant implementability limitations, would require removal of valuable tree habitat across the Site, would present global geotechnical stability concerns for the nearby CSX railroad, and would present substantial delay or disruption to planned Site use.

This FS Report documents the development and evaluation of remedial alternatives in sufficient detail such that risk management decision makers may select a remedy for the Site. Following review of the evaluations documented in this FS Report, NYSDEC and the USEPA will document the preferred remedial action in a Proposed Plan. Following receipt of public comments on the Proposed Plan, the selected remedial alternative will be documented in a ROD.

1. INTRODUCTION

1.1 Regulatory Background

This report documents the Feasibility Study (FS) that was conducted to develop and evaluate potential remedial alternatives to address SYW-12 Site media pursuant to the Administrative Consent Order (ACO) (D-7-0001-00-02) between the New York State Department of Environmental Conservation (NYSDEC) and Honeywell International Inc. (Honeywell), dated April 10, 2000 (NYSDEC 2000). The SYW-12 Site is located in Syracuse, Onondaga County, New York; a Site Location Map is included as attached Figure 1-1 and below as Figure 1.

Figure 1: SYW-12 Site Location

The SYW-12 Site is within a New York State-regulated wetland (Wetland SYW-12) and undeveloped property owned by Onondaga County. This FS addresses SYW-12 Site media, including soil/fill material and groundwater, between Onondaga Creek to the south, Onondaga Lake to the west, and the railroad tracks to the north and east (herein defined as the SYW-12 Site), as depicted on Figure 1-2.

As documented in the July 2005 Record of Decision (ROD) issued by United States Environmental Protection Agency (USEPA) and NYSDEC for the Onondaga Lake Bottom Subsite (USEPA and NYSDEC 2005), the SYW-12 Site was administratively included in the investigation of the Wastebed B/Harbor Brook (WBB/HB) Site (an Onondaga Lake subsite). The SYW-12 Site was addressed in the *WBB/HB Revised Remedial Investigation (RI) Report* [O'Brien & Gere Engineers, Inc. (OBG) 2015], *Revised Human Health Risk Assessment (HHRA) Report* (OBG 2009) and subsequent hazard calculation updates (Appendix 1), and the *Revised Baseline Ecological Risk Assessment (BERA) Report* (OBG 2011).

Following the RI and risk assessments, as approved by the NYSDEC, the WBB/HB Site was separated into two operable units (OUs, Honeywell 2014; NYSDEC 2014). The OU-1 *FS Report* was submitted to the NYSDEC in July 2018 (OBG 2018); the OU-1 *ROD* was subsequently issued in October 2018 (USEPA and NYSDEC 2018). The SYW-12 Site was later redesignated as New York State Inactive Hazardous Waste Site No. 734075A (NYSDEC 2021). This FS Report is for the SYW-12 Site (formerly WBB/HB OU-2).

1.2 Site Description

As described in the *Onondaga Lake FS Report* (Parsons 2004), Wetland SYW-12 is a 45.5-acre (AC) (18.4 hectare), Class I wetland, portions of which are located around the mouth of Ley Creek along the northeastern shoreline of Onondaga Lake (Figure 1-2). Wetland SYW-12 is a palustrine, emergent, broad-leaved deciduous wetland [TAMS Consultants, Inc. (TAMS) 2002]. The eastern edge of Wetland SYW-12, near the railroad berm, consists of shrubs and saplings and is dominated by invasive species including common reed (*Phragmites australis*), common buckthorn (*Rhamnus cathartica*) and box elder (*Acer negundo*). Mature trees typical of floodplain forests occupy the central portion of this wetland and include red maple (*Acer rubrum*), willow (*Salix spp.*), and cottonwood (*Populus deltoides*). The remainder of the wetland is dominated by thick stands of common reed with silky dogwood (*Cornus amomum*) along the outer edges. Wetland SYW-12 is seasonally flooded. Floodplain limits are identified on Figure 1-3. As described below in Section 2.8, the SYW-12 Site also serves as a roost site for wintering bald eagles (*Haliaeetus leucocephalus*).

The SYW-12 Site is bounded by the CSX railroad tracks to the north and east, Onondaga Creek to the south, and Onondaga Lake to the west (Figure 1-2). The Lower Ley Creek subsite of the Onondaga Lake Superfund Site is also situated to the north. The SYW-12 Site encompasses approximately 10.4 AC of upland (*i.e.,* non-wetland areas) and 13.1 AC of delineated wetland between Onondaga Creek and the CSX railroad tracks based on a 2018 updated wetland delineation (Anchor QEA 2018) to evaluate jurisdictional wetland delineation boundaries identified in 2008 (OBG and Parsons 2010).

1.3 Site History

Prior to the early 1800s, the SYW-12 Site was partially under water with the remaining portion comprising cedar and ash swamp and marsh. Both Mud Creek (later renamed Ley Creek) and Onondaga Creek meandered across the northern portion of the Site before discharging to Onondaga Lake. In 1822, New York State lowered the level of Onondaga Lake by approximately 2 feet (ft), resulting in draining of swamps and wetlands along the lakeshore, including a portion of the SYW-12 Site. The newly created land was filled in and partitioned as building lots.

Figure 2: Aerial View of SYW-12

In 1873, the lower 3/4 mile of Onondaga Creek was rerouted and channelized slightly south of the present-day Barge Canal. A channel and harbor basin were also dredged at the mouth of Onondaga Creek (Onondaga Historical Association 2012) as part of the construction of a large amusement complex known as the Iron Pier Resort. The complex included a 600-foot pavilion that was built adjacent to the harbor; the pavilion contained venues for dining, bowling, billiards, concerts, and a carousel, and steamboats from the harbor provided service to other resorts on the lake (Figure 3). The Iron Pier Resort was closed in 1906, and the pavilion was demolished by 1908.

Figure 3: Former Iron Pier Resort - 1899 (Thompson 2002)

Following closure and demolition of the pavilion, historical maps indicate that portions of the SYW-12 Site, Iron Pier channel and harbor basin may have been filled with refuse materials (*e.g.*, soda ash, waste fill) from various sources. Dredged materials were also potentially placed on the SYW-12 Site because of additional changes to the Onondaga Creek location and configuration, including dredging of the Barge Canal and Harbor terminal in 1915, which relocated the channel between the pre-1873 Onondaga Creek channel and the 1873 relocated Onondaga Creek channel. The Barge Canal was reportedly dredged on several occasions between 1941 and 1954 (New York Department of Public Works 1950, 1954; Syracuse Herald-Journal 1941, 1946).

Based on a review of historic aerial maps, the SYW-12 Site has changed in shape and size over time as a result of dredge deposition and natural erosion but has remained undeveloped and vegetated with low lying vegetation, brush and trees since the early 1900s.

1.4 Report Organization

This FS Report contains five sections, as follows:

- Section 1: Introduction, including Site description and Site History
- Section 2: Summary of previous environmental investigations and studies, including a summary of the RI, HHRA, and BERA
- Section 3: Development of remedial alternatives
- Section 4: Detailed analysis of alternatives
- Section 5: Conclusions

2. SITE CHARACTERIZATION

This section presents the SYW-12 Site conditions as they relate to this FS. As described in Section 1, this FS addresses SYW-12 Site soil/fill material and groundwater. As summarized below, SYW-12 Site conditions have been evaluated during a series of investigations that are described in detail in the *Revised RI Report* (OBG 2015).

Current SYW-12 Site groundwater conditions were also evaluated during an April 2019 groundwater elevation monitoring and sampling event. The supplemental investigation was performed in accordance with the November 20, 2018 *Wastebed B/Harbor Brook SYW-12 Groundwater Sampling Work Plan* (OBG 2018), approved by NYSDEC on December 7, 2018. The scope and results of the investigation are detailed in the *Revised SYW-12 2019 Groundwater Investigation Report* (Ramboll Americas Engineering Solutions, Inc. (Ramboll; formerly known as OBG 2020) and summarized below.

2.1 Previous Investigations

Together with historical usage of the SYW-12 Site, previous geologic and hydrogeologic studies provided the framework for the selection of sampling locations and the initial analytical parameters for samples collected during the RI. Additional studies at the SYW-12 Site include:

- SYW-12 Wetlands Mitigation Sampling (OBG 1995)
- Onondaga Wetlands Subsurface Investigation (C&S Companies 2001)
- Onondaga Lake RI/FS Phase 2A Investigation (Exponent 2001)
- Onondaga Lake Wetland/Floodplain Assessment Final Report (OBG and Parsons 2010)
- SYW-12 Sources of Contamination Investigation Revised Report (SCI) (OBG 2014)
- Wastebed B/Harbor Brook Revised Remedial Investigation Report (Revised RI Report) (OBG 2015)

In addition to the reports referenced above, the data and results of these studies are discussed in the *Revised RI Report* (OBG 2015) and *Revised SYW-12 2019 Groundwater Investigation Report* (Ramboll 2020).

2.2 Remedial Investigation

The RI was performed pursuant to an ACO (D-7-0001-00-02) between the NYSDEC and Honeywell, dated April 10, 2000 (NYSDEC 2000), and in accordance with the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA 1988) and Part 300.68 of the *National Oil and Hazardous Substances Pollution Contingency Plan*, and CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986.

The data generated during the RI were used to evaluate the nature and extent of chemical parameters of interest (CPOIs) and identify potential source areas. The RI information and April 2019 groundwater sampling results were also used in the development of the alternatives in this FS. The evaluation of the analytical data and field observations from the RI indicate that the

sources of impacted SYW-12 Site media are related to potential historic off-Site sources[2] and potential historical placement of dredge materials[3] and fill materials in this area.

The following conclusions were developed based on the RI and April 2019 groundwater investigation:

- The SYW-12 Site geology consists of three distinct layers including:
    - The unconsolidated deposits which consist of 2 to 15 ft of reworked fill below a thin layer of recently deposited wetland sediments.
    - The fill unit which consists of sand, silt, gravel, shell material and concretions that overlie at least 15 to 25 ft of marl.
    - The marl unit which becomes gradually finer grained with depth from a sandy, shell rich marl at the top of the unit to clayey silt marl with a trace of shell material at the bottom of the unit.
    - Based on regional geologic information and data collected from nearby sites, the geologic units underlying the marl unit include silt and clay, silt and fine-grained sand/basal sand and gravel, till, and bedrock.

- SYW-12 Site groundwater is present at depths of 3.3 to 9.2 ft below ground surface (bgs) [362.6 ft mean sea level (msl) to 365.3 ft msl]. The groundwater occurs in the unconsolidated unit and flows westward towards and discharges into Onondaga Lake from the central and southern portions of the Site. Groundwater on the northern portion of the Site is moving north towards Ley Creek.
    - The hydraulic conductivity values for the shallow fill/marl unit range from 0.36 to 27.10 ft/day [1.27×10^{-4} to 9.56×10^{-3} centimeters per second (cm/sec)] across the SYW-12 Site.
    - As described in the *Revised SYW-12 2019 Groundwater Investigation* Report (Ramboll 2020), there are two groundwater types present at the SYW-12 Site consisting of freshwater and dilute halite brine. Inorganic geochemistry from monitoring wells on the SYW-12 Site include chloride levels ranging from 360 to 2,650 milligrams per liter (mg/L).

- CPOIs at the Site include benzo(a)pyrene and assorted polycyclic aromatic hydrocarbons (PAHs), chlorinated benzenes, benzene, toluene, ethylbenzene, and total xylenes (BTEX), polychlorinated biphenyls (PCBs), and inorganics.
    - CPOIs in soil/fill material are randomly distributed across the SYW-12 Site and are likely related to several sources including historical placement of fill material in the former Onondaga Creek channel/Iron Pier area, dredge spoils from Onondaga Creek (NYSDOH, 1946), historic dredge material from the southern portion of Onondaga Lake, and potential historic off-Site sources (*i.e.*, former Marley property, Oil City properties, former

[2] As stated in the RI Report, potential historic off-Site sources include the former Marley Property, Oil City and Ley Creek. Based on Site groundwater data, off-Site impacts are currently *de minimis*. Additionally, the presence of the CSX railroad tracks and lack of stormwater conveyance piping preclude surface runoff and overland flow from these off-Site areas based on current conditions.

[3] As stated in the RI Report, dredge materials from the southern portion of Onondaga Lake and Onondaga Creek may have been disposed of on the Site.

Hiawatha Manufactured Gas Plant [MGP] site, former Erie Boulevard MGP site, and Ley Creek). The off-Site Marley and Oil City properties are believed to have impacted the barge canal sediment that was then placed on the SYW-12 Site during historic dredging operations. These off-Site properties are currently being addressed by other parties under NYSDEC oversight.

- There are few exceedances of the Class GA groundwater standards and guidance values (SGVs) for organic constituents in RI groundwater samples suggesting that organic constituents in surface and subsurface soils are generally not mobilizing to groundwater. The April 2019 groundwater samples indicated a decrease in organic constituent concentrations as there were no exceedances of the Class GA groundwater standards. Inorganics, including sodium and chloride, were also detected in groundwater during RI and supplemental groundwater monitoring.

2.3 Nature and Extent of Contamination

This section presents a summary of the nature and extent of contamination at the SYW-12 Site. Based on RI data and April 2019 groundwater investigation, the CPOIs identified for the SYW-12 Site include benzo(a)pyrene and assorted PAHs, chlorinated benzenes, BTEX, PCBs, and inorganics. The nature and extent of these CPOIs for the SYW-12 Site are provided in the *Revised RI Report* (OBG 2015) and SCI (OBG 2014). Sample locations are depicted on Figure 2-1.

Reasonably anticipated land uses have been considered to identify areas to be addressed in this FS and support the development and evaluation of remedial alternatives. Analytical results presented in the *Revised RI Report* and *SCI* were compared during the FS to the 6 New York Codes, Rules and Regulations (NYCRR) 375 (Part 375) SCOs for Commercial Use, Protection of Ecological Resources, and Protection of Groundwater in consideration of anticipated future land use. SCOs for the Protection of Ecological Resources were applied to surface soil/fill material (0 to 2 ft bgs), while SCOs for Commercial Use and Protection of Groundwater were applied to surface and subsurface (up to 15 ft bgs) soil/fill material. Part 375 SCOs for Unrestricted Use were not considered relevant or appropriate given the current and reasonably anticipated future land use; however, they were considered for purposes of developing an alternative capable of achieving unrestricted conditions in the FS. Consistent with the applicable classification, groundwater analytical results were compared to Class GA groundwater SGVs.

Based on these considerations, the nature and extent of contamination is presented in Section 2.3.1 (surface soil/fill material), Section 2.3.2 (subsurface soil/fill material), and Section 2.3.3 (groundwater). Appendix 2 provides summary statistics for detected constituents and applicable, relevant, or appropriate requirements (ARARs) exceedances in surface soil/fill material, subsurface soil/fill material, and groundwater.

2.3.1 Surface Soil/Fill Material

Surface soil/fill material samples were collected between 0 and 2 ft bgs as part of the Supplemental RI. These sample locations, laboratory analyses, and analytical results are provided in the *Revised RI Report* (OBG 2015). The analytical results were compared to the Part 375 soil SCOs for Commercial Use, Protection of Ecological Resources, Protection of Groundwater, and Unrestricted Use (Appendix 2). Surface soil analytical results for select constituents are presented in Appendix 3, Figures 1 through 6.

- **Volatile organic compounds** (**VOCs**): Chlorinated benzenes and BTEX compounds were detected consistently in the surface soils collected at the SYW-12 Site. However, the concentrations did not exceed the Part 375 SCOs.

- **Semi-volatile organic compounds** (**SVOCs**): Seven SVOCs were detected above the Part 375 SCOs for Unrestricted Use, with four also exceeding SCOs for Commercial Use, four exceeding SCOs for Protection of Groundwater, and one exceeding its SCO for Protection of Ecological Resources. These mainly consisted of assorted PAHs and were detected in each surface soil sample collected at the SYW-12 Site.

- **Pesticides**: Five pesticides were detected exceeding the Part 375 Unrestricted Use and Protection of Ecological Resources SCOs including 4,4'-DDT, 4,4'-DDD, dieldrin, 4,4'-DDE, and endrin. These were detected at locations throughout the SYW-12 Site. None were detected above the corresponding Commercial Use and Protection of Groundwater SCOs. These were detected at locations throughout the SYW-12 Site.

- **PCBs**: PCBs (Aroclor 1254 and Aroclor 1260) were detected in the majority of surface soil samples above the Part 375 SCOs for Unrestricted Use. Some exceedances were also observed of soil SCOs for Commercial Use and Protection of Ecological Resources.

- **Dioxins/Furans**: Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/PCDFs) were detected in each of the surface soil samples collected. PCDD/PCDFs were not collected from all surface soil locations as discussed in the *Revised RI Report*. The total Toxicity Equivalent (TEQ) values ranged from 0.24 nanogram per kilogram (ng/kg) to 185 ng/kg. Toxicity equivalency factors (TEFs) were used to calculate TEQs for individual PCDD/PCDF congeners. This normalizes each of the individual congeners to 2,3,7,8-Tetrachlorodibenzo-P-dioxin (TCDD) and a total TEQ is then calculated by summing the individual TEQs. This total TEQ was then compared to 2,3,7,8-TCDD risk values.

- **Inorganic constituents**: The inorganics were detected at each of the sample locations on-site, with the majority of exceedances observed for mercury, zinc, lead, chromium, cadmium, copper, silver and nickel. The highest number of exceedances were for Part 375 SCOs for Unrestricted Use and Protection of Ecological Resources, with some constituents also exceeding the Part 375 SCOs for Commercial Use (mercury, copper and cadmium) and Protection of Groundwater Use (mercury and cadmium).

- **Petroleum Hydrocarbons**: The petroleum hydrocarbon analytical results indicate that lubricating oil is distributed in Site surface soils. One location, near Ley Creek, contained #6 Fuel Oil.

2.3.2 Subsurface Soil/Fill Material

Subsurface soil/fill material samples were collected from depths between 2 and 44 ft bgs as part of the Supplemental RI and SCI. The soil boring and test pit sample locations, laboratory analyses, and analytical results are presented in the *Revised RI Report* and *SCI*, respectively. Appendix 2 provides summary statistics for detected constituents and ARARs exceedances in subsurface soil/fill material.

- **VOCs**: There was no clear pattern of distribution of VOCs within subsurface soil at the SYW-12 Site, with concentrations highly variable between locations. The VOCs detected at concentrations exceeding SCOs included total xylenes, ethylbenzene, acetone, 2-butanone, and methylene chloride. Most exceedances were observed for the Part 375 Unrestricted Use and Protection of Groundwater SCOs.

- **SVOCs**: Based on the analytical results, SVOCs were also distributed throughout shallower subsurface soils (2 to 16 ft bgs) at the SYW-12 Site but were not detected in the deeper subsurface samples. PAHs were the dominant SVOCs present in the subsurface soils and accounted for most of the exceedances observed above Part 375 SCOs. Naphthalene was detected in subsurface soils at concentrations above Part 375 SCOs.

- **Pesticides and PCBs**: Pesticides and PCBs were only detected in subsurface soils between 2 and 10 ft bgs and were not detected in deeper subsurface soils. There were few detections observed throughout the Site, with limited exceedances of the SCOs observed.

- **Inorganic Constituents**: Inorganics were detected throughout the SYW-12 Site in subsurface soils. The highest number of SCO exceedances were observed for lead, mercury, copper, zinc, nickel, silver, chromium, and cadmium, with most exceedances of Part 375 soil SCOs for Unrestricted Use. Mercury, cadmium, and arsenic also exceeded soil SCOs for Commercial Use and Protection of Groundwater.

- **Petroleum Hydrocarbons**: Similar to surface soils, petroleum hydrocarbon analytical results indicate that both lubricating oil and #6 Fuel Oil constituents are present in Site soils. Some of the highest concentrations were observed within or adjacent to the former Onondaga Creek channel footprint.

Visual Observations

The presence of stained soils and black stained sludge were first observed during the 2007 Supplemental RI in five soil borings [HB-GWS-04, HB-GWS-07, HB-MW-25, HB-SB-51, and HB-SB-52; Figure 114 of the *Revised RI Report* (OBG, 2015)]. These locations were distributed across the central area of the SYW-12 Site and had sludge intervals ranging from 0.5 inches (in) to 46 in and stained soils intervals ranging from 4 in to 8 ft. The *Revised RI Report* identified potential sources including off-Site sources, fill material used for the former Onondaga Creek and Iron Pier, and other historical fill potentially placed on-Site (OBG 2015). The widest intervals were observed within or adjacent to the former Onondaga Creek channel. These five locations had elevated PAH concentrations that exceeded Part 375 SCOs but only HB-SB-51 and HB-SB-52 had concentrations of VOCs (ethylbenzene) that were detected at concentrations greater than the Part 375 SCOs. VOCs (*i.e.*, BTEX compounds) were typically non-detect or below the Part 375 SCOs. Furthermore, as discussed below in Section 2.3.3, the few exceedances of groundwater SGVs for inorganics suggests that constituents in Site soil/fill material are generally not mobilizing to groundwater.

The SCI was subsequently performed to delineate the former Onondaga Creek channel and further evaluate the sources of constituents in the former channel. The trenches advanced through the former channel area had coal tar/petroleum-like impacted soils, including non-aqueous phase liquids (NAPLs) in test pits HB-TP-55 and HB-TP-55AN, and odors at varying

thicknesses for the extents of HB-TP-55, HB-TP-55AN, HB-TP-55BS, HB-TP-56, and HB-TP-57. The impacted soil and fill material including NAPL were typically above the marl layer in these trenches. HB-TP-54A, which is the trench closest to Onondaga Lake, was the only excavation without evidence of stained soils or odors. These trenches also identified pilings that were most likely the former channel's bank shoring.

Field observations and analytical results have identified the former Onondaga Creek channel as impacted soil/fill material. Additionally, impacted material showing as stained soils was observed at two locations outside the boundaries of the SCI excavation footprint. These indicate that impacted material at the SYW-12 Site is likely related to fill material or historical dredge material placed on-site; while potential off-Site sources may have historically impacted sample locations with SCO exceedances, there is no evidence that these sites are a continuing source of SCO exceedances at the SYW-12 Site. An evaluation of data and field observations performed subsequent to the RI was performed as part of this FS. It was found that the presence of stained soils and NAPL does not necessarily correlate with elevated organics concentrations in soil and groundwater at proximate locations. This evaluation included a comparison of subsurface soil data exceeding SCOs for the Protection of Groundwater, exceedances of Class GA SGVs, and field observations of stained soils and NAPL.

A total of seven polytetrafluoroethylene (PTFE) sheen net samples, six from the test trenches and one from the soil borings, were collected as part of the SCI. Four of the PTFE sheen net samples were collected from the groundwater surface located at approximately 7 to 16 feet bgs within the test trenches (OBG 2014). Three PTFE samples, two from test trench and one from a soil boring, were collected by pouring laboratory deionized water over excavated soil material and allowing the water to interact with the soil in a dedicated aluminum pan. The deionized water was then passed through the PTFE sheen net.

Visual observations during the test trenching indicated that when soils were disturbed a sheen formed on the groundwater within the excavated trench. The results of the sheen net sampling verified that PAHs and petroleum biomarkers were detected in this sheen(Tables 29 and 30, *Sources of Contamination Investigation Revised Report*, see Appendix 4) that had been mobilized from the Site soils when disturbed. The results of the sheen net sampling and the corresponding groundwater sampling indicate that the organic compounds remain bound to the soils when undisturbed.

2.3.3 Groundwater

SYW-12 Site groundwater was evaluated as part of the Supplemental RI, SCI, and supplemental April 2019 groundwater investigation. The monitoring well sample locations, laboratory analyses, and analytical results are presented in the *Revised RI Report, SCI, and Revised SYW-12 2019 Groundwater Investigation Report*, respectively. Appendix 2 provides summary statistics for detected constituents and ARARs exceedances in groundwater.

As reported in the *Revised RI Report* (OBG 2015), there were a few VOC and SVOC exceedances to Class GA standards. Sampling conducted in 2019 indicated that naphthalene was the only organic that exceeded the Class GA SGVs (exceedance of the guidance value in only one well), with lower detected concentrations in 2019 than historical detections (Ramboll 2020). The few exceedances of the groundwater Class GA SGVs for organics (when compared to the constituents

detected in the subsurface soil and sheen net samples) suggests that the constituents detected in surface and subsurface soils are generally not mobilizing to groundwater (Appendix 5, Figure 1); however, naphthalene concentrations in subsurface soil may be contributing to localized naphthalene detected in HB-MW-29. The monitoring well with the highest concentration of BTEX and PAHs was HB-B-04W located in the center portion of the Site adjacent to Onondaga Lake.

Inorganics detected in SYW-12 Site groundwater include barium, iron, magnesium, manganese, sodium, and chloride, with Class GA SGV exceedances primarily observed for iron, manganese, sodium, and chloride. The concentrations of these constituents were above Class GA SGVs in all wells at the Site. As described in the *Revised SYW-12 2019 Groundwater Investigation Report*, the elevated inorganics may be naturally occurring (Ramboll 2020).

2.4 Geotechnical Evaluation

In the fall of 2019, field investigations were implemented in accordance with a 2019 NYSDEC-approved work plan. These investigations were implemented to evaluate geotechnical conditions at the Site in relation to potential remedial options in proximity of the active CSX railroad tracks. As part of the field investigations, cone penetrometer testing and geotechnical soil borings were completed in November 2019. Geotechnical samples were collected as part of this effort. The geotechnical investigation results were presented in the *Draft Geotechnical Report Honeywell SYW-12 Site at Onondaga Lake* (B&B Engineers & Geologists of New York, P.C. 2021).

The results of the geotechnical investigation were used to evaluate potential settlement and slope stability for berms and construction access roads and the nearby railroad bed berm. The geotechnical evaluations concluded that:

- The existing slope stability of the railroad bed berm presents significant concerns for soil disturbance in the vicinity of the railroad tracks. Specifically, the calculated factor of safety against stability failure is currently unacceptable for construction involving excavation along the railroad tracks.
- Slope stability associated with the construction of berms or construction access roads can be readily mitigated by adjusting berm widths during design such that these can be safely utilized during construction.
- Settlement concerns associated with placement of covers at the thickness envisioned in the constructed wetland can be mitigated through pre-loading and construction monitoring, such that settlement effects on the nearby tracks can be addressed during design and remediated during construction.

2.5 Conceptual Site Model

As described above, there appear to be several sources that may have impacted the SYW-12 Site in the past. These potential historical sources include:

- The former Marley property,
- Former Oil City area,
- Former Hiawatha Manufactured Gas Plant (MGP) site,
- Former Erie Boulevard MGP site,
- Former West Shore Railroad Pintsch Gas Plant site,
- Onondaga Creek dredge materials, including material from the barge canal,

- Historical dredge materials from the southern portion of Onondaga Lake, and
- Ley Creek.

These potential source areas are adjacent to the Site, contain similar constituents to those detected at the Site, and had viable transport pathways for constituents to reach the Site including the original alignment of Onondaga Creek through the SYW-12 Site and previous placement at the SYW-12 Site of historical dredge materials likely impacted by these potential off-Site sources.

2.6 Human Health and Baseline Ecological Risk Assessment

The risk assessments were performed using conservative regulatory methodologies prescribed in the CERCLA guidance (USEPA 1988) and are provided in the *Revised HHRA and BERA Reports* (OBG 2009 and OBG 2011, respectively). Both the *Revised HHRA and BERA Reports* have been submitted and approved by the NYSDEC. The final *Revised HHRA Report* was approved by the NYSDEC on May 19, 2010. The final *Revised BERA Report* was approved by the NYSDEC on September 13, 2011. Summaries of the HHRA and BERA findings are presented below.

Subsequent to the completion of the *Revised HHRA Report*, USEPA modified inhalation exposure methodologies and later issued updated toxicity information for carcinogenic PAHs (USEPA 2009 and 2017a). Revised human health hazard and risk calculation tables were developed in 2018 to evaluate child and adult recreators and are included in Appendix 1 and described in Section 2.6.1 below. Re-evaluations of hazards and risk posed to select non-recreational receptor populations were conducted to address recent agency comments, and are also included and discussed in Section 2.6.1.

2.6.1 HHRA and Updated Hazard/Risk Evaluations

As part of the HHRA, current and reasonably anticipated future land use scenarios were identified for the SYW-12 Site. Potential human receptor populations were identified for quantitative exposure and risk evaluation using current USEPA risk assessment guidance:

- Child recreational visitor (current/future)
- Adult recreational visitor (current/future)
- Railroad worker (current/future)
- Utility worker (current/future)
- Construction worker (future)
- Commercial/Industrial worker (future)
- Child resident (future)
- Adult resident (future)

Recreational and railroad worker receptors were assumed to be exposed to surface soil via ingestion, dermal contact, fugitive dust or volatile emissions. Utility worker exposure to surface and subsurface soil to a depth of less than or equal to 10 ft (*i.e.*, surface and subsurface soil) was based on ingestion, dermal contact, fugitive dust or volatile emissions, and groundwater present during excavations necessary for utility work. The resident and the commercial/industrial worker receptors were assumed to be exposed to surface soil via incidental ingestion, dermal contact, and inhalation of particulate dust or volatile emissions. Inhalation of vapors in the occupational workspace or residence from vapor intrusion was also evaluated as a viable

exposure pathway. A future construction worker was evaluated for exposure to surface and subsurface soil via ingestion, dermal contact, fugitive dust or volatile emissions, and groundwater within excavations created during construction activities (OBG 2009).

The non-cancer hazards and lifetime incremental cancer risks presented in the 2009 HHRA for the SYW-12 Site under a reasonable maximum exposure (RME) scenario along with the corresponding constituents that drive the calculated risk are summarized for each receptor in Table 2-1, and as follows:

- Total lifetime excess carcinogenic risks did not exceed the cumulative regulatory limit [$1x10^{-4}$] for current/future railroad workers, future commercial/industrial workers, future adult residents, and current/future adult recreational visitors.
- Excess cancer risks exceeding the cumulative regulatory threshold at the SYW-12 Site were calculated for the future child resident, current/future child recreational visitor, current/future utility worker, and future construction worker. The incremental cancer risk exceeding $1x10^{-4}$ for utility workers and construction workers were driven by benzo(a)pyrene in groundwater. The cancer risk above the cumulative regulatory limit for child recreators and child residents was driven by benzo(a)pyrene in surface soil.
- Total non-carcinogenic hazards posed to current/future utility workers, child recreational visitors, adult recreational visitors, railroad workers, commercial/industrial workers, and adult residents were below the cumulative regulatory limit of 1.0.
- Total hazards for the future child resident and future construction worker were above the cumulative regulatory hazard threshold of 1. For the child resident, the hazard was driven by exposure to highly chlorinated PCBs in surface soil. The hazard quotient (HQ) for chromium (HQ=1.1) exceeded the regulatory threshold for the construction worker, contributing the majority of the hazard to the total hazard index (HI) for this receptor population.

The 2009 HHRA also conducted a vapor intrusion screening to identify constituents that could present an indoor inhalation risk to a hypothetical future occupant of a building constructed on the SYW-12 Site. Naphthalene was identified as the constituent of concern (COC) for the vapor intrusion pathway given that maximum groundwater concentration was approximately 11 times higher than the corresponding vapor intrusion groundwater screening level. Benzene was also retained as a vapor intrusion COC owing to its status as a Class A carcinogen.

Since completion of the *Revised HHRA Report*, USEPA has conducted a re-evaluation and update of toxicity information for carcinogenic PAHs that indicates they have less carcinogenic potency than previously thought (USEPA 2017a). In addition, in 2009, USEPA modified the assessment methodology for inhalation risk assessment and issued guidance for this exposure route (USEPA 2009). To incorporate these updates, risk calculations for soil exposures for the most sensitive non-residential receptor group and based on the anticipated Site use (*i.e.*, recreators) were revised in 2018[4]. The revised hazard and risk calculation tables for child and adult recreators that incorporate the updated inhalation exposure methodologies and USEPA toxicity information are included in Appendix 1, and summarized below:

[4] Revisions to child and adult resident hazard and risk tables were not performed as part of the 2018 hazard/risk re-evaluation given that residential use of the SYW-12 parcel is not expected or likely.

- Total lifetime excess carcinogenic risks for both child and adult recreators do not exceed the cumulative regulatory cancer risk threshold.
- Total hazards for both child and adult recreators do not exceed the acceptable cumulative regulatory hazard threshold.

In addition, hazards and risks were recalculated for non-recreational receptors for which total hazards and/or excess cancer risk exceeded regulatory limits in the 2009 *Revised HHRA Report* to accommodate USEPA updates to risk assessment methods and toxicity changes for carcinogenic PAHs. Per Table 2-1, these receptors included current/future utility workers, future construction workers, and future child residents. Revised hazard and risk estimates for these receptors indicate the following (see Appendix 1):

- Total lifetime excess carcinogenic risks for utility workers and construction workers are below the $1x10^{-4}$ cumulative regulatory threshold
- The total excess cancer risk posed to child residents is at but does not exceed the cumulative regulatory threshold.

It should be noted that while the lifetime excess cancer risks for utility workers, construction workers, and child residents are below the regulatory risk threshold based on the revised hazard and risk evaluation, non-carcinogenic hazards calculated for these receptors are essentially unchanged by the USEPA updates to risk assessment methods and toxicity values. As such, the unacceptable hazards posed to child residents by highly chlorinated PCBs in surface soil and to construction workers by chromium in groundwater, as calculated in the 2009 *Revised HHRA Report*, remain potential threats to these receptor groups. However, it should be noted that the unacceptable hazard posed by chromium to construction workers was based on the results obtained during the RI; sampling subsequent to the RI indicate the absence of chromium in groundwater underlying the SYW-12 Site, indicating there likely is no unacceptable risk attributable to chromium in groundwater, and therefore chromium should not be considered a groundwater COC. Additionally, while chromium was detected in groundwater in RI data, and these data were used to calculate EPCs in the HHRA, more of the detections and the higher levels of chromium were found in the groundwater screening results obtained in 2006 than in the 2007 data, which represents samples collected from monitoring wells and is more representative of groundwater quality at the Site.

A summary of the re-evaluated (post-HHRA) hazards and risks posed to child recreators, utility workers, construction workers, and child residents are presented in Table 1 below.

Table 1 – Human Health Risk Re-Evaluation Summary

Timeframe	Receptor	Exposure Medium	Cancer Risk	Non-Cancer Hazard	Hazard/Risk Driving COCs
Current/Future	Utility Worker	Surface/Subsurface Soil	3×10^{-6}	0.07	--
		Outdoor Air	4×10^{-7}	0.006	--
		Shallow Groundwater	5×10^{-5}	0.6	--
		All Media	6×10^{-5}	0.6	--
Current/Future	Child Recreator	Surface Soil	6×10^{-5}	0.9	--
		Outdoor Air	2×10^{-7}	0.006	--
		All Media	6×10^{-5}	0.9	--
Future		Surface/Subsurface Soil	1×10^{-6}	0.8	--

Timeframe	Receptor	Exposure Medium	Cancer Risk	Non-Cancer Hazard	Hazard/Risk Driving COCs
	Construction Worker	Outdoor Air	2×10^{-7}	0.07	--
		Shallow Groundwater	3×10^{-5}	7.1	Benzo(a)pyrene, chromium[1]
		All Media	3×10^{-5}	8.0	Benzo(a)pyrene, chromium[1]
Future	Child Resident	Surface Soil	1×10^{-4}	7.6	Highly chlorinated PCBs
		Outdoor Air	5×10^{-6}	0.4	--
		All Media	1×10^{-4}	7.9	Highly chlorinated PCBs

- Shaded cells indicate exceedance of the USEPA acceptable cancer risk or non-cancer hazard threshold.
[1] Based on HHRA results using groundwater data collected during RI; chromium and benzo(a)pyrene were not detected in groundwater monitoring well samples collected subsequent to the RI.

In conclusion, based on the calculated risks completed as part of the 2009 *Revised HHRA* and the subsequent updated calculations presented in Appendix 1, the receptors for which non-cancer hazards and lifetime incremental cancer risks exceed the corresponding cumulative regulatory limits were limited to the following:

- Excess cancer risks: None. Re-calculations of lifetime excess cancer risks for receptors with cancer risks originally exceeding the cumulative regulatory threshold at the SYW-12 Site in the *Revised HHRA Report* are either at the cumulative regulatory limit (*i.e.*, future child residents) or below the limit (*i.e.*, current/future utility worker, future construction worker, and current/future child recreator).
- Total hazards for the future child resident and future construction worker were above the acceptable cumulative regulatory hazard threshold of 1. For the future child resident, the hazard was driven by exposure to highly chlorinated PCBs in surface soil. For the future construction worker, the hazard was driven by benzo(a)pyrene and chromium in groundwater. Risk to future construction workers that contact soil only and not groundwater (*e.g.*, trail construction workers) would not be unacceptable.

2.6.2 BERA

The WBB/HB *Revised BERA* was submitted to the NYSDEC on August 12, 2011 and approved by the NYSDEC on September 13, 2011. The Site was evaluated as the SYW-12 Site Exposure Area in the BERA in accordance with Steps 4 through 7 of USEPA's ERAGS guidance. The Site consists of a mix of floodplain deciduous forest, shrubs, and grasses (dominated by common reed). Forested and emergent wetland habitats comprise much of the exposure area. An assessment of the function and value of the delineated wetland identified the following principal functions/values: groundwater recharge/discharge; flood-flow alteration; sediment/toxicant retention; nutrient removal; sediment/shoreline stabilization; wildlife habitat (O'Brien & Gere and Parsons 2010).

The WBB/HB *Revised BERA* identified current and future habitat use and potential ecological receptors at the SYW-12 Site (OBG 2011). Ecological risks for both community receptors (*i.e.*, terrestrial plants, soil invertebrates, benthic invertebrates, fish) and upper trophic level wildlife receptors (avian and mammalian populations) that may inhabit and/or forage within the SYW-12 Site are summarized in Table 2-2 for constituents that may result in adverse effects under a chronic exposure scenario. Based on the ecological exposure assessment and risk characterization conducted for the receptors identified, unacceptable risk was driven by the following constituents by receptor for the SYW-12 Site Exposure Area:

- Potential risk to terrestrial plants is driven by 11 metals via exposure to surface soil based on average concentrations throughout the exposure area exceeding screening criteria for the protection of plants. The highest average concentration to screening criterion ratio was calculated for chromium (114).
- Potential risk to soil invertebrates is driven by five metals via exposure to surface soil based on exceedances of screening criteria for the protection of soil invertebrates and microfauna. The highest average concentration to screening criterion ratio was calculated for chromium (286).
- Potential food chain bioaccumulation risks for insectivorous birds, as represented by the American robin (*Turdus migratorius*), exceeded the risk threshold (*i.e.*, HQ > 1.0) for lowest effect dose levels[5] for six metals and four organic compounds in surface soil. Chromium drove the majority of the risks among the metals (HQ = 37.6); food chain exposure to total PCBs yielded the highest risk for organic compounds, and overall, for the American robin (HQ = 28,522).
- Risks to insectivorous mammals from food chain exposure, as represented by the short-tailed shrew (*Blarina brevicauda*), exceeded 1.0 based on lowest effect level doses for five metals and five organic compounds in surface soil. The highest risk for metals was calculated for cadmium (HQ = 11.2), while total PCBs was the primary risk driver for organic compounds, and overall (HQ = 21,278). The lowest effects-based HQ for the short-tailed shrew for the 2,3,7,8 TCDD TEQ (for mammals) also exceeded 1.0 (HQ = 11.1)
- Potential food chain risks to carnivorous mammals, as represented by the red fox (*Vulpes vulpes*), are considered nominal for each constituent with the exception of chromium. The lowest effects-based HQ (2.5) for chromium was the sole exceedance of the lowest-effect level dose for the carnivorous mammal trophic group.
- Risks to carnivorous mammals from food chain exposure, as represented by the red-tailed hawk (*Buteo jamaicensis*), did not exceed 1.0 for any constituent based on lowest effect level doses.
- Potential risks to predatory mammals that may forage on terrestrial mammals and fish in the lake area abutting the SYW-12 Site, as represented by the mink (*Neovison vison*), are considered nominal given that no HQs based on lowest effect level doses exceeded 1.0.
- Concentrations of constituents detected in surface soil were compared to federal, state, or Ontario criteria or effect benchmarks for sediment for the protection of benthic invertebrates. This screening evaluation was conducted to assess the potential effects of detected constituents in SYW-12 Site surface soil under the assumption that the surface soil may function as sediment in some periodically inundated areas that could support benthic invertebrate and fish communities. Constituents with average surface soil concentrations above sediment screening values were represented primarily by metals, pesticides, PAHs, and 2,3,7,8-TCDD TEQ, as presented in Table 2-2.
- Concentrations of constituents detected in shallow groundwater were compared to surface water criteria for the protection of aquatic organisms and fish, and to state water quality standards and guidance values for the protection of wildlife as part of a conservative screening evaluation of potential shallow groundwater impacts to lake surface water. Constituents with average groundwater concentrations exceeding these screening values were largely represented by metals and PAHs, as presented in Table 2-2.

[5] Based on lowest observed adverse effect level (LOAEL) doses derived from ecotoxicological guidance documents or other literature sources.

Notable is that the BERA incorporated Part 375 SCOs for Protection of Ecological Resources in an initial screening of SYW-12 Site surface soil to identify ecological COCs, for which more focused evaluations of direct toxicity and bioaccumulation were conducted. In deriving the Protection of Ecological Resources SCOs, NYSDEC opted to utilize many of the procedures used by USEPA in developing its Ecological Soil Screening Levels (Eco-SSLs). The methods used to identify Eco-SSLs, and subsequently adopted by NYSDEC to derive the Protection of Ecological Resources SCOs, "represent the best, most current, accepted scientific methods for assessing the uptake and bioaccumulation of soil-borne contaminants by plants and soil invertebrates and for estimating food chain risks to birds and terrestrial wildlife" (NYSDEC 2006). As such, the Protection of Ecological Resources SCOs, used in part to evaluate contaminant nature and extent at the SYW-12 Site, has broad application to the protection of representative soil-dwelling flora and fauna (*i.e.*, terrestrial plants, soil invertebrates) and bird and mammal populations that may be present at the Site and, for this reason, evaluated in the BERA.

Based on the ecological exposure assessment, effects characterization, and risk characterization for the SYW-12 Site, the *Revised BERA Report* concluded that select metals and organic compounds, namely chromium, cadmium and PCBs, pose a potential risk at estimates considerably above the USEPA hazard threshold of 1 to communities or organisms and to bird and mammal populations with relatively restrictive home ranges (*e.g.*, American robin, short-tailed shrew).

2.7 Selection of Representative Remedy Drivers

The purpose served by COCs in the FS differs from that of the RI. In the RI, COCs (and their selection) underpin the comprehensive characterization of the nature and extent of contamination. In contrast, COCs in the FS inform the definition of the remedy footprint and the measures used to evaluate whether the remedy, once implemented, would be effective in achieving the RAOs and meeting the remedial goals (*i.e.,* ARARs and preliminary remedial goals [PRGs]). Given these different purposes, a key objective in the selection of COCs in this FS is to focus the list of chemicals evaluated in the RI to a targeted list of chemicals that can serve as surrogates for others because they are most likely to drive risk and remediation, and therefore will be representative chemicals for optimizing remedy protectiveness.

In light of that objective, representative FS risk and remedy drivers were selected as follows:

1. For all chemicals detected in surface soil/fill material (defined as samples collected within the upper 2 ft of soil/fill material), the sample count, detection frequency, mean of detected concentration, and 95% upper confidence limit on the mean concentration (95% Upper Confidence Limit [UCL]) values were tabulated.
2. Upper bound exposure point concentrations (EPCs), represented as the lower of the 95% UCL and maximum concentration, were compared to SCOs for Commercial Use and the Protection of Ecological Resources.
3. Chemicals were retained as representative FS COCs if their EPCs are higher than the lower of the SCOs for Commercial Use and the Protection of Ecological Resources.

Chemicals were also retained as representative FS COCs if they were identified as human health or ecological risk drivers. Human health risk drivers are defined as constituents producing an unacceptable lifetime excess cancer risk or non-cancer hazard (see Section 2.6.1). Ecological risk

drivers are those constituents producing unacceptable hazards for avian and mammalian receptor populations evaluated in the BERA based on lowest effect level doses (see Section 2.6.2). Based on the above screening methodology, 22 chemicals or chemical groups were identified as representative FS COCs. Representative FS COCs are represented by five SVOCs, five pesticides, total PCBs, 10 metals, and the 2,3,7,8-TCDD TEQ for mammals. Appendix 6 provides summary statistics for constituents detected in surface soil samples, and the results of the representative FS COC identification process described above.

Chemicals identified as representative risk and remedy drivers were further considered relative to the United States Fish and Wildlife Service (USFWS) targeted constituents for the SYW-12 Site (USFWS 2018), their persistent, bioaccumulative and/or toxic status (PBT, USEPA 2017b), and the magnitude of their exceedances above SCOs, as presented in Appendix 6. The resultant representative FS risk and remedy drivers based on the refined analysis are: benzo(a)pyrene, 4,4'-DDT, total PCBs, mercury, chromium and cadmium. The extent of the representative risk and remedy drivers is also characteristic of the distribution of the remaining FS COCs as they are generally co-located. Figures 1 through 6 in Appendix 3 illustrate the spatial distributions of concentrations of these six representative risk and remedy drivers in surface soil/fill material at the Site.

2.8 Other Considerations

Subsequent to publication of the 2011 *Revised BERA*, bald eagle utilization of the SYW-12 Site has increased significantly, primarily via seasonal aggregation of roosting bald eagles. The SYW-12 Site serves as a winter roost site and concentration area for the eagles. Bald eagles likely gather at this Site because of the warm water outflow from the nearby Metro Wastewater Treatment Facility which provides open water and the opportunity for eagles to forage during winter months (USFWS 2018). The large trees at the SYW-12 Site serve as roosts for wintering bald eagles.

As part of the FS development, USFWS provided recommendations related to chemical-specific ARARs and soil/fill material locations to be addressed that would also preserve trees that serve as roosts for bald eagles (USFWS 2018). The following measures were also recommended by USFWS to provide for the continued integrity of this roost site and enable bald eagles to feed and shelter during winter:

- Minimize tree clearing as part of remediation
- Perform remedial activities outside the December 15 to March 15 winter roosting season to avoid disturbance to roosting bald eagles

The NYSDEC's March 2016 *Conservation Plan for Bald Eagles in New York State* provides further guidelines and actions recommended for the conservation of New York's bald eagle population, and recommends that work and activities disturbing trees be performed outside the December 1 to March 31 winter roosting season. These measures will be considered as part of the development and evaluation of remedial alternatives.

3. DEVELOPMENT OF REMEDIAL ALTERNATIVES

This section documents the development of remedial alternatives for SYW-12 Site soil/fill material and groundwater, consistent with the *Guidance for Conducting Remedial Investigation and Feasibility Studies Under CERCLA* (USEPA 1988), *NYSDEC's Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10)* (NYSDEC 2010a), and the RI/FS Work Plan (OBG 2002). As part of the development of remedial alternatives, remedial action objectives (RAOs) and general response actions (GRAs) were identified for the FS. In addition, the areas and volumes of media to be addressed by the remedial alternatives and specific remedial technologies that, following screening, were used to develop the range of remedial alternatives evaluated in this FS are documented. Consistent with NYSDEC's *DER-31 – Green Remediation* (NYSDEC 2011) and USEPA's *Superfund Green Remediation Strategy* (USEPA 2010a), green remediation concepts were also considered during the development of alternatives in this FS.

3.1 Development of Remedial Action Objectives (RAOs)

RAOs are media-specific goals for protecting human health and the environment. RAOs form the basis for the FS by providing overall goals for site remediation. The RAOs are considered during the identification of appropriate remedial technologies and development of potential remedial alternatives for the Site, and later during the evaluation of remedial alternatives.

RAOs are based on professional and engineering judgment, risks identified in the *Revised HHRA and BERA Reports* (OBG 2009 and 2011, respectively) and subsequent updated calculations (Appendix 1), potential ARARs, and migration potential. Additionally, the current, intended, and reasonably anticipated future land use of the SYW-12 Site were considered during the development of the RAOs. Documentation of the rationale employed in the development of RAOs for Site media is presented below.

3.1.1 Identification of ARARs

There are three types of ARARs: chemical-specific, location-specific, and action-specific. Chemical-specific ARARs are health- or risk-based numerical values, or methodologies which when applied to site-specific conditions result in numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in or discharged to the ambient environment. Location-specific ARARs set restrictions on activities based on the characteristics of the land on which the activity is to be performed. Action-specific ARARs set controls or restrictions on particular types of remedial actions once the remedial actions have been identified as part of a remedial alternative. The identification of potential ARARs is documented in Table 3-1. The rationale for the selection of chemical-specific ARARs related to 6 NYCRR 375 SCOs and land use is further described below.

3.1.2 Land Use and Selection of Soil Cleanup Objectives

Consistent with 6 NYCRR 375-1.8 (f) and DER-10 4.2 (i) the current, intended, and reasonably anticipated future uses of the SYW-12 Site are considered when selecting SCOs. The following land use information is relevant to the development of RAOs:

- The SYW-12 Site is currently owned by Onondaga County and is currently zoned as parkland within the City of Syracuse. The surrounding area is used for commercial use. CSX Railroad tracks are also present immediately to the north and east of the Site.
- The land is currently undeveloped, and given the prevalent wetlands throughout the SYW-12 Site, future development for residential or industrial use is not plausible.
- An extension of the Onondaga County Loop the Lake Trail, a multi-use recreational trail, is proposed for construction on the Site. The multi-use recreational trail will involve passive public uses with institutional controls to keep trail users on the trail.

Figure 4: Bald Eagles Congregating at SYW-12

- The bald eagle is listed as a threatened species in New York State, pursuant to (6 NYCRR 182.5[b]6.iii). In accordance with 6 NYCRR 182.8, activities that are likely to result in a 'take' of listed species are generally prohibited, including any adverse modification of habitat or modification of essential behavior. The occupation of the SYW-12 Site by the bald eagle, particularly exhibited by winter roosting behavior of a large number of individuals (as shown in Figure 4), is recognized by the US Fish and Wildlife Service and NYSDEC.

Given that the reasonably anticipated future use for the SYW-12 Site includes a proposed multi-use recreational trail, the potential risks identified in the *Revised HHRA* and *BERA* for un-remediated conditions, and the seasonal presence of eagles, the following chemical-specific ARARs [*i.e.*, 6 NYCRR Part 375 SCOs] were identified as appropriate for the SYW-12 Site:

- 6 NYCRR Part 375 SCOs for Commercial Use, including passive recreation use
    - Commercial use, as defined in 6 NYCRR Part 375-1.8(g)(2)(iv) includes passive recreation uses, which are public uses with limited potential for soil contact.
    - SCOs for Commercial Use were applied to surface and subsurface soil/fill material at depths up to 15 ft bgs, as defined in 6 NYCRR Part 375-3.8(e)(2)(iii).

- 6 NYCRR Part 375 SCOs for the Protection of Ecological Resources
    - Consistent with 6 NYCRR Part 375-6.6, SCOs for Protection of Ecological Resources must be considered and applied where terrestrial flora and fauna and the habitats that support them are identified.
    - Also consistent with 6 NYCRR Part 375-6.6, the SCOs for the Protection of Ecological Resources do not apply to sites or portions of sites where the condition of the land (*e.g.*, paved, covered by impervious surfaces, building and other structures) precludes the existence of an ecological resource.
    - SCOs for the Protection of Ecological Resources were applied to surface soil/fill material at depths ranging from 0 to 2 ft bgs, based on potential ecological exposure depths.

- 6 NYCRR Part 375 SCOs for the Protection of Groundwater
  - Consistent with 6 NYCRR Part 375-6.5, SCOs for the Protection of Groundwater are applicable at restricted use sites where contamination has been identified in on-site soil by the remedial investigation and groundwater standards are, or are threatened to be, contravened by the presence of soil contamination at concentrations above the Protection of Groundwater SCOs.
  - As described in Section 2.3.3, the few exceedances of groundwater Class GA SGVs for organics suggests that the constituents detected in surface and subsurface soils are generally not mobilizing to groundwater.
  - SCOs for the Protection of Groundwater were considered for surface and subsurface soil/fill material at depths up to 15 ft bgs, as defined in 6 NYCRR Part 375-3.8(e)(2)(iii); however, as described above, a comparison of constituents that exceed the Protection of Groundwater SCOs to the constituents that exceed Class GA standards in groundwater indicate that the constituents exceeding the Protection of Groundwater SCOs do not exceed SCOs for the corresponding Class GA standards. As presented in the *Revised SYW-12 2019 Groundwater Investigation Report*, naphthalene was the only organic compound detected above the corresponding Class GA Guidance Value at monitoring well HB-MW-29. The naphthalene exceedance was limited to one location (HB-MW-29), with lower detected concentration in 2019 than historical detections. Locations of soil concentrations above the naphthalene SCO for the Protection of Groundwater are not co-located with this groundwater exceedance (Appendix 5, Figure 1).

For the purpose of evaluating an alternative capable of achieving unrestricted conditions, analytical results for soil/fill material were also compared to the 6 NYCRR Part 375 Unrestricted Use SCOs.

3.1.3 RAOs for Soil/Fill Material and Groundwater

Potential chemical-specific ARARs and human health and ecological risks identified for soil/fill material and groundwater at the SYW-12 Site were considered during the development of RAOs and remedial alternatives. As described in Section 2.3, soil/fill material and groundwater samples exhibit concentrations above chemical-specific ARARs and/or to be considered information (TBCs) in certain areas of the SYW-12 Site. Groundwater at the SYW-12 Site is classified as Class GA (NYCRR Part 701), with potential use as a source of potable water. Though SYW-12 Site groundwater is not used as a drinking or industrial water supply and is highly unlikely to be used as a drinking or industrial supply in the future since the area is supplied by municipal water from Onondaga County Water Authority, groundwater exceedances of ARARs were considered (OBG 2009). Potential unacceptable risks for human exposures to constituents identified as risk and remedy drivers in soil/fill material and groundwater were identified in relation to current and future Site workers and future child receptors (i.e., current/future utility worker, future construction workers, and future child resident). Potential risks were identified that related to terrestrial ecological receptor exposures to soil/fill material.

The NYSDEC and New York State Department of Health (NYSDOH) *New York State Brownfield Cleanup Program Development of Soil Cleanup Objectives Technical Support Document* (NYSDEC and NYSDOH 2006) presents the assumptions, rationale, algorithms and calculations utilized to develop the SCOs. The SCOs were developed by NYSDEC and NYSDOH based on potential health effects to human and ecological receptors, rural soil background concentrations, and maximum

acceptable soil concentrations. Thus, the promulgated SCOs for the protection of human and environmental health were used to ascertain acceptable concentrations for a given anticipated site use. Attainment of these SCOs was assumed to constitute acceptable protectiveness and, therefore, the SCOs were used as a measure for achievement of the corresponding RAOs.

RAOs for Public Health Protection

Based on consideration of potential chemical-specific ARARs, nature and extent of contamination, potentially unacceptable risks, and the current intended and reasonably anticipated future use of the SYW-12 Site and its surroundings, the following RAOs for soil/fill material and groundwater were developed for the protection of human health:

- Prevent, or reduce to the extent practicable, ingestion/direct contact with contaminated soil/fill material.
- Prevent, or reduce to the extent practicable, inhalation of or exposure to contaminants volatilizing from contaminated soil/fill material and unacceptable inhalation exposure associated with soil vapor.
- Prevent, or reduce to the extent practicable, potential unacceptable risks to human health associated with ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent, or reduce to the extent practicable, potential unacceptable risks to human health associated with contact with, or inhalation of VOCs from contaminated groundwater.

RAOs for Environmental Protection

Based on consideration of potential chemical-specific ARARs, nature and extent of contamination, potentially unacceptable risks, the current, intended and reasonably anticipated future use of the SYW-12 Site and its surroundings, and the recognized value of and use of the forested areas of the site by the bald eagle, the following RAOs were developed for the protection of the environment:

- Restore groundwater to levels that meet state and federal standards within a reasonable timeframe.
- Prevent, or reduce to the extent practicable, adverse impacts to biota from ingestion/direct contact with contaminated soil/fill material causing toxicity or impacts from bioaccumulation through the terrestrial food chain.
- Prevent, or reduce to the extent practicable, the migration of contaminants that would result in groundwater, sediment, or surface water contamination.

3.2 PRGs

PRGs are an important tool for selecting general response actions, developing remedial alternatives and, following remedy implementation, evaluating the effectiveness of the remedial action.

The numerical goals in remediation areas would be Part 375 SCOs for Commercial Use and the Protection of Ecological Resources. Consideration of area-weighted average concentrations would serve to evaluate the effectiveness and protectiveness of remedies that address areas exhibiting exceedances of the SCOs for Commercial Use and the Protection of Ecological Resources.

Addressing these remedial goals would be balanced with the ecological benefit of preserving valuable forested habitat, including protected habitat critical to the bald eagle.

In brief, mature trees would be mapped (*i.e.*, location, size, condition, speciation), suitable prey species would be sampled, and co-located surface soil samples would be collected and analyzed. The outcomes of this assessment and sampling would inform the long-term monitoring plan to be developed during engineering design.

3.3 Development of General Response Actions

GRAs are media-specific actions which may, either alone or in combination, form alternatives to satisfy the RAOs and SCOs. GRAs identified for soil/fill material and groundwater, based on the RAOs, are summarized as follows:

Soil/Fill Material

- **No action.** No action must be considered in the FS, as required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) Part 300.430] and DER-10 Sections 4.1 (d) and 4.4 (b), as a baseline against which other actions are evaluated (NYSDEC 2010a).
- **Institutional controls/limited actions.** Actions that provide site access and use restrictions, monitoring, and provisions for continued operation of the remedy.
- **Natural recovery.** Actions that rely on natural processes to attenuate contaminants in soil/fill material.
- **Containment actions.** Actions that minimize the potential for direct contact with and erosion of surface soil/fill material.
- ***In situ* treatment actions.** Actions that treat soil/fill material in place to reduce mobility or toxicity.
- **Removal actions.** Actions to excavate soil/fill material.
- ***Ex situ* treatment actions.** Actions that treat soil/fill material following removal, to reduce mobility or toxicity.
- **Disposal actions.** Actions that dispose of soil/fill material on-site or off-site.

Groundwater

- **No action.** No action must be considered in the FS, as required by NCP (40 CFR Part 300.430) and DER-10 Sections 4.1 (d) and 4.4 (b), as a baseline against which other actions are evaluated.
- **Institutional controls/limited actions.** Actions that provide use restrictions, monitoring, and provisions for continued operation of the remedy.
- **Natural recovery.** Actions that rely on natural processes to attenuate contaminants in groundwater.
- **Hydraulic control.** Actions that collect and/or control groundwater flow, minimizing further migration.
- **Treatment.** *In situ* or *ex situ* actions that treat groundwater to reduce mobility or toxicity.

The GRAs for this FS are identified in Tables 3-2 and 3-3.

3.4 Identification of Volumes and Areas of Media

Volumes and areas of soil/fill material and groundwater to be addressed in this FS were estimated based on Site conditions, the nature and extent of contamination, RAOs, and potential chemical-specific ARARs.

The areal extents of surface soil/fill material to be addressed are described below.

Surface Soil/Fill Material

The areal extents of surface soil/fill material to be addressed in the FS are described below based on findings presented in the *Revised RI Report* (OBG 2015) and *SYW-12 SCI* (OBG 2014).

- Surface soil/fill material (between 0 and 2 ft bgs) exhibit concentrations of constituents that are greater than the potential chemical-specific ARARs over the approximate 23.5 AC comprising the SYW-12 Site (Section 3.1).
  - Surface soil/fill material concentrations of PAHs, PCBs, and metals were detected above the respective 6 NYCRR Part 375 SCOs for Commercial Use over much of the SYW-12 Site.
  - Surface soil/fill material exceedances of 6 NYCRR Part 375 SCOs for the Protection of Ecological Resources and Unrestricted Use were also identified for VOCs, PAHs, PCBs, pesticides and metals over the approximate 23.5 AC Site.

Subsurface Soil/Fill Material

In total, it is estimated that approximately 410,700 cubic yards (cy) of surface and subsurface soil/fill material exceed Unrestricted Use SCOs. In accordance with DER-10, this FS evaluates remedial options to address subsurface soil/fill material with respect to restoration to unrestricted use conditions.

Groundwater

There is limited potential for groundwater upwelling and flux to Onondaga Lake consistent with evidence of negligible mobility of constituents in soil/fill material to groundwater.

- Based on an evaluation of groundwater upwelling velocities, groundwater upwelling and the resulting potential for groundwater discharge to Onondaga Lake along the SYW-12 Site shoreline is negligible (S.S. Papadopulous & Associates 2012).
- The presence of NAPL blebs and sheen were observed during the SCI. As described in Section 2.3.2, NAPL blebs and sheens were identified in test pits HB-TP-55 and HB-TP-55AN; however, mobile NAPL was not found within the groundwater zone (OBG 2014) consistent with groundwater concentrations.
- Despite the presence of stained soil, limited contaminants are found in groundwater above New York State (NYS) Class GA groundwater standards; the contaminants are likely bound to subsurface soils and are generally not mobilizing to groundwater. As described in Section 2.3.2, evaluation of data and field observations performed subsequent to the RI found that the presence of stained soils and NAPL does not necessarily correlate with elevated organic concentrations in soil and groundwater at proximate locations. Historic VOC concentrations exceeding Class GA standards were limited to two wells in the central portion of the SYW-12 Site (HB-B-04W and HB-MW-29, Figure 2-1), and slight exceedances of Class GA standards for phenolic compounds were limited to two wells in the central portion of the Site (HB-MW-

23 and HB-MW-25, Figure 2-1). The VOCs detected in HB-B-04W consisted of ethylbenzene, isopropylbenzene, toluene, and total xylenes. The VOCs detected in HB-MW-29 consisted of benzene, toluene, ethylbenzene and o-, m-, and p-xylenes, and total xylenes, and isopropylbenzene. The 2019 groundwater data indicates that naphthalene is the only organic compound detected above the corresponding Class GA Guidance Value. As described in the 2020 *Revised SYW-12 2019 Groundwater Investigation Report*, no VOCs were detected above the Class GA standards during the 2019 event. In addition, no SVOCs were detected above the Class GA standards during the 2019 sampling event.

- Inorganic constituents are present at concentrations exceeding Class GA standards in wells across the SYW-12 Site. As described in the 2020 *Revised SYW-12 2019 Groundwater Investigation Report,* inorganic constituents (*i.e.*, iron, manganese, magnesium, barium, and sodium) exceeded Class GA SGVs. The inorganic chemistry at the SYW-12 Site suggests that the area is typically fresh groundwater with a varying native halite brine influence.

3.5 Identification, Screening, and Evaluation of Remedial Technologies and Process Options

Potentially applicable remedial technologies and process options for each GRA were identified and then screened on the basis of technical implementability. Technical implementability for each identified process option was evaluated with respect to contaminant information, physical characteristics, and areas and volumes of affected media summarized in Section 3.4. Remedial technologies and process options for soil/fill material and groundwater are further described below. As detailed in Section 2.3.2, the presence of stained soil and NAPL does not correlate with elevated organic concentrations in soil and groundwater; therefore, remedial technologies and process options were not evaluated for stained soil and NAPL.

3.5.1 Identification of Remedial Technologies and Process Options

Descriptions of retained technologies and process options identified for the FS are presented in Tables 3-2 and 3-3 and summarized as follows:

Soil/Fill Material

- No action
- Biota monitoring
- Access/use restrictions/administrative control(s) (institutional controls)
- Site controls (site management plan)
- Periodic reviews (periodic site reviews)
- Natural attenuation
- Cover system (vegetation enhancement, engineered cover, low permeability cover)
- *In situ* treatment (enhanced bioremediation, chemical oxidation, solidification/stabilization)
- Excavation (mechanical excavation)
- On-site disposal (on-site consolidation/reuse)
- Off-site disposal (off-site commercial landfill, off-site treatment facility)

Groundwater

- No action
- Groundwater monitoring
- Access/use restrictions/administrative control(s) (institutional controls)
- Site controls (site management plan)

- Periodic reviews (periodic site reviews)
- Natural attenuation [natural attenuation, monitored natural attenuation (MNA)]
- Physical barrier wall (slurry wall, sheet piles)
- Extraction (extraction wells, collection trench, multi-phase extraction)
- *In situ* treatment (enhanced bioremediation, chemical oxidation)
- *Ex situ* off-site physical/chemical treatment (Willis-Semet GWTP and/or Metro)

3.5.2 Screening and Evaluation of Remedial Technologies and Process Options

The remedial technologies and process options were evaluated further according to the criteria of effectiveness, implementability, and cost. The effectiveness criterion included the evaluation of:

- Potential effectiveness of the process option in meeting the RAOs and accommodating the estimated areas and/or volumes of media summarized in Section 3.4
- Potential effects on human health and the environment during implementation (including, as appropriate, construction and operation)
- Reliability of the process options for constituents and conditions.

Technical and institutional aspects of implementing the process options were assessed for the implementability criterion. The capital and operation and maintenance (O&M) costs of each process option were evaluated as to whether they were high, medium, or low relative to the other process options of the same technology type. Based on the evaluation, the more favorable process options of each technology type were chosen as representative process options. The selection of representative process options simplifies the assembly and evaluation of potential remedial alternatives but does not eliminate other process options for consideration. The representative process option provides a basis for conceptual design during the FS, without limiting flexibility during the remedial design phase. An alternative process option may be selected during the remedial design phase as a result of design evaluations or testing. The screening and evaluation of technologies addressing SYW-12 Site soil/fill material is summarized in Table 3-2. The screening and evaluation of technologies addressing groundwater at the SYW-12 Site is summarized in Table 3-3.

Soil/Fill Material

Most *in situ* treatment technologies addressing soil/fill material were not retained because of limited implementability and/or effectiveness due to the following SYW-12 Site conditions:

- Heterogeneous subsurface soil/fill material
- Access limitations, underground utilities, and transportation infrastructure, including Onondaga Lake and CSX Railroad lines
- Potential geotechnical limitations associated with construction adjacent to water bodies and the CSX Railroad lines
- Potential for seasonal flooding; the SYW-12 Site is located within the 100- and 500-year floodplain adjacent to Onondaga Lake, with a portion of the SYW-12 Site delineated as a wetland (OBG and Parsons 2010).

The screening and evaluation of technologies for soil/fill material (Table 3-2) resulted in the following *in situ* technologies/process options being evaluated, but not retained:

- *In situ* biological treatment via bioventing and phytoremediation

- *In situ* physical/chemical treatment via soil vapor extraction, multi-phase extraction, flushing, and electrokinetic separation
- *In situ* thermal treatment via hot water injection, steam injection, electrical resistance heating, radio frequency heating, thermal conduction, and vitrification.

Ex situ treatment technologies addressing soil/fill material were not retained because of limitations in implementability and practicability of addressing Site-wide volumes of material and associated restoration in conjunction with insufficient space on-site for treatment processes and staging of materials. Additionally, excavation and *ex situ* treatment of soil/fill material would not support future anticipated SYW-12 Site use. Implementability would also be limited due to potential geotechnical challenges related to excavating adjacent to bodies of water and the CSX Railroad lines. Based on the screening and evaluation of technologies for soil/fill material (Table 3-2), the following technologies/process options were evaluated, but not retained:

- *Ex situ* biological treatment via biopiles, landfarming, and slurry-phase bioreactor
- *Ex situ* chemical treatment via chemical oxidation, extraction/washing, and dehalogenation
- *Ex situ* physical treatment via particle size separation and solidification/stabilization
- *Ex situ* thermal treatment via low temperature thermal desorption, pyrolysis, and incineration.

Groundwater

In situ treatment technologies addressing groundwater were not retained because of limited implementability and/or effectiveness due to heterogeneity of subsurface materials, variety of constituents, and potential for seasonal flooding of the SYW-12 Site and floodplain adjacent to Onondaga Lake. Based on the screening and evaluation of technologies for groundwater (Table 3-3), the following technologies/process options were evaluated, but not retained:

- *In situ* physical treatment via in-well air stripping, air sparging, and circulation wells
- *In situ* treatment via a permeable reactive barrier
- *Ex situ* biological/physical treatment via constructed treatment wetland.

3.5.3 Representative Process Options

A description of the representative process options for retained technologies, by GRA and technology for soil/fill material and groundwater, is presented in the following sections.

No Action

No action was identified as a representative process option for soil/fill material and groundwater. The no action alternative must be considered in the FS, as required by the NCP (40 CFR Part 300.430) and DER-10 Section 4.4(b)3 (NYSDEC 2010a). Under this process option, no remedial actions addressing Site soil/fill material and groundwater would be conducted.

Institutional Controls/Limited Actions

Institutional controls, site management plan, and periodic site reviews were identified as representative process options associated with the institutional controls/limited actions GRA for soil/fill material and groundwater.

- **Institutional controls.** Access/use restrictions (*e.g.*, institutional controls) would be recorded for the SYW-12 Site documenting land use restrictions and requiring that activities that would potentially expose contaminated materials (and require health and safety precautions) be performed in accordance with the SYW-12 Site management plan. The institutional controls would also provide provisions to evaluate and address, if necessary, potential soil vapor intrusion if buildings are constructed at the Site.
- **Site management plan.** A Site management plan would document Site institutional and engineering controls and any physical components of the selected remedy requiring operation, maintenance, and monitoring to provide for continued effectiveness of the remedy. As defined in 6 NYCRR Part 375-1.2(o), engineering controls include, but are not limited to, pavement, caps, covers, subsurface barriers, vapor barriers, slurry walls, building ventilation systems, fences, access controls, provision of alternative water supplies via connection to an existing public water supply, adding treatment technologies to such water supplies, and installing filtration devices on private water supplies. The Site management plan would also present provisions for periodic site reviews.
- **Periodic site reviews.** Periodic reviews and certification are required by 6 NYCRR Part 375 where institutional and engineering controls, monitoring, and/or O&M activities are required at the Site. In accordance with 6 NYCRR Part 375-1.8(h)(3), the frequency of periodic reviews should be annual, unless a different frequency is approved by NYSDEC. Periodic site reviews would also include the performance of Five Year Reviews in accordance with 40 CFR 300.430(f)(4) ii.

Monitoring

Biota monitoring and groundwater monitoring were identified as representative process options associated with the institutional controls/limited actions GRA for soil/fill material and groundwater, respectively.

- **Biota monitoring.** Biota monitoring would involve periodic sampling and analysis of biota. Biota monitoring would provide a means of monitoring remedy effectiveness and assessing protectiveness of ecological receptors.
- **Groundwater monitoring.** Groundwater monitoring would involve periodic sampling and analysis of groundwater. Groundwater monitoring would provide a means of detecting changes in constituent concentrations in groundwater.

Natural Recovery

Natural attenuation and MNA were identified as the representative process options associated with the natural recovery GRA for groundwater.

- **Natural attenuation.** Natural attenuation results from naturally occurring processes reducing the mass, mobility, volume, or concentration of organic constituents in groundwater over time. *In situ* processes include biotic and/or abiotic degradation, sorption, dilution, volatilization and/or transformation. Natural attenuation of organic constituents in groundwater at the SYW-12 Site is discussed in the *Revised SYW-12 2019 Groundwater Investigation Report* (Ramboll 2020). As summarized in that report, the latest 2019 data indicated that naphthalene is present in groundwater at concentrations above the NYS Class GA guidance value, but no other organics are present above NYS Class GA standards or guidance values. As further discussed in the *Revised SYW-12 2019 Groundwater*

Investigation Report, geochemical conditions at the Site are favorable for natural attenuation of PAHs to occur. Further, the presence of methane and observed decreases in groundwater concentrations of PAHs such as acenaphthene and naphthalene over time indicate that natural attenuation is likely occurring. Compound-specific isotope analysis (CSIA) conducted to evaluate biodegradation timeframes for other portions of the WBB/HB Site was not possible for SYW-12 Site groundwater due to the low concentrations of detected organic compounds in groundwater at the SYW-12 Site.

- **MNA**. MNA adds a monitoring component to natural attenuation. This would involve implementation of a long-term groundwater monitoring program to monitor the natural attenuation of naphthalene. If necessary, MNA of additional contaminants may be evaluated.

Containment

An engineered cover was identified as the representative process option associated with the containment GRA for soil/fill material. Containment systems provide a means of minimizing erosion of soil/fill material and the potential for contact with the soil/fill material on the SYW-12 Site.

- **Engineered cover.** An engineered cover would consist of a soil layer of an appropriate thickness, or other surface such as gravel, pavement or buildings, over existing soil/fill material. Grading and cover installation would be performed such that drainage is promoted, erosion is minimized, and cover integrity is preserved. This cover would be considered for areas where surface soils exhibit concentrations above applicable 6 NYCRR Part 375 SCOs. This cover would be effective at preventing erosion of and contact with exposed surface soil and soil/fill material. Routine cover maintenance, consisting of mowing of vegetation or repairs to paving and inspections for integrity, would be necessary.

Removal

Mechanical excavation was identified as the representative process option associated with the removal GRA for soil/fill material.

- **Mechanical excavation.** Mechanical excavation of soil/fill material is generally implemented using construction equipment such as backhoes and front-end loaders. Excavated areas are backfilled, graded, and restored based on restoration requirements. Sloping techniques, benching, and/or engineering controls (*i.e.*, sheet piling) would be necessary during excavation to maintain stability of excavation walls. Geotechnical stability evaluations were performed in relation to potential remedial options proximate to the active CSX railroad tracks. Results of the geotechnical evaluation were used to evaluate implementability and safe methods for excavation. Dewatering of excavations and management of water would also be necessary.

Disposal

On-site consolidation and disposal at off-site commercial treatment/disposal facilities were identified as representative process options associated with the disposal GRA for soil/fill material.

- **On-site consolidation/reuse.** Coupled with mechanical removal, excavated soil/fill material would be placed in an on-site containment system (*i.e.*, consolidation) or reused on-site (*e.g.*, fill material for placement under the multi-use recreational trail, site grading or

aesthetic features) following characterization and approval for consolidation by NYSDEC in accordance with a spoils characterization plan. Following soil consolidation, the area would be restored with a soil layer of an appropriate thickness, or other surface such as pavement, over consolidated soil/fill material.

- **Off-site commercial landfill.** Coupled with mechanical removal, excavated soil/fill material would be transported to regulated, commercial off-site landfill for subsequent disposal, if it meets land disposal restrictions. Waste characterization sampling and analysis would be completed, and a Waste Manifest would be submitted to, and approved by the landfills prior to disposal.

3.6 Assembly of Remedial Alternatives

Five remedial alternatives were developed by assembling GRAs and representative process options into combinations that address RAOs for SYW-12 Site media. In addition, special consideration of overall value of SYW-12 Site habitat and the seasonal use of the Site by the bald eagle was included during the development of the alternatives. A summary of the alternatives and their components is presented in Tables 2 and 3 below.

Table 2 – SYW-12 Site Remedial Alternatives

Alternative 1
No Action

Alternative 2
Limited Actions and MNA

Alternative 3
Engineered cover on perimeter area (8.2 acres), wetland restoration/creation, biota monitoring, and MNA

Alternatives 4A & 4B*
Surface excavation and engineered cover/restoration on perimeter and interior areas (10 acres), biota monitoring, MNA, Limited tree removal

Alternative 5
Full removal (including all trees) and offsite disposal (23.5 acres) with MNA

*Alternatives 4A – on-site consolidation
Alternatives 4B – off-site disposal

Table 3 – Remedial Alternative Components

General Response Action	Remedial Technology/Process Option	Remedial Alternative					
		1	2	3	4A	4B	5
No action	No action	•					
Limited actions	Biota monitoring			•	•	•	
	Institutional controls		•	•	•	•	•
	Site management plan		•	•	•	•	•
	Periodic reviews		•	•	•	•	•

General Response Action	Remedial Technology/Process Option	Remedial Alternative					
		1	2	3	4A	4B	5
Monitoring	Groundwater monitoring		•	•	•	•	•
Natural attenuation	MNA of naphthalene in groundwater (other constituents may be evaluated, if necessary)		•	•	•	•	•
Pre-design investigation				•	•	•	
Containment	Engineered cover system – non-forested wetland			•			
	Engineered cover system – non-forested upland			•	•	•	
Removal and restoration	Mechanical excavation – non-forested wetland surface soil/fill material				•	•	
	Mechanical excavation – forested and non-forested wetland and upland – surface and subsurface soil/fill material						•
	Wetland restoration			•	•	•	•
Disposal	Off-site disposal of excavated soil/fill material					•	•
	On-site reuse of excavated soil/fill material				•		

Notes:
1. The Alternative 3 pre-design investigation surface soil sampling and tree survey may result in additional remedial footprint.

2. Alternative 4 pre-design surface soils sampling may result in additional remedial footprint.

3.6.1 Alternative 1 – No Action

Alternative 1 is a no action alternative. A no action alternative is required by the NCP and NYSDEC's DER-10 Section 4.4(b)3 (NYSDEC 2010a) and serves as a benchmark for the evaluation of action alternatives. This alternative provides for an assessment of the environmental conditions if no remedial actions are implemented. Alternative 1 could be implemented immediately.

3.6.2 Alternative 2 – Limited Actions and MNA

Alternative 2 provides for an assessment of the environmental conditions if no remedial actions are implemented. This alternative includes ongoing natural attenuation, including MNA of naphthalene in groundwater. Groundwater monitoring would be performed as part of site management and MNA of other contaminants may be evaluated, if necessary. Alternative 2 would include the following remedial components, as described below:

- Institutional controls
- Site management plan
- Periodic site reviews
- Groundwater monitoring.

The remedial components of Alternative 2 are common to Alternatives 3 through 5 (Sections 3.6.3 through 3.6.5) and are described below.

Institutional Controls

Administrative control(s) such as institutional control (*e.g.*, environmental easements, deed restrictions, and environmental notices) would be recorded for the SYW-12 Site to require the

continued management of controls to maintain protectiveness of human health and the environment. The institutional controls would limit SYW-12 Site and groundwater use and require maintenance of remedial elements. Should future use of the SYW-12 Site change, an evaluation and possible mitigation of potential vapor intrusion may be required in on-site buildings under provisions specified in the institutional controls. Restrictions would preclude activities that would potentially expose surface and subsurface soil/fill materials or impair the integrity of remedial measures without prior review and approval by NYSDEC. The reasonably anticipated future land use for the SYW-12 Site is for a multi-use recreational trail. The institutional controls would reflect this SYW-12 Site use. Onondaga County has indicated that signage requiring recreational users to remain on the trail will be incorporated in the construction of the multi-use recreational trail. The potential need for additional measures (*e.g.*, fencing, dense vegetation, and/or sampling) would be reviewed during the design of the selected remedial alternative.

Site Management Plan

A site management plan would guide future activities at the SYW-12 Site by documenting institutional and engineering controls and by developing requirements for periodic site reviews, the implementation of required O&M activities (including protection measures required during subsurface soil disturbance activities to prevent exposure to sheens), and future development on the SYW-12 Site. In addition, consistent with 6 NYCRR Part 375-1.8(h)(3), annual certification of institutional and engineering controls would be required in the site management plan.

Periodic Site Reviews

Periodic site reviews would be conducted in accordance with the site management plan to evaluate the SYW-12 Site with regard to continuing protection of human health and the environment as evidenced by information such as documentation of field inspections. 6 NYCRR Part 375-1.8(h)(3) specifies that the frequency of periodic site reviews and certification of institutional and engineering controls should be annual, unless a different frequency is approved by NYSDEC; it is assumed that annual reviews would be conducted at the SYW-12 Site. Because this alternative would result in contaminants remaining above levels that allow for unlimited use and unrestricted exposure, CERCLA (40 CFR 300.430(f)(4)ii) requires that the SYW-12 Site be reviewed at least once every five years. If justified by the review, remedial actions may be implemented to remove, treat, or contain the contaminated soils.

Groundwater Monitoring

Periodic sampling and analysis of groundwater would be included as a means of detecting changes in groundwater concentrations and monitoring the natural attenuation of naphthalene in groundwater. MNA of other contaminants may be evaluated, if necessary. Specific monitoring locations, parameters, and frequencies would be established during remedial design. For the purpose of the FS cost estimation, it was assumed that the monitoring program would consist of semi-annual sampling of ten monitoring wells with analyses for VOCs, SVOCs (including PAHs), metals, mercury, cyanide, and cations/anions.

3.6.3 Alternative 3 – Engineered Cover on Perimeter Area (8.2 AC), Wetland Restoration/Creation, Biota Monitoring, and MNA

Alternative 3 includes implementation of an engineered cover system over non-forested wetland and upland areas of the SYW-12 Site based on potential chemical-specific ARARs and current and reasonably anticipated future land uses at the SYW-12 Site. The anticipated acreage of the

engineered cover system is approximately 8.2 AC. The engineered cover system would address SCOs for Commercial Use and the Protection of Ecological Resources within non-forested wetland and upland areas where accessible and when not detrimental to the environment (*e.g.,* tree removal, disturbance of bald eagles). Biota monitoring, as a means of monitoring protectiveness of ecological resources and remedy effectiveness, would also be included under Alternative 3. Alternative 3 also includes pre-design surface soil sampling and a tree survey to evaluate the potential need to address surface soil/fill material in approximately 2.2 AC of additional wetland and upland areas based on potential chemical-specific ARARs, including four areas of non-forested wetland on the western portion of the SYW-12 Site, one upland forested area on the southern portion of the Site, and two areas of forested wetland on the northern portion of the SYW-12 Site. This alternative would include institutional controls, a site management plan, periodic reviews, and groundwater monitoring, as described under Alternative 2. This alternative would also include ongoing natural attenuation, including MNA of naphthalene in groundwater. Groundwater monitoring would be performed as part of site management and MNA of other contaminants may be evaluated, if necessary.

Engineered Soil Cover

The engineered soil cover would consist of an approximately 8.2-AC 2-foot thick soil cover system including wetland and upland soil cover over existing 5.9 AC of non-forested wetland (perimeter wetlands) and existing 0.7 AC of non-forested upland for the purposes of mitigating potential exposures to constituents exceeding SCOs for Commercial Use and the Protection of Ecological Resources in soil/fill material. The remedial footprint is ecologically-focused to enhance protection to ecological receptors by reducing ecological exposure while balancing remedial activities with habitat disruption, particularly in consideration of the extensive utilization of the Site by the bald eagle and the overall high value of the forested SYW-12 Site habitat. Specifically, damage to root zones or removal of mature trees used for eagle roosting would be avoided.

A surface soil pre-design investigation and tree survey would be performed to evaluate the addition of up to seven areas, totaling 2.2 AC, to the remedial footprint. The areas for consideration include two areas within the forested wetland characterized by scrub vegetation on the northern portion of the Site, four areas within the non-forested wetland on the western portion of the Site, and one upland forested area on the southern portion of the Site. Should surface soil sampling and the tree survey indicate that elevated surface soil/fill material concentrations are present and large trees would not be removed or disturbed (*e.g.*, within the drip-zone of the large trees), remediation of these areas would be considered during the design. The final wetland restoration approach, including opportunities to improve wetland functions and values, would be further evaluated during the design phase[6]. Permitting requirements such as those in 6 NYCRR Part 663, Article 15 and 6 NYCRR Part 608 would also be considered during the design phase.

To address loss of wetland acreage or function, wetland conditions will be targeted for the engineered cover areas necessary within the current wetland footprint, and wetland mitigation would also be incorporated into the cover through construction of perched wetland over portions of current non-forested uplands, as necessary. As a point of comparison, perched wetlands were

[6] During wetland design, the following will be addressed:

- The principle of minimization of wetland loss would be applied
- Mitigation would be planned where wetland construction results in loss of wetland acreage or function

constructed and are successfully functioning on the lakeshore of Onondaga Lake at the Wastebeds 1 through 8 Subsite. As part of the wetland design efforts for these wetlands, a water budget was completed that indicated there is sufficient local precipitation to support perched wetlands along the Onondaga Lakeshore (See Appendix 7). These conditions are anticipated for the SYW-12 Site. A similar evaluation would be conducted as part of the cover design for the SYW-12 Site, in conjunction with grading/soil profile design such that wetland conditions and functions are addressed. Where the water budget and/or grading cannot replace wetland conditions, additional mitigation measures would be considered during design. The conceptual boundaries of the engineered cover system are illustrated on Figure 3-1.

For the purpose of developing FS cost estimates, it was assumed that 5.9 AC of this cover system would consist of 12-in clay subgrade material and 12-in topsoil with internal clay berms. Additionally, approximately 1.6 AC of perimeter berms are included to support establishment of a wetland. The berms would consist of 18-in subgrade material, 6-in topsoil, and vegetation over the 24-inch cover (for approximately 4-ft combined height from existing grade). As a part of the design process, the need for water-retaining berms would be evaluated and, if possible, eliminated from the design in order to reduce the areal extent and volume of in-filling. This approach would allow for a smoother transition from the restored wetland cover to the existing/adjacent areas which would be less intrusive to wildlife movements than a berm and would also take up less space. The wetland construction/restoration details to be explored during the design would include limited excavation/grading/microtopography and an engineered soil profile which would promote sufficient flooding and saturation to facilitate the development of wetland soils and hydrology, specification of appropriate native plants for sustained wetland habitat functions and values, and incorporation of other habitat structures. It was further assumed, for cost estimate purposes, that 0.7 AC of this cover system in the upland areas would consist of 18-in subgrade material and 6-in topsoil and vegetation. The final covers would also be installed to support and preserve existing mature trees present proximate to the proposed cover system. Additional tree-planting may also be performed as part of restoration. Forested areas, including mature trees, would be surveyed during pre-design activities. A demarcation layer would also be considered during the remedial design to delineate the boundary between soil/fill material and the engineered cover system and would be compatible with the wetland, as necessary.

A geotechnical evaluation has been performed to evaluate remedy implementability by reviewing settlement and stability concerns relative to the railroad tracks. Specifically, a maximum primary consolidation settlement of 0.8 inches was estimated at the railroad track bed as a result of placement of the engineered soil cover. Over 30 years, the existing creep rate along the rail line is 0.6 inches. For this reason, the calculated settlement resulting from the placement of the engineered cover is anticipated to be implementable. In addition, stability of features such as berms and construction roads were evaluated. It was concluded that stability concerns related to construction safety can be mitigated through design. These findings are documented in the *Geotechnical Report Honeywell SYW-12 Site at Onondaga Lake* (B&B Engineers & Geologists of New York, P.C. 2021). These findings would be shared with railroad operators as part of the design phase.

Because the Onondaga County trail has not yet been constructed and discussion and coordination with railroad operations needs to be conducted, the boundaries of the remedy illustrated in

Figure 3-1 are conceptual. The extent of the cover system would be revisited during the design phase based on pre-design activities and in consideration of the trail alignment.

The cover system would require routine maintenance and inspection to maintain integrity and proper function. Based on the descriptions and assumptions above, it is anticipated that Alternative 3 would be constructed in one construction season, resulting in approximately 2,450 truck trips (*i.e.,* round-trip).

Grading/Handling of Surface Soil/Fill Material (To be Considered)
To improve the success of the restored wetlands the remedial design would consider excavation and/or grading to allow for additional water to restored wetlands. For the purpose of cost estimating, it is assumed that soil/fill material in the top 2 ft of the interior wetland areas would be graded/handled at the SYW-12 Site (*e.g.*, enhance wetland hydraulics and function, under multi-use recreational trail, site grading and aesthetics). Reuse options and limitations (*e.g.*, within wetland areas), impacts to the bald eagle habitat, and the final wetland restoration approach, including opportunities to improve wetland functions and values, planting of trees and sustainable remediation principles would be further evaluated during the pre-design and design phases so that loss of wetland acreage and function are minimized. Should reuse of excavated/graded/handled materials not be possible at the Site following remedial design evaluations, some material may need to be managed off-site. Permitting requirements such as those in 6 NYCRR Part 663, Article 15 and 6 NYCRR Part 608 would also be considered during the design phase.

The conceptual boundaries of the additional wetland areas to be considered are illustrated on Figure 3-1. Onondaga County multi-use recreational trail plans have recently been finalized, and construction is anticipated to be started in the near future. As described above, a geotechnical evaluation has been performed to evaluate implementability and stability concerns relative to the railroad tracks. For these reasons, the boundaries of the remedy illustrated in Figure 3-1 are conceptual.

Biota Monitoring
Periodic sampling and analysis of biota would be included as a means of monitoring remedy effectiveness and assessing protectiveness of ecological receptors. Specific sample locations, species, sample and analytical methods, and frequencies would be assessed and established during the remedial design. For the purpose of the FS cost estimation, it was assumed that the monitoring program would consist of analysis of soil invertebrate and small mammal tissue, with collection of co-located surface soil/fill material samples for laboratory analysis of chemical constituents, including representative risk and remedy driver constituents. A baseline sampling program, consisting of two sampling events, would be implemented, with subsequent sampling events following remedy implementation using an adaptive, data-driven approach (*e.g.,* Years 3 and 5). Field assessment of Site vegetative community composition (*e.g.*, diversity, richness, invasive species evaluation) and qualitative wildlife community observations would be performed to support the biota monitoring program. The field assessment would also include an evaluation of Site trees, specifically trees that serve as roosts for bald eagles, for overall health and preservation. The details related to the scope of biota sampling would be developed during the remedial design phase.

3.6.4 Alternative 4 – Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 AC), Biota Monitoring, and MNA, with Limited Tree Removal

Alternative 4 includes mechanical excavation of surface soil/fill material (up to 2 ft bgs) within non-forested wetland areas and implementation of an engineered cover system over non-forested upland areas of the SYW-12 Site based on potential chemical-specific ARARs and current and reasonably anticipated future land uses at the SYW-12 Site. Wetland restoration would also be included under Alternative 4 to address wetland areas disturbed during remedial activities. The total anticipated acreage of the engineered cover system is approximately 10 AC. Excavation of surface soil/fill material with implementation of an engineered cover system would address SCOs for Commercial Use and the Protection of Ecological Resources within non-forested wetland and upland areas where accessible and when not detrimental to the environment (*e.g.,* tree removal, disturbance of bald eagles). This alternative would include institutional controls, a site management plan, periodic reviews, and groundwater monitoring, as described under Alternative 2. Biota monitoring, as described under Alternative 3, would also be included under this alternative. This alternative would also include ongoing natural attenuation, including MNA of naphthalene in groundwater. Groundwater monitoring would be performed as part of site management and MNA of other contaminants may be evaluated, if necessary.

Soil/fill material management options are evaluated below as variations of Alternative 4. On-Site reuse and off-site disposal options are presented as Alternatives 4A and 4B, respectively.

Surface Soil/Fill Material Removal

The shallow excavation (up to 2 ft bgs) with wetland restoration would be implemented over approximately 6.5 AC of non-forested wetland on the eastern and western portions of the SYW-12 Site (interior wetlands) for the purposes of reducing potential erosion and mitigating potential exposures and associated risks to constituents exceeding SCOs in soil/fill material. The remedial footprint is ecologically-focused to achieve protection to ecological receptors by reducing ecological exposure while balancing remedial activities with habitat disruption, particularly in consideration of the extensive utilization of the Site by the bald eagle and overall high value of the forested SYW-12 Site habitat. Specifically, damage to root zones of mature trees used for eagle roosting is avoided. A surface soil pre-design investigation would be performed to evaluate the addition of two areas to the remedial footprint. The areas for consideration include two areas within the non-forested wetland characterized by scrub vegetation on the northern portion of the Site and one upland forested area on the southern portion of the Site. Should surface soil sampling indicate that elevated surface soil/fill material concentrations are present and large trees would not be disturbed (*e.g.*, within the drip-zone of the large trees), remediation of these areas would be considered during the design.

Excavated soil/fill material would either be reused at the SYW-12 Site (*e.g.*, under multi-use recreational trail, site grading and aesthetics) under Alternative 4A or transported and disposed off-site under Alternative 4B. Soils remaining on Site would be placed beneath an engineered cover consisting of a 2-ft thick soil cover over approximately 3 AC of upland areas for the purposes of reducing potential erosion and mitigating potential exposures and associated risks to constituents exceeding SCOs in soil/fill material. Disturbance of approximately 0.5 AC of forested upland/wetlands would be needed to reach these 1.2 AC of non-forested wetlands, and the engineered cover system would be extended over these 0.5 AC. Wetland restoration will be

considered for the 0.5 AC of forested wetland assumed to be disturbed during implementation of Alternative 4. The final wetland restoration approach, including opportunities to improve wetland functions and values, would be further evaluated during the design phase[7]. Permitting requirements such as those in 6 NYCRR Part 663, Article 15 and 6 NYCRR Part 608 would also be considered during the design phase.

Mechanical excavation would be conducted to remove surface soil/fill material exceeding the SCOs for Commercial Use and the Protection of Ecological Resources within 6.5 AC of non-forested wetland areas on the eastern and western portions of the SYW-12 Site (interior wetlands). For cost estimation purposes in the FS, the total volume of soil to be excavated is estimated at approximately 21,000 cy based on assumed removal of soil from existing grade to approximately 2-ft bgs.

The excavated areas would be covered and restored as a wetland with a 2-ft thick soil/wetland cover over 6.5 AC (and additional 0.5 AC of forested upland/wetland assumed to be disturbed), providing 12-in subgrade material and 12-in topsoil. As a result, the total acreage of engineered soil cover under Alternative 4 is 10 AC of wetland and upland soil cover over existing 6.5 AC of non-forested wetland, 0.5 AC of forested upland/wetland, and existing 3 AC of non-forested upland areas. A demarcation layer would be considered during the remedial design to delineate the boundary between soil/fill material and restored wetland/engineered soil cover system and would be compatible with the wetland, as necessary. The conceptual boundaries of the surface soil/fill material removal areas are illustrated on Figure 3-2. Onondaga County's multi-use recreational trail construction is anticipated to begin in the near future.

A geotechnical evaluation has been performed to evaluate implementability by reviewing settlement and stability concerns relative to the railroad tracks. Global slope stability related to excavation activities along the railroad was evaluated and found to significantly limit implementability of this alternative. Specifically, the calculated exiting Factor of Safety is close to 1.0, and excavation in the vicinity of the railroad tracks further reduces the Factor of Safety below 1.0. A typical Factor of Safety for construction is 1.3 for the interim condition in accordance with the *Engineering and Design Manual Slope Stability* prepared by the U.S. Army Corps of Engineers (USACE, 2003). Global slope stability failures are typically catastrophic and in the vicinity of an active railroad have the potential for derailment, loss of life and/or temporary closing of a rail line. Offsetting the excavation 20 feet would result in no discernable effect on the existing railroad factor of safety. Offsetting the excavation 50 feet would be required for the excavation to be outside of the potential failure surface along the railroad. Further refinement of offsets, including additional offset safety buffers, is required in final design. Offsets or slotted excavation techniques alone are not anticipated to result in acceptable conditions and would require additional stabilizing measures such as ground improvements or rigid inclusions (*e.g.*, sheet piling). Ground improvements or rigid inclusions have significant stability concerns due to the sensitivity of the soils and proximity to the railroad tracks. Further geotechnical evaluations would be necessary to evaluate excavation and stabilizing measures in the vicinity of the railroad.

[7] During wetland design, the following will be addressed:

- The principle of minimization of wetland loss would be applied
- Mitigation would be considered where wetland construction results in loss of wetland acreage or function.

In regard to settlement, a maximum total settlement of 0.2 inches was estimated at the railroad track bed as a result of replacement of engineered soil cover following excavation. Over 30 years, the existing creep rate along the rail line is 0.6 inches. For this reason, the calculated settlement resulting from the placement of the engineered cover is anticipated to be implementable. In addition, stability of features such as construction roads were also evaluated. It was concluded that stability concerns related to construction safety can be mitigated through design. These findings are documented in the *Geotechnical Report Honeywell SYW-12 Site at Onondaga Lake* (B&B Engineers & Geologists of New York, P.C. 2021). These findings would be shared with railroad operators as part of the design phase.

Because the Onondaga County trail has not yet been constructed additional geotechnical evaluations and discussion, and coordination with railroad operations needs to be conducted, the boundaries of the cover system illustrated in Figure 3-2 are conceptual.

The cover system would require routine maintenance and inspection to maintain integrity and proper function.

Alternative 4A — On-Site Reuse

Excavated material could be reused on-site under Alternative 4A. For remedial alternative cost estimation purposes, it was assumed that approximately 21,000 cy of soil/fill material could be reused at the SYW-12 Site for uses including, but not limited to, placement under a multi-use recreational trail, site grading and aesthetic features. Consistent with NYSDEC's DER-10, excavated material would be covered by a 2-ft thick soil cover. Reuse options and limitations (*e.g.*, within wetland areas) would be further evaluated during pre-design and design activities. The large areas of wetland covering the Site coupled with uncertainty in installation timeframes for planned features at the Site may limit reuse options.

For the purpose of developing FS cost estimates, it was assumed that excavated soil/fill material would be consolidated under approximately 3 AC of upland cover. Should additional excavated spoils require stockpiling, they would be covered and maintained such that adverse effects of soil erosion and direct contact by potential human and ecological receptors would be addressed. It was also assumed that excavated materials would not require amending (*i.e.*, stabilization) prior to placement. Based on the descriptions and assumptions above, it is anticipated that Alternative 4A would be constructed and soil/fill reused on-Site over the course of one to two construction seasons, resulting in approximately 2,650 truck trips (*i.e.,* round-trip).

Alternative 4B – Off-Site Transportation and Disposal

Excavated material was assumed for off-site transportation and disposal under Alternative 4B. For remedial alternative cost estimation purposes, it was assumed that approximately 21,000 cy of soil/fill material would be transported and disposed off-site. Based on the descriptions and assumptions above, it is anticipated that Alternative 4B would be constructed and soil/fill transported off-site over the course of one to two construction seasons, resulting in approximately 4,200 truck trips (*i.e.,* round-trip).

3.6.5 Alternative 5 – Full Removal (Including All Trees) and Off-site Disposal (23.5 AC) with MNA

Alternative 5 includes mechanical excavation of soil/fill material within forested and non-forested areas of the SYW-12 Site. Excavated soil/fill material would be transported off-site for disposal. Excavated areas would be backfilled, and wetlands and upland vegetation would be restored. In addition, Alternative 5 also includes ongoing natural attenuation, including MNA of naphthalene in groundwater. Groundwater monitoring would be performed as part of site management and MNA of other contaminants may be evaluated, if necessary.

Alternative 5 is intended to evaluate restoration of the SYW-12 Site to unrestricted use conditions through the full excavation of soil/fill material. As such, Alternative 5 includes removal and replacement of soil/fill material at the Site exhibiting concentrations above 6 NYCRR Part 375 Unrestricted Use SCOs where accessible. This is anticipated to require removal of material as deep as 16 ft bgs. Excavated material would be managed off-site. Due to the required 30-foot setback from the adjacent CSX Railroad tracks, impacted material may remain on-Site. Therefore, institutional controls, a site management plan, periodic reviews, and groundwater monitoring, as described under Alternative 2, may be necessary. This alternative would also include ongoing natural attenuation. Based on the descriptions and assumptions below, it is anticipated that this alternative would be constructed in five to seven construction seasons.

Excavation depths and volumes required to achieve unrestricted conditions are anticipated to present the following constructability and community concerns:

Geotechnical Concerns, Mechanical Excavation and Off-Site Disposal of Soil/Fill

Mechanical excavation would be conducted to remove Site-wide soil/fill material. Material to be removed ranges in thickness between 6 and 16 ft over approximately 23.5 AC. A geotechnical evaluation has been performed to evaluate implementability and stability concerns relative to the railroad tracks for Alternatives 3 and 4. This evaluation identified implementability concerns associated with shallow excavation included in Alternative 4, thus, these concerns would be greater for the deeper excavations included in Alternative 5. Engineering controls (*i.e.*, sheet piling and bulkhead) would be necessary along the perimeter of the SYW-12 Site to maintain stability of excavation walls, prevent potential impacts to the railroad tracks and to prevent inundation from Onondaga Lake and the mouths of Onondaga Creek and Ley Creek. Due to the required setbacks from the adjacent railroad tracks, no soil removal is assumed within 30-ft of rail structures. Further geotechnical evaluations would be necessary to evaluate sheet pile installation in the vicinity of the railroad. Therefore, impacted material may remain on-Site following excavation due to these constraints. Based on these assumptions, approximately 400,000 cy of soil/fill material is estimated for excavation under Alternative 5.

It has been assumed that dewatering soil/fill material would be required during excavation below the groundwater table and prior to off-site transportation and disposal. Treatment of construction water is anticipated to be necessary. For purposes of estimating costs for this alternative, it is assumed that a temporary water treatment facility would be utilized to treat this construction water.

Because additional geotechnical evaluations and discussion and coordination with Onondaga County and railroad operations needs to be conducted, the remedy depiction illustrated in Figure 3-3 is conceptual.

Off-Site Transportation and Disposal

For remedial alternative cost estimation purposes, a total of 400,000 cy of excavated soil/fill material was assumed for off-site transportation and disposal under Alternative 5. Due to the number of trees and larger organic debris that will be generated from clearing, it is assumed that an estimated 900 tons of organic debris will also require off-site transport and management. For remedial alternative cost estimating purposes, approximately 600,000 tons of soil would be transported and disposed off-site. It is estimated that the soil/fill and organic debris would be transported off-site over the course of four construction seasons, resulting in approximately 56,000 truck trips (*i.e.,* round-trip).

Following excavation of soil/fill material, Alternative 5 would require backfill and restoration. A demarcation layer would be considered during the remedial design to delineate the boundary between remaining soil/fill material and clean backfill along the CSX railroad track setback. Approximately 13.1 AC of wetlands are projected to be disturbed under this alternative. The disturbed areas are anticipated to be restored as both forested and non-forested wetland on the SYW-12 Site. Clean backfill would be transported via trucks from off-site borrow sources to the Site for restoration of approximately 13.1 AC of existing wetland footprint. Excavation areas would be backfilled to existing grade using materials appropriate for wetland establishment. Appropriate wetland species would be planted to reestablish both forested and non-forested wetlands to include wetland vegetation, shrubs and trees.

4. DETAILED ANALYSIS OF ALTERNATIVES

This section documents the detailed analysis of five remedial alternatives developed during the assembly of remedial alternatives. The detailed analysis of the remedial alternatives was conducted consistent with NYSDEC's *DER-10 Technical Guidance for Site Investigation and Remediation* (NYSDEC 2010a), the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA 1988), and consistent with the *RI/FS Work Plan* (OBG 2002). This section describes the individual and comparative analysis of the remedial alternatives with respect to ten evaluation criteria that embody the specific statutory requirements that must be evaluated to satisfy the CERCLA remedy selection process. As described in Section 4.2.1, Alternative 2, the limited actions alternative, would not provide protection of the environment; therefore, it does not meet the threshold criteria described below. Consistent with the NCP, Alternative 2 shall not be considered further in the detailed evaluation and comparative analysis of alternatives.

4.1 Individual Analysis of Alternatives

NYSDEC DER-10 Section 4.2 indicates that, during remedy selection, ten evaluation criteria should be categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria. The threshold criteria must be satisfied in order for an alternative to be eligible for selection. The primary balancing criteria are used to balance the differences between the alternatives. The modifying criteria are formally considered during the NYSDEC review of, and public comment on, the Proposed Plan. The criteria are described below:

Table 4 – Remedial Alternative Evaluation Criteria

Criterion	Considerations
Threshold Criteria	
Overall protectiveness of human health and the environment	• Achievement and maintenance of adequate protection • Elimination, reduction, or control of site risks through treatment, engineering, or institutional controls • Assessment relative to the current, intended, and reasonably anticipated future use of the Site and its surroundings.
Compliance with ARARs	• Attainment of chemical-, location-, and action-specific ARARs • Grounds for invoking a waiver, if necessary.
Primary Balancing Criteria	
Long-term effectiveness and permanence	• Magnitude of potential residual risk from materials remaining at the conclusion of the remedial activities. • Adequacy and reliability of controls necessary to manage materials left on Site.
Reduction of toxicity, mobility, or volume through treatment	• Treatment or recycling processes employed, and materials treated • Amount of hazardous substances, pollutants, or contaminants treated or recycled • Degree of expected reduction of mobility, toxicity, or volume of the waste due to treatment or recycling

Criterion	Considerations
	• Degree to which treatment would be irreversible • Type and quantity of residuals that would remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate • Degree to which treatment would reduce the inherent hazards posed by the Site.
Short-term effectiveness	• Short-term potential risks to the community during implementation • Potential impacts to workers and effectiveness/reliability of protective measures • Potential environmental impacts and the effectiveness/reliability of mitigative measures • Time until protection would be achieved.
Implementability	• Technical difficulties and unknowns • Reliability of the technology • Ease of undertaking additional remedial actions • Ability to monitor the effectiveness of the remedy • Activities needed to coordinate with other offices and agencies • Ability and time required to obtain any necessary agency approvals and permits • Availability of adequate off-site treatment, storage, and disposal capacity/services • Availability of necessary equipment and specialists • Provisions to obtain necessary additional resources • Availability of prospective technologies.
Cost	• Capital costs • Annual O&M costs • Periodic O&M costs • Present worth cost.
Land Use[8]	• Consistency with land use
Modifying Criteria	
State acceptance	• Indicates whether, based on its review of the RI/FS reports and the Proposed Plan, the state supports, opposes, and/or has identified any reservations with the preferred response measure.
Community acceptance	• Summarizes the public's general response to the response measures described in the Proposed Plan and the RI/FS reports. Community acceptance will be assessed in the ROD and includes determining which of the response measures the community supports, opposes, and/or has reservations about.

[8] Land use is not a criterion under the NCP; however, it is a primary balancing criterion under NYSDEC's guidance entitled *DER-10/Technical Guidance for Site Investigation and Remediation* (NYSDEC 2010a). For this reason, it is retained as a primary balancing criterion for the detailed analysis of alternatives at this Site.

The objective of the detailed analysis of alternatives was to analyze and present sufficient information to allow the alternatives to be compared and a remedy selected. The analysis consisted of an individual assessment of each alternative with respect to the evaluation criteria that encompass statutory requirements and overall feasibility and acceptability. The summary of this analysis is presented in Table 4-1.

4.1.1 Area-Weighted Average Concentrations

Limited additional analysis of available data was conducted as a mechanism for further evaluating remedial alternatives. Area-Weighted Average Concentrations (AWACs) were developed for the constituents identified as representative risk and remedy drivers to aid in assessing remedial alternatives in the context of FS threshold criteria. As discussed above in Section 2.7, six representative risk and remedy drivers (cadmium, chromium, mercury, benzo[a]pyrene, 4,4'-DDT and total PCBs) were selected based on their concentrations, PBT designation, role in driving risk at the Site, and general co-location with the remaining FS COCs. Because AWACs are constituent-specific values representative of the Site as a whole, they are useful in characterizing current and future conditions and thereby assessing overall remedy protectiveness and compliance with ARARs.

AWACs were developed for current (pre-remediation) conditions as well as for post-remediation scenarios (Alternatives 3 and 4). A total of 21 sample locations utilizing surface soil (0-2 ft bgs) data collected in 2006 served as the basis for the assessment, including the incorporation of results from the 0-0.5, 0.5-1, and 1-2 ft horizons. Treatment of the data was consistent with the approach utilized in the Geddes Brook/Ninemile Creek FS Report (Parsons 2005). Procedures for utilizing these data are discussed further in Appendix 8.

ArcGIS was used to conduct the AWAC analysis using the software's inverse distance weighting function to create a surface of interpolated values from empirical sample data for each constituent. In the next step, interpolated concentrations are multiplied by the area they represent (weighted) and the products summed. The result of the summation is then divided by the total acreage of the Site to develop an area-weighted average concentration. In the pre-remediation scenario, the average concentrations of the interpolated surface are equivalent to the AWAC value for each constituent.

AWACs were developed for current site conditions and post-remedy conditions For Alternatives 3 and 4 (AWACs are not considered a necessary exercise for full removal—Alternative 5). Post-remedy AWACs reflect the arithmetically combined concentrations associated with topsoil placement (as part of a cover or post-excavation restoration) and remaining surface soil concentration in undisturbed areas. The assumed topsoil concentration and source are provided in Appendix 8. As such, these AWACs reflect the spatially weighted concentration representing both the remediated area and undisturbed portions of the Site. A comparison of surface soil analytical results for select constituents to SCOs is presented in Appendix 3 for reference.

The development of AWACs is based on the premise that interpolated values are more similar to known values when they are near and less similar farther away, as well as the assumption that interpolated concentrations are representative of actual concentrations on-site. Additional information collected in the future (*e.g.*, as part of a pre-design investigation) may be used to update and refine the AWAC analysis and reduce uncertainty inherent in interpolative techniques.

Additional discussion on incorporating AWACs into the assessment of protectiveness and informing the analysis of alternatives is presented in Section 4.2.1.

4.2 Comparative Analysis of Alternatives

The detailed analysis of alternatives also included a comparative evaluation designed to consider the relative performance of the alternatives and identify major trade-offs among them. The comparative evaluation of the alternatives is presented in the following subsections. In the comparative analysis of alternatives, the performance of each alternative relative to the others was evaluated for each criterion. As noted in Section 4.1, the detailed evaluation with respect to the FS criteria for each of the alternatives is presented in Table 4-1.

4.2.1 Overall Protection of Human Health and the Environment

Based on the reasonably anticipated future SYW-12 Site use as including a recreational trail (including post-HHRA evaluations), current human health hazards and risks associated with recreational use for all receptors are acceptable based on post-HHRA re-evaluations of hazard and risk and the absence of detectable chromium in groundwater (see Section 2.6.1). Alternative 1, the no action alternative, would not provide protection of human health relative to potential exposure to soil/fill material and groundwater for receptors such as construction or utility workers. Alternative 2, that only includes institutional controls, does not provide protection of the environment because it does not address ecological receptors at the Site. For this reason, Alternative 2 is not advanced further in the comparative analysis of alternatives. Alternatives 3 through 5 would provide for human health protection relative to potential exposure to soil/fill material through engineering and institutional controls. Institutional controls, a site management plan, and groundwater monitoring included in Alternatives 3 through 5 would provide protection of human health relative to potential exposure to surface and subsurface soil/fill material, sheens and groundwater for receptors such as construction or utility workers. The site management plan would require special measures to control water during excavation activities. Groundwater monitoring would also provide a means to monitor the progress of natural attenuation of naphthalene in groundwater. Alternative 3 would provide protectiveness through placement of a wetland cover and engineered soil cover within non-forested wetland and non-forested upland areas, respectively, in addition to institutional controls, and groundwater monitoring. Alternative 3 would also include the flexibility to provide added protection (as determined by pre-design soil sampling) through grading/handling of surface soil/fill material to address 2.2 additional acres of additional wetland and upland areas. Alternative 4 would provide protectiveness through removal of surface soil/fill material within non-forested wetlands, restoration of non-forested wetlands, placement of an engineered cover within non-forested upland areas, institutional controls, and groundwater monitoring.

An evaluation of surface soil AWACs was conducted for existing conditions and conditions following implementation of Alternatives 3 and 4, illustrating improvement in average surface soil concentrations as a result of these remedies (see Appendix 8) Based on the analysis presented in Section 4.1.1 and detailed in Appendix 8, surface soil AWACS are below SCOs for Commercial Use for chromium, mercury, 4,4-DDT and total PCBs with no further remedy implementation (*i.e.*, under Alternative 1). Implementation of Alternatives 3 or 4 would further reduce AWACs for these representative risk and remedy drivers and would reduce AWAC values for cadmium to below the corresponding Commercial Use SCO. Implementation of Alternatives 3 and 4 would also reduce AWAC values for benzo(a)pyrene to concentrations marginally exceeding the

corresponding Commercial Use SCO. Potential exposure risks for human receptors to residual contamination would be addressed through engineering and institutional controls.

Ecologically-focused remediation goals include achieving protection and reducing ecological exposure which is accomplished by balancing remedial activities with habitat disruption, particularly in consideration of the extensive utilization of the Site by the bald eagle and overall high value of the forested SYW-12 Site habitat. Remedial Alternatives 3 and 4 are expected to reduce average surface soil concentrations below SCOs for the Protection of Ecological Resources for benzo(a)pyrene and total PCBs. Post-remediation AWACs for cadmium, chromium, mercury, and 4,4-DDT would potentially exceed SCOs for the Protection of Ecological Resources within the top two feet of soil, though significant reductions are anticipated.

Further examination of post-remedy exposure for these constituents was completed by examining the potential risk to the most sensitive receptor evaluated in the BERA, the short-tailed shrew. Potential risks for Alternatives 3 and 4 were examined using the exposure parameters and assumptions presented in the BERA and the AWACs developed for these alternatives as the exposure point concentration. Based on this analysis for constituents that would potentially exceed the SCOs for the Protection of Ecological Resources, Alternatives 3 and 4 would reduce lowest observed adverse effect level (LOAEL)-based HQs to less than one for mercury and 4,4-DDT, while values for cadmium and chromium only marginally exceed one in these remedial scenarios (Alternative 3: cadmium = 4.6, chromium = 1.5; Alternative 4: cadmium = 4.3, chromium = 1.4). Recognizing the small home range of the short-tailed shrew, additional perspective regarding the risk associated with exposure to cadmium and chromium is gained through an examination of the LOAEL-based HQs for these constituents on a sample location-specific basis. Using the location-specific inputs developed in support of the AWAC analysis, a point-by-point assessment of LOAEL-based HQs indicates that more than half of HQs greater than one are addressed for cadmium and chromium by the proposed Alternatives 3 and 4. This analysis also identifies that the highest six HQs for cadmium and seven of the highest eight HQs for chromium are addressed by these remedial alternatives.

Although slight impacts to individual receptors with smaller home ranges within the forested area may occur, this analysis suggests that effects at the population level across the Site are expected to be marginal once remediation is implemented (addressing the highest concentrations and LOAEL-based HQs). Given the fact that post-remedy HQs for cadmium and chromium are only marginally above one for the most sensitive receptor and that Alternatives 3 and 4 reduce HQs below one for mercury and 4,4-DDT and meet SCOs for the Protection of Ecological Resources for benzo(a)pyrene and total PCBs, ecological exposures are expected to be minimal following remedy implementation. Further, the ecological benefit of preserving critical forest habitat heavily utilized by the bald eagle and preserving/enhancing the overall value of SYW-12 Site habitat may outweigh the presence of some elevated concentrations of metals and pesticides. This is particularly pronounced when one considers that the removal of mature trees would not be offset by replanting young trees for multiple decades and that the success of fully mitigating the lost function and value associated with removal of forested habitat is expected to be low. The bald eagle currently utilizes the forested habitat extensively (particularly in the winter), and the wholesale removal of these trees associated with a more intrusive remedy would disrupt this behavior for the foreseeable future which is considered unacceptable by multiple stakeholders and in contrast to New York State regulations pertaining to protections of threatened species and

their habitat. NYSDEC Division of Environmental Remediation Policy 31 (Green Remediation) outlines the State's preferred approach to remediating a site in the context of the larger environment. This policy reflects the practice and expectation of "*considering **all** environmental effects of remedy implementation and incorporation options to **minimize the environmental footprint** of cleanup actions*". Alternatives 3 and 4 are consistent with this policy through the minimization of disturbance to a highly valued habitat and iconic national species.

Therefore, based on the fact that Alternatives 3 and 4 address a significant portion of the elevated concentrations at the Site, that remaining concentrations are not expected to have population level effects when the Site is considered in its entirety, and that significant habitat alteration and bald eagle disturbance is avoided, Alternatives 3 and 4 are considered protective of ecological exposures. Alternatives 3 and 4 address protectiveness of anticipated future use and ecological receptors while observing primary tenets of *Ecological Risk Assessment Guidance for Superfund* (ERAGS; USEPA 1997) and *NYSDEC DER-31* (Green Remediation Program Policy).

Consistent with 6 NYCRR-1.8(f) and DER-10.4.2(i), the current, intended, and reasonably anticipated future use of the SYW-12 Site was considered when selecting SCOs. Alternative 1 would not be consistent with current, intended, and reasonably anticipated future use of the Site. The engineered cover system in Alternative 3 would address at least 8.2 AC of non-forested wetland and upland area surface soil/fill material exceeding SCOs consistent with current, intended, and reasonable anticipated future use of the Site. The engineered cover systems with added removal of surface soil/fill material in Alternative 4 would support the current, intended, and reasonably anticipated future land use, and address the 10 AC of non-forested wetland and upland areas along with 0.5 AC of forested upland; however, it is anticipated to impact mature trees that are important habitat to the bald eagle. Removal of soil/fill material in Alternative 5 would support the current, intended, and reasonably anticipated future land use and address 23.5 AC of Site area exceeding SCOs; however, it would delay future construction and/or use of a recreational trail planned at the SYW-12 Site and would result in Site-wide clearing of valuable forested habitat.

Alternative 1 would not address RAOs related to potential erosion and direct contact with soil/fill material. Alternatives 3 and 4 would provide protectiveness of the environment and would provide for additional protection of human health within non-forested wetland and upland areas and would meet RAOs through the use of engineered cover systems, which would control potential erosion of, and direct contact with, soil/fill material as well as control the potential inhalation of dust in these areas. Alternative 4 would provide added protection of human health and the environment within non-forested wetland areas as compared to Alternative 3 and would meet RAOs through covers and the removal of surface soil/fill material for portions of the Site. Institutional controls, a site management plan, and monitoring would provide for continued protection of the environment and provide a means to evaluate continued protectiveness in Alternatives 3 through 5. Alternatives 3 and 4 also include biota monitoring for the purpose of assessing protectiveness. Alternative 5 would be protective of human health and the environment within forested and non-forested wetland and upland areas through removal of accessible surface and subsurface soil/fill material and would allow for unrestricted use of the majority of the Site by addressing soil/fill material exceeding SCOs for Unrestricted Use. With the exception of Alternative 5, each of the alternatives would provide preservation of trees utilized seasonally by bald eagles for roosting.

In summary, Alternatives 1 and 2 do not satisfy the threshold criteria. Alternative 1 does not provide protection of human health and the environment, and Alternative 2 does not provide protection of the environment. Alternative 2 will not be advanced further in the comparative analysis of alternatives. Alternatives 3 through 5 would satisfy the threshold criteria by providing protection of human health and the environment. Alternatives 3 through 5 would provide varying degrees for protection of human health and the environment through engineering and institutional controls. Alternative 5 would provide the greatest protectiveness; however, Alternative 5 would result in the greatest impact to forested habitat, including eagle roosting, through Site-wide removal of trees. Alternatives 3 and 4 are considered protective of human and ecological receptors by addressing elevated soil concentrations while preserving the highly valued habitat, critical to overall SYW-12 Site ecology and utilized by the bald eagle. Alternative 4 is anticipated to result in greater disturbance to the eagle habitat, since it requires removal of mature trees.

4.2.2 Compliance with ARARs

Potential chemical-, location-, and action-specific ARARs identified for consideration in the FS are summarized in Table 3-1. Table 3-1 identifies the 6 NYCRR Part 375 SCOs for Commercial Use as ARARs. While surface soil at the Site exhibit concentrations above Commercial Use SCOs, as discussed above under Sections 2.6.1 (HHRA) and 4.2.1 (Overall Protection of Human Health and the Environment), the *Revised HHRA* and subsequent re-evaluation identified acceptable risks for anticipated use of the Site (*e.g.*, recreational trail). Alternative 1 does not provide a means of addressing soil/fill material exceeding SCOs. Institutional controls, a site management plan and periodic reviews included in Alternatives 3 through 5 would reduce the potential for human exposure and associated risks to soil/fill material exceeding ARARs. Although groundwater is not currently or anticipated to be used as a potable water source, potential exposures to groundwater exceeding chemical-specific ARARs would also be addressed through institutional controls under Alternatives 3 through 5. Groundwater monitoring would provide a means to measure the progress of natural attenuation of naphthalene in groundwater under Alternatives 3 through 5.

For Alternative 3, soil exceeding SCOs would be addressed within a portion of the non-forested wetland and upland areas through installation of an engineered cover system where accessible and not detrimental to the environment (*e.g.*, tree removal, disturbance of bald eagles). Installation of an engineered cover with additional removal of surface soil/fill material within the western portion of the non-forested wetland areas and restoration with clean material would address soil exceeding SCOs within additional non-forested wetland in Alternative 4 as compared to Alternative 3, though this would require removal of some forested habitat. As described in Section 4.2.1, although some areas exhibiting concentrations greater than SCOs would remain undisturbed, based on the fact that Alternatives 3 and 4 address a significant portion of the elevated concentrations at the Site, remaining concentrations are expected to be protective of community impacts to ecological receptors throughout the Site, based on area weighted averaging calculations coupled with avoidance of significant habitat alteration and bald eagle disturbance. Alternative 5 would address surface and subsurface soil exceeding Unrestricted Use SCOs within the footprint of the SYW-12 Site, including forested and non-forested areas. For Alternative 4, should reuse of material be incorporated into the remedy, consideration for re-exposure and long-term management would be addressed in remedial design and O&M requirements.

No location- or action-specific ARARs were identified for Alternative 1, the no action alternative. Construction methods and safety procedures would be implemented to adhere to the location- and action-specific ARARs identified in Alternatives 3 through 5. Specifically, institutional controls would be implemented in Alternatives 3 through 5 in general conformance with NYSDEC's guidance DER-33 (NYSDEC 2010b) and EPA Guidance (see https://www.epa.gov/superfund/superfund-institutional-controls-guidance-and-policy). Additionally, Alternatives 3 and 4 would mitigate potential erosion and exposure to soil/fill material where engineered cover systems are installed and would be implemented in general conformance with NYSDEC's DER-10 (NYSDEC 2010a). Procedures would be implemented to adhere to the location-specific ARARs related to federal and state requirements for cultural, archeological, and historical resources. Additionally, proposed actions would be conducted in a manner consistent with Fish and Wildlife Coordination Act requirements for protection of Onondaga Lake and for areas proximate to Onondaga Lake. As necessary, proposed actions under Alternatives 3 through 5 would be implemented in general conformance with state and federal wetland and floodplain assessment requirements in addition to navigable waterway and New York State Railroad Law. Specifically, wetland permitting requirements such as those in 6 NYCRR Part 663, Article 15 and 6 NYCRR Part 608 would be considered during the remedial design phase. With respect to action-specific ARARs, proposed engineered cover system, wetland restoration and excavation activities would be conducted consistent with applicable standards; earth moving/excavation activities would be conducted consistent with air quality standards; and transportation and disposal activities would be conducted in accordance with applicable State and Federal requirements, by licensed and permitted haulers.

Location-specific ARARs related to habitat protection, including the Federal Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq), USFWS National Bald Eagle Management Guidelines (USFWS 2007), Conservation Plan for Bald Eagles in NYS (NYSDEC 2016), and 6 NYCRR 182 provide requirements and guidance regarding the protection of bald eagle habitat, including the take and disturbance of bald eagles, and limiting activities that may alter communal roost sites and foraging areas. Alternatives 3 and 4 can be implemented while preserving the valuable tree habitat, with minimal removal of low to mid-story vegetation and retaining larger-scale vegetation at the Site, whereas Alternative 5 requires Site-wide removal of trees currently providing high-value forested habitat at the site and used as winter eagle roosting habitat at the Site.

In summary, Alternative 1 does not provide a means to attain chemical-specific ARARs. Alternatives 3 and 4 provide a means for attaining chemical-specific ARARs for soil/fill material to the extent practicable, in light of the presence of sensitive eagle habitat. Alternative 4 would address an additional 1.8 acres of the Site, as compared to Alternative 3, however, Alternative 4 is anticipated to result in impacts to the important forested habitat. While Alternative 5 provides for attainment of chemical-specific ARARs across the Site, this would require removal of all the trees that currently provide high-value forested habitat at the Site and serve as winter roosting habitat for bald eagles. Alternatives 3 and 4 can be implemented consistent with action-specific and location-specific ARARs.

4.2.3 Long-term Effectiveness and Permanence

The *Revised HHRA Report* and subsequent updated evaluations concluded that potential risks associated with exposure to surface soil/fill material under planned recreational use of the SYW-12 Site are acceptable under current conditions. Potentially unacceptable human health risks associated with potential human exposure to groundwater (*e.g.*, construction or utility workers) would remain in Alternative 1; whereas these potential risks would be addressed through institutional controls in Alternatives 3 through 5 and removal of accessible soil/fill material to achieve Unrestricted Use SCOs in Alternative 5. Remedial actions proposed under Alternatives 3 through 5 would provide for additional human health and ecological risk protection over the long-term.

Residual risks associated with surface soil/fill material would be addressed via an engineered cover system in Alternative 3, and via removal of surface/soil fill material and an engineered cover system in Alternative 4. Alternative 4 would provide some additional residual risk reduction relative to Alternative 3 as it would result in remediation of a greater acreage of wetland. Residual risks associated with surface soil within forested wetland areas would be addressed through institutional controls. Mature trees utilized at the SYW-12 Site by bald eagles would be maintained in Alternatives 1, 3 and 4; however, clearing of mature trees would be required under Alternative 5. Limited clearing of undergrowth and trees would be required for implementation and access purposes in Alternative 4. Residual risks associated with soil/fill material would be addressed under Alternative 5; however, clearing of mature tree stands would remove valuable habitat as a result of remedy implementation. Institutional controls, a site management plan and periodic reviews under Alternatives 3 through 5 would also address residual risks associated with groundwater and soil/fill material.

USFWS advises balancing ecological risk associated with soil and sediment contamination with adverse impacts to bald eagles if roost trees are removed (USFWS 2018). Specifically, USFWS recommended that remedial activities include minimal tree clearing and be performed outside the December 15 to March 15 winter roosting season. NYSDEC also recommend that forestry activities and tree clearing be performed outside the December 1 to March 31 winter roosting season (NYSDEC 2016). As described in Section 4.2.1, although some areas exhibiting concentrations greater than SCOs would remain undisturbed, Alternatives 3 and 4 are expected to be protective of community impacts to ecological receptors throughout the Site, based on area weighted averaging calculations coupled with avoidance of significant habitat alteration and bald eagle disturbance. Alternatives 3 and 4 would provide a better balance between addressing soil/fill material concentrations and tree preservation, as compared to Alternative 5, as disturbance of forested areas would be minimized under Alternatives 3 and 4 in order to preserve the valuable tree habitat. Alternative 5 would address RAOs in forested and non-forested areas at the Site, however, Alternative 5 would require Site-wide removal of trees currently used as winter eagle roosting habitat at the Site.

No controls are included in Alternative 1. Institutional controls, site management plan, and periodic reviews included in Alternatives 3 through 5 would be an adequate and reliable means of controlling SYW-12 Site use and potential exposure to soil/fill material and groundwater. Groundwater monitoring included in Alternatives 3 and 4 also would provide an adequate and reliable means of monitoring conditions at the SYW-12 Site and evaluating constituent attenuation over the long-term. Biota monitoring included under Alternatives 3 and 4 would

provide a means of monitoring remedy effectiveness and assessing protectiveness of ecological receptors. Maintained engineered cover systems included in Alternatives 3 and 4 would be adequate and reliable means of controlling potential erosion of and exposure to soil/fill material within non-forested wetland and upland areas. The cover systems and restoration activities under Alternatives 3 and 4 would also provide a means for wetland restoration and mitigation, enhancing the function and value of on-Site non-forested wetlands. Excavation and off-site management of soil/fill material in Alternative 5 would provide adequate and reliable means of controlling potential erosion of and exposure to SYW-12 Site soil/fill material.

Long-term O&M requirements, including wetland and cover inspection and maintenance and groundwater and biota monitoring, in Alternatives 3 and 4 would result in minimal impacts to the environment. No long-term sustainability impacts are anticipated for Alternative 5 since no long-term maintenance would be required. Consistent with NYSDEC and USEPA policies on green remediation, sustainability considerations alone should not be used to justify implementation of a no further action or a less comprehensive alternative.

In summary, Alternatives 3 through 5 would provide long-term effectiveness and permanence, while Alternative 1 would not. Alternative 5 provides the most reduction in residual risk, however, it requires removal of trees that enhance the overall value of SYW-12 Site habitat and provide eagle roosting habitat. While Alternatives 3 and 4 would support the anticipated future use of the SYW-12 Site for a multi-use recreational trail while preserving trees utilized seasonally by bald eagles for foraging and roosting. Alternative 4 would provide some additional level of long-term effectiveness and permanence relative to Alternative 3 as it would result in a greater acreage of remediation although limited tree removal would be required. Potential residual human health risks associated with Alternatives 3 through 5 are adequately and reliably addressed through engineering and institutional controls. Each alternative would result in minimal long-term fuel/energy consumption, greenhouse gas emissions, and impacts to water, ecology, workers, or the community associated with long-term maintenance of the remedies.

4.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

There would be no reduction in toxicity, mobility, or volume in soil/fill material through treatment provided in Alternatives 1 and 3 through 5. Reduction of mobility (*i.e.*, potential erosion) of representative risk and remedy driver constituents in surface soil/fill material would be addressed through installation of the engineered cover systems in Alternatives 3 and 4. Based on the results of the surface soil pre-design investigation, Alternatives 3 and 4 may provide added reduction of mobility of representative FS risk and remedy driver constituents through installation of additional engineered cover. Alternative 5 would provide for the greatest reduction in toxicity, mobility, and volume through excavation and off-site management of surface and subsurface soil/fill material. Reduction of mobility and volume of representative constituents in surface soil/fill material would not be due to treatment. Under each alternative, natural attenuation is expected to reduce groundwater naphthalene concentrations over the long-term.

4.2.5 Short-term Effectiveness

Alternative 1, the no action alternative, does not include active remedial components, and therefore, would not present potential adverse impacts to workers and the community. Alternatives 3 through 5 would be implemented and constructed using proper protective equipment to manage potential risks to on-site workers, and proper precautions and monitoring

to be protective of the general public and the environment. The RAOs related to protection of human health related to exposure to groundwater (intrusive exposure), protection of the environment relative to ecological exposure to and potential erosion of soil/fill material would not be met under Alternative 1. Potential public health exposure to groundwater would be addressed in Alternatives 3 through 5 through implementation of institutional controls and through removal of accessible SYW-12 Site soil/fill material in Alternative 5 to meet Unrestricted Use SCOs.

RAOs for the protection of public health would be met under Alternatives 3 through 5 upon implementation of Site-wide institutional controls. RAOs for the protection of the environment would not be attained Site-wide for Alternatives 1, 3, and 4. The engineered cover system in Alternatives 3 and 4 would address SCOs for Commercial Use and the Protection of Ecological Resources within non-forested wetland and upland areas where accessible and not detrimental to the environment (*e.g.,* tree removal, disturbance of bald eagles). Specifically, RAOs for the protection of the environment in non-forested areas would be addressed to varying degrees for Alternatives 3 and 4 upon installation of 8.2 AC cover systems (Alternative 3) and 10 AC cover systems (Alternative 4). In forested areas, RAOs for the protection of the environment would not be attained for Alternatives 3 and 4; however mature trees that currently provide valuable SYW-12 Site habitat and seasonal roosting habitat for bald eagles would be preserved. The RAO for the protection of the environment would be addressed upon removal of the soil/fill materials Site-wide under Alternative 5.

The groundwater restoration RAO is addressed for Alternatives 1, 3, and 4 through natural attenuation and through full removal of soil/fill material and natural attenuation in Alternative 5. Natural attenuation of organic constituents in groundwater at the SYW-12 Site is discussed in the *Revised SYW-12 2019 Groundwater Investigation Report* (Ramboll 2020). As summarized in that report, geochemical conditions at the Site are favorable for natural attenuation of PAHs, including naphthalene, to occur. Further, the presence of methane and observed decreases in groundwater concentrations of PAHs over time such as acenaphthene and naphthalene indicate that natural attenuation is likely occurring. Groundwater monitoring and institutional controls provided added protection for each of these alternatives.

Alternative 3 is anticipated to be completed within 1 construction season, while Alternative 4 is anticipated to be completed within 1 to 2 construction seasons. Due to the volume of surface and subsurface soil/fill material exceeding Unrestricted Use SCOs, Alternative 5 would require a longer timeframe to attain RAOs in the forested and non-forested wetland, as excavation is estimated to take place over 5 to 7 construction seasons.

Impacts to the community resulting from the construction of Alternatives 3 and 4 would primarily be due to increased truck traffic and increased noise for the duration of construction for the engineered cover systems under Alternative 3 and 4 and surface soil/fill material excavation under Alternatives 4A and 4B. Additional truck traffic and noise is anticipated for the duration of Alternatives 4B due to off-site transport of excavated surface soil/fill material. Alternative 5 would have significantly increased truck traffic, noise, dust and emissions compared to Alternatives 3 and 4 due to clearing the SYW-12 Site of mature tree stands prior to surface and subsurface soil/fill material excavation for the 5 to 7-year duration of construction. The implementation of the clearing, surface and subsurface soil/fill material excavation and off-site disposal included in Alternative 5 would result in far greater impacts to the community, including

substantially increased traffic, dust and emissions as well as increased noise. Additionally, Alternative 5 would involve the addition of sheeting along the railroad tracks and bulkhead installation along the shoreline during construction.

As it relates to traffic, transportation of engineered cover materials to the SYW-12 Site is anticipated to result in approximately 2,450 truck trips under Alternative 3, while transport of engineered cover materials, excavation of surface soil/fill material, on-site consolidation and wetland restoration under Alternatives 4A is anticipated to result in approximately 2,650 truck trips. Alternative 4B is anticipated to result in an additional 1,550 truck trips for off-site disposal of excavated soil/fill material when compared to Alternative 4A. Excavation of surface and subsurface soil/fill material, off-site transportation and disposal and wetland restoration included in Alternative 5 would result in approximately 56,000 truck trips, resulting in the greatest impact to traffic and short-term environmental footprint.

With respect to sustainability, there is an environmental footprint inherent in implementation of each alternative as it relates to construction and operation, as well as impacts to the community (as described above). The implementation of the excavation and off-site disposal included in Alternative 5 would result in far greater direct emissions and fuel consumption, as compared to importing construction materials and construction of the engineered cover system included in Alternative 3 and engineered cover systems, surface soil/fill material excavation and management of excavated material included in Alternative 4. Construction of Alternatives 3 and 4 would result in greater greenhouse gas impacts than Alternative 1, and construction of Alternative 5 would result in substantially greater greenhouse gas impacts than the other alternatives. It is estimated that greenhouse gas emissions associated with construction and transportation needs for Alternative 5 would be approximately 15,500 metric tons of carbon dioxide equivalent (MtCO2e), as compared to an estimated 375 MtCO2e for cover construction and removal of surface soil/fill material within the non-forested wetland areas with on-Site reuse in Alternative 4A, an estimated 850 MtCO2e for cover construction and removal of surface soil/fill material within non-forested wetland areas with off-site transport and disposal in Alternative 4B, and an estimated 375 MtCO2e for cover construction included in Alternative 3. Off-site transport and disposal of soil/fill material under Alternative 4B would represent a 40 to 125 percent increase in greenhouse gas emissions compared to on-site consolidation in Alternative 4A. Alternatives 3 and 4 would represent the equivalent of the annual emissions of approximately 50 to 180 cars; however, excavation of materials in Alternative 5 would represent adding annual emissions of an additional 3,300 cars. Consistent with NYSDEC and USEPA policies on green remediation, sustainability considerations should not be used to justify implementation of a no action alternative or a less comprehensive alternative when a more comprehensive remedy is called for, appropriate, and feasible.

Green remediation techniques, as detailed in NYSDEC's Green Remediation Program Policy – DER-31 (NYSDEC 2011) and USEPA's Region 2 Clean and Green Policy (USEPA 2010b), would be considered for each alternative to reduce short-term environmental impacts. Green remediation best practices such as the following may be considered:

- Use of renewable energy and/or purchase of renewable energy credits to power energy needs during construction and/or O&M of the remedy

- Reduction in vehicle idling, including both on and off-road vehicles and construction equipment during construction and/or O&M of the remedy
- Design of cover systems, to the extent possible, to be usable for alternate uses, require minimal maintenance (*e.g.*, less mowing), allow for infiltration of storm water and/or be integrated with the planned use of the property
- Reuse of material that would otherwise be considered a waste
- Use of Ultra Low Sulfur Diesel (ULSD).

In summary, each alternative would provide short-term effectiveness. Worker and community risks during remedy implementation are greater for Alternative 5 compared to Alternatives 3 and 4. The added risks to workers and the community, the added duration to achieve RAOs, significant traffic impacts to the community, significantly greater environmental footprint, and disturbance of valuable forested and eagle roosting habitat make Alternative 5 a much less effective means of attaining RAOs as compared to other alternatives.

4.2.6 Implementability

Alternative 1 would be the easiest alternative to implement, as there are no activities to undertake. Alternatives 3 and 4 are implementable. Alternatives 3 and 4 can be readily constructed and maintained; the materials necessary for the construction of these alternatives are reasonably available. The engineered cover systems and wetland restoration in Alternatives 3 and 4 would incorporate constructible and reliable technologies. Excavation of soil/fill material in Alternative 4 would also incorporate constructible and reliable technologies. As described under Section 3.6.4, because it is necessary to evaluate and identify on-site reuses to manage the additional spoils anticipated during implementation of Alternative 4A as compared to Alternative 3, Alternative 4A is less implementable than Alternative 3. Off-site transport and disposal options were also evaluated under Alternative 4B. Alternative 4B would result in additional truck traffic compared to Alternative 4A due to transport of excavated material off-site and transport of additional backfill materials on-Site. Off-site transport of excavated surface soil/fill material would result in potentially adverse impacts to the community, including air quality, traffic and roadway conditions and is less implementable than Alternative 4A; however, more impacted soil/fill material would remain on-Site in Alternative 4A. Alternative 4B would also result a potential increase in safety-related risks and impacts to CSX railroad operations due to off-site transport of excavated soil/fill material requiring additional crossing and coordination with railroad traffic proximate to the Site. Landfill disposal capacity would require confirmation prior to implementation of Alternative 4B. Alternative 3 is more implementable compared to Alternatives 4A, and 4B due to the reduced truck traffic and resulting impacts to the community and CSX Railroad operations. Excavation near the CSX railroad required in Alternatives 4A and 4B make these alternatives less implementable due to potential stability risks to the CSX railroad than Alternative 3. The necessary equipment and specialists would be available for these alternatives. Monitoring the effectiveness of the engineered covers in Alternatives 3 and 4 would be accomplished through cover system inspections and maintenance to verify continued cover integrity, visual signs of erosion, and condition of the engineered cover. Areas of wetland restoration/mitigation in Alternatives 3 and 4 would also be monitored for signs of erosion, condition of vegetation, and presence of invasive species. A site management plan and periodic reviews would also be implemented under Alternatives 3 and 4 for the purpose of monitoring and documenting remedy effectiveness, in addition to groundwater monitoring as a means for monitoring potential changes in groundwater concentrations. Implementation of Alternatives 3

through 5 would require consideration of SYW-12 Site access across the CSX Railroad tracks and work in proximity to the railroad, Onondaga Lake, Onondaga Creek, and Ley Creek. Alternatives 3 through 5 would also require coordination with other agencies including NYSDEC, New York State Department of Transportation (NYSDOT), NYSDOH, USEPA, USFWS, City of Syracuse, Onondaga Nation, and CSX Railroad. Coordination with Onondaga County would also be necessary to support multi-use recreational trail construction and maintenance.

A geotechnical evaluation was performed to evaluate implementability and stability concerns relative to the CSX Railroad tracks under Alternative 4. This evaluation concluded that global stability associated with excavation in the vicinity of the railroad tracks under Alternative 4 are anticipated to significantly limit implementability of these alternatives. Based on the completed geotechnical analysis and deeper Site-wide excavation, Alternative 5 would present greater stability concerns along the CSX Railroad tracks. CSX concurrence with remedial design of the cover and excavation elements included in these alternatives would be required. Thus, stability concerns may affect implementability of these alternatives.

Alternative 5 is not implementable for the following reasons:

- Excavation and off-site management of 400,000 cy of soil/fill material associated with Alternative 5 would be extremely difficult to implement. Alternative 5 would be significantly more difficult to implement than the cover placement contemplated in Alternatives 3 and 4 or the soil/fill material excavation and cover placement contemplated in Alternative 4. Specifically, there are significant implementability limitations associated with excavation, transportation, and obtaining appropriate disposal capacity for this large volume of material.
- Excavation considerations that limit the implementability of Alternative 5 include challenging construction water management and greater slope stability concerns relative to the active CSX Railroad lines when compared to the shallow excavations included in Alternative 4, which would require CSX concurrence during the remedial design. Construction water management using a temporary treatment system is anticipated to be significant during the excavation since large volumes are anticipated due to the presence of heterogenous and permeable fill and excavations in proximity of the on-site wetlands, Onondaga Lake, Onondaga Creek, and Ley Creek. Excavations in the vicinity of active railroads, subsurface utilities, and surface water bodies are anticipated to limit the implementability of excavations in certain areas and require the costly design, procurement and installation of shoring. As part of the supporting geotechnical evaluations, installation of sheet piling would be evaluated and installed, if required, to support excavations in these areas.
- Transportation considerations that severely limit the implementability of Alternative 5 include significantly increased traffic, fuel usage, and adverse effects on both air quality and community safety. Based on anticipated bulking of the material as a result of excavation, the total estimated volume requiring disposal of 400,000 cy (estimated to be approximately 615,000 tons). Based on daily production rate of 500 cy per day for 10 months of the year, it is estimated that up to approximately 100,000 cy of material could be shipped off-site each year in 7,000 truckloads (up to 35 truckloads per day) with an approximately equivalent number of trips being required for restoration, over a duration of 5 to 7 years. During a 10-hour workday, this would equate to approximately 1 truck entering or leaving the Site every 10 minutes. In addition to the potentially significant adverse effects on local air quality and

community traffic patterns, traffic of this magnitude is anticipated to result in significant adverse effects on conditions of roadways.

- Ecological considerations that limit the implementability of Alternative 5 include removal of trees providing valuable forested habitat and utilized by bald eagles. As discussed in Section 3.1.2, the SYW-12 Site serves as a winter roost site and concentration area for a large number of bald eagles, a State-listed Threatened species. Alternative 5 would require disturbance of 23.5 acres and removal of trees Site-wide that serve as an important habitat and it is anticipated it would take several decades to restore.

In summary, Alternatives 1 and, 3 are readily implementable. Alternative 4 is less implementable than Alternative 3. The necessary equipment and specialists would be available for each alternative. Cover system and wetland area construction materials are anticipated to be available. Alternative 5 is not practical or implementable for the reasons cited above.

4.2.7 Cost

Detailed cost estimates for the alternatives are included as **Tables 4-2 through 4-6**. The costs associated with Alternatives 1 and 3 through 5 are summarized as follows:

Table 5 – Summary of Remedial Alternative Cost Estimates

Alternative	Total estimated capital cost	Total estimated present worth of O&M (30 years)	Total estimated net present worth cost
1 – No Action	$0	$0	$0
3 – Engineered Cover on Perimeter Area (8.2 AC), Wetland Restoration/Creation, Biota Monitoring, and MNA	$7.5 M	$0.79 M	$8.3 M
4A – Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 AC), Biota Monitoring, MNA, Limited Tree Removal	$21.1 M	$0.80 M	$21.9 M
4B – Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 AC), MNA, Limited Tree Removal with Off-Site Disposal	$26.2 M	$0.80 M	$27.0 M
5 – Full removal (including all trees) and offsite disposal (23.5 AC) with MNA	$281 M	$0.18 M	$281 M

4.2.8 Land Use

The Site owner plans to construct a public multi-use recreational trail. Human health risks associated with recreational use are acceptable under current conditions. While exceedances to SCOs for Commercial Use are noted for surface soil at the Site, based on the *Revised HHRA Report* (**Section 2.6.1**), Alternatives 1 and 3 through 5 would be protective of human health for current conditions and intended and reasonably anticipated future uses of the SYW-12 Site. Of the constituents identified as representative risk and remedy drivers in Sections 2.7 and 4.1.1 (*i.e.*, cadmium, chromium, mercury, benzo[a]pyrene, 4,4'-DDT, and total PCBs), current AWACs

exceed Commercial Use SCOs only for cadmium and benzo[a]pyrene. Implementation of Alternatives 3 and 4 would improve the Site-wide average concentrations for each of these constituents considerably and reduce the value for cadmium to below the Commercial Use SCO. Further details are presented in Appendix 8. Post-remediation AWACs were evaluated for the constituents identified as representative risk and remedy drivers and demonstrate that remedies improve Site-wide concentrations (Appendix 8).

The engineered cover system (non-forested wetland) included in Alternatives 3 and 4, engineered cover system (upland) included in Alternatives 3 and 4, and removal of surface soil/fill material included in Alternative 4 (non-forested wetland) would be consistent with current, intended, and reasonably anticipated future use of the property. Site access, construction and monitoring activities would be coordinated with Onondaga County, CSX Railroad and NYSDEC. Access to the interior wetlands on the western portion of the Site would require coordination with Onondaga County and may be impacted by construction of the multi-use trail. Alternatives 1, 3, and 4 would support land use and maintain mature tree stands utilized seasonally by bald eagles for foraging and roosting. Removal of forested and non-forested wetland and upland area soil/fill material under Alternative 5 would not support continued use of the property by bald eagles for winter roosting and foraging and would not align with the intended timing of the proposed multi-use recreational trail.

4.2.9 State Acceptance

Evaluation of the state acceptance criterion indicates whether, based on its review of the RI/FS reports, the NYSDEC supports, opposes, and/or has identified any reservations with the preferred response measure. State acceptance will be addressed in the Proposed Plan.

4.2.10 Community Acceptance

Evaluation of the community acceptance criterion summarizes the public's general response to the response measures described in the Proposed Plan and in the RI/FS reports. Community acceptance will be assessed in the ROD and includes determining which of the response measures the community supports, opposes, and/or has reservations about.

5. CONCLUSIONS

To provide long-lasting protection to human health and environment, five remedial alternatives were developed and evaluated for the SYW-12 Site as documented in this FS Report. Specifically, this FS Report documents the development of RAOs for the protection of human health and the environment to address contaminants identified for the SYW-12 Site. Consistent with DER-10 and the NCP, the five remedial alternatives developed to address these RAOs were subjected to a detailed evaluation based on required evaluation criteria and in sufficient detail such that risk management decision makers may select a remedy for the SYW-12 Site. Alternative 2 was not advanced through the comparative analysis of alternatives because it did not meet the threshold criteria.

Based on current conditions and the reasonably anticipated future SYW-12 Site use as a recreational trail, the revised risk evaluation concluded that risks associated with the multi-use recreational trail are acceptable under current conditions (Appendix 1). Because of potential risk to ecological receptors and forested habitat, a key consideration in remedy selection is environmental protection.

Threshold evaluation criteria for alternatives are overall protectiveness of human health and the environment, and compliance with ARARs. As discussed in Section 4, Alternatives 1 and 2 do not satisfy the threshold criteria, because they do not provide protection of the environment or provide a means to attain ARARs. Alternatives 3 and 4A/B satisfy the threshold criteria by providing protection to human health, providing a balance between addressing ecological risks and the protected eagle habitat at the Site, and addressing the identified ARARs, to the extent practicable. Alternative 5 satisfies the threshold criteria, however this alternative would significantly impact the protected eagle habitat at the Site. Therefore, except for Alternatives 1 and 2, each alternative would be eligible for further evaluation and selection as the final remedy.

Further evaluation based on the primary balancing criteria (long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; land use; and cost) concludes that Alternatives 3 and 4A/B would satisfy the primary balancing criteria, as these alternatives would provide for adequate and reliable means of mitigating potentially unacceptable risks. In contrast, Alternative 5 did not compare favorably because this alternative is significantly less implementable than Alternatives 3 and 4A/B, and cannot be constructed without adversely impacting overall SYW-12 Site forested habitat, including protected eagle habitat. Furthermore, Alternative 5 would involve disturbing a substantial quantity of soil requiring significant water management and material transportation and would involve challenges with slope stability, and likely impacts on nearby railroad operations. As a result of the additional site management needs under Alternative 5, the cost of that alternative is more than an order of magnitude greater than Alternatives 3 and 4A/B.

Alternatives 3 and 4A/B would provide varying degrees of protectiveness relative to potential exposure to soil/fill material and groundwater. While Alternatives 3 and 4A/B are comparable in terms of two of the primary balancing criteria, reduction of toxicity, mobility, or volume through treatment, and land use, and would support the anticipated future use of the SYW-12 Site for a multi-use recreational trail while preserving trees utilized seasonally by bald eagles for foraging and roosting, Alternatives 4A/B would provide some additional long-term effectiveness and

permanence relative to Alternative 3 as they would result in remediation of a greater acreage of wetland area with limited tree removal required to implement these alternatives.

Based on geotechnical evaluations performed for the Site, excavation near the CSX railroad required in Alternatives 4A/B would present global stability concerns for the nearby CSX railroad that significantly limits the implementability of these alternatives as compared to Alternative 3. Site-wide excavation of soil/fill material up to approximately 16 ft bgs in Alternative 5 would present greater geotechnical stability concerns along the railroad tracks compared to Alternative 4. Alternative 4B would produce additional impacts to the community as a result of increased truck traffic and noise compared to Alternative 4A, due to the off-site disposal of excavated soil/fill material. Specifically, Alternative 4B is anticipated to result in an additional 1,550 truck trips, respectively, for off-site disposal of excavated soil/fill material when compared to Alternative 4A. With respect to sustainability, Alternative 4B would result in greater fuel consumption and greenhouse gas emissions as a result of off-site transport and disposal activities, with an estimated 125 percent increase in greenhouse gas emissions compared to Alternative 4A. The need to identify reuse for substantially more excavated material and manage this material in Alternative 4A as compared to Alternative 3, makes Alternative 4A less implementable than Alternative 3. Alternatives 4A and 4B would provide a similar level of protection of human health and the environment; however, Alternative 4A could be implemented with fewer adverse impacts to the community (*i.e.*, noise, truck traffic and associated roadway safety and emissions), compared to Alternative 4B, however, more contaminated material would remain on-Site in Alternative 4A. Alternative 3 is less costly than Alternatives 4A/B, and Alternative 4A is less costly than Alternative 4B.

As part of the process established for remedial alternatives under the ACO, following review of the evaluations documented in this FS Report, NYSDEC and USEPA will identify an alternative to propose as the preferred remedy to be documented in a Proposed Plan for the SYW-12 Site. Following receipt of public comments on the Proposed Plan, the selected remedial alternative will be documented in a ROD for the SYW-12 Site.

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TABLES

Table 2-1. SYW-12 HHRA RISK AND HAZARD SUMMARY

Timeframe	Receptor	Exposure Medium	Cancer Risk	Non-Cancer Hazard	Hazard/Risk Driving COCs
Current/Future	Utility Worker	Surface/Subsurface Soil	1×10^{-5}	0.06	--
		Outdoor Air	9×10^{-9}	0.0001	--
		Shallow Groundwater	4×10^{-4}	0.1	Benzo(a)pyrene
		All Media	4×10^{-4}	0.2	Benzo(a)pyrene
Current/Future	Railroad Worker	Surface Soil	4×10^{-5}	0.2	--
		Outdoor Air	3×10^{-8}	0.0005	--
		All Media	4×10^{-5}	0.2	--
Current/Future	Child Recreator	Surface Soil	4×10^{-4}	0.9	Benzo(a)pyrene
		Outdoor Air	7×10^{-9}	0.0005	--
		All Media	4×10^{-4}	0.9	Benzo(a)pyrene
Current/Future	Adult Recreator	Surface Soil	1×10^{-5}	0.04	--
		Outdoor Air	1×10^{-8}	0.0001	--
		All Media	1×10^{-5}	0.04	--
Future	Construction Worker	Surface/Subsurface Soil	5×10^{-6}	0.7	--
		Outdoor Air	1×10^{-8}	0.004	--
		Shallow Groundwater	2×10^{-4}	2	Benzo(a)pyrene (cancer risk); chromium (hazard)
		All Media	2×10^{-4}	2	Benzo(a)pyrene
Future	Commercial/Industrial Worker	Surface Soil	6×10^{-5}	0.3	--
		Outdoor Air	1×10^{-7}	0.002	--
		All Media	6×10^{-5}	0.3	--
Future	Child Resident	Surface Soil	7×10^{-4}	7.4	Benzo(a)pyrene (cancer risk); highly chlorinated PCBs (hazard)
		Outdoor Air	1×10^{-7}	0.009	--
		All Media	7×10^{-4}	7.4	Benzo(a)pyrene (cancer risk); highly chlorinated PCBs (hazard)
Future	Adult Resident	Surface Soil	5×10^{-5}	0.2	--
		Outdoor Air	2×10^{-7}	0.002	--
		All Media	5×10^{-5}	0.2	--

- Shaded cells indicate exceedance of the USEPA acceptable cancer risk or non-cancer hazard threshold.

Table 2-2. SYW-12 BERA RISK SUMMARY				
Receptor Population / Community	**Representative Receptor**	**Exposure Media**	**COPC(s) with HQs > 1***	**COPC-Specific HQ**
Wildlife – Invertivorous Birds	American Robin	Surface Soil, Soil Invertebrate Prey, Plants	Barium	5.3
			Cadmium	5.8
			Chromium	37.6
			Lead	1.7
			Mercury	7.6
			Zinc	5.0
			Total PCBs	28522
			Bis(2-ethyl)hexyl phthalate	2.0
			Butylbenzylphthalate	32.1
			Hexachlorobenzene	64.0
			Pyrene	1.4
Wildlife – Insectivorous Mammals	Short-Tailed Shrew	Surface Soil, Soil Invertebrate Prey	Cadmium	11.2
			Chromium	2.6
			Copper	1.6
			Vanadium	1.7
			Zinc	1.9
			Total PCBs	21278
			Dieldrin	1.3
			Bis(2-ethyl)hexyl phthalate	1.2
			Hexachlorobenzene	44.8
			2,3,7,8-TCDD Equiv. (Mammals)	11.1
Wildlife – Carnivorous Birds	Red-Tailed Hawk	Surface Soil, Soil Invertebrate Prey	*NONE*	*NONE*
Wildlife – Carnivorous Mammals	Red Fox	Surface Soil, Small Mammal Prey, Plants	Chromium	2.5
Wildlife – Piscivorous/ Carnivorous Mammals	Mink	Surface Soil, Small Mammal Prey, Fish Prey	*NONE*	*NONE*
Terrestrial Plant Community	Plants	Surface Soil	Cadmium	3.5
			Chromium	114
			Copper	1.5
			Lead	2.9
			Manganese	1.4
			Mercury	5.3
			Nickel	1.04
			Selenium	2.1
			Silver	1.8
			Vanadium	6.7
			Zinc	5.2
Terrestrial Invertebrate Community	Soil Invertebrates	Surface Soil	Chromium	286
			Copper	2.1
			Iron	63.1
			Manganese	3.1
			Zinc	2.6

Table 2-2. SYW-12 BERA RISK SUMMARY				
Receptor Population / Community	**Representative Receptor**	**Exposure Media**	**COPC(s) with HQs > 1***	**COPC-Specific HQ**
Aquatic Community/ Wildlife Populations	Aquatic Biota/Wildlife	Shallow Groundwater	Barium	145
			Cadmium	4.6
			Cobalt	7.9
			Cyanide	1.2
			Iron	3.7
			Lead	1.8
			Manganese	10.4
			Mercury	694/2.3**
			Selenium	2.2
			4,4′-DDT	1.4
			Benzo(a)pyrene	341
			Fluorene	1.1
			Total Xylenes	1.7
Benthic Invertebrate Community	Benthic Invertebrates	Surface Soil***	Cadmium	246860
			Copper	6.5
			Lead	4.6
			Mercury	10.6
			Nickel	2.0
			Silver	3.6
			Zinc	2.2
			Total PCBs	61.3
			4,4′-DDD	2.6
			4,4′-DDT	11.7
			Dieldrin	5.8
			Endrin	2.6
			Endrin Ketone	1.9
			Heptachlor Epoxide	3.1
			Acenaphthene	74.6
			Anthracene	11.4
			Benz(a)anthracene	14.6
			Benzo(a)pyrene	10.3
			Benzo(ghi)perylene	9.1
			Benzo(k)anthracene	8.2
			Chrysene	14.3
			Dibenz(a,h)anthracene	8.3
			Fluoranthene	14.6
			Fluorene	5.7
			Hexachlorobenzene	6.2
			Indeno(1,2,3-cd)pyrene	5.7
			Naphthalene	1.8
			Phenanthrene	23.1
			Phenol	2.2
			Pyrene	18.0
			m,p-Xylenes	2.7
			2,3,7,8-TCDD Equiv. (Birds)	3.3

Table 2-2. SYW-12 BERA RISK SUMMARY				
Receptor Population / Community	**Representative Receptor**	**Exposure Media**	**COPC(s) with HQs > 1***	**COPC-Specific HQ**
			2,3,7,8-TCDD Equiv. (Mammals)	2.0
Onondaga Lake Fish Community	Fish	Shallow Groundwater	Barium	145
			Cadmium	4.6
			Cobalt	7.9
			Copper	1.2
			Cyanide	3.7
			Iron	28.3
			Lead	3.4
			Manganese	10.4
			Mercury	2.3
			Selenium	2.4
			Silver	50.8
			Vanadium	1.7
			4,4′-DDT	1636
			2-Methylnaphthalene	1.7
			Acenaphthene	1.6
			Benz(a)anthracene	131
			Benzo(a)pyrene	341
			Bis(2-ethyl)hexyl phthalate	4.1
			Fluorene	7.9
			Naphthalene	1.8
			Phenanthrene	1.1
			Pyrene	1.1
			Total Xylenes	1.7
Onondaga Lake Fish Community	Fish	Surface Soil***	Cadmium	246680
			Copper	6.5
			Lead	4.6
			Mercury	10.6
			Nickel	2.0
			Silver	3.6
			Zinc	2.2
			Total PCBs	61.3
			4,4′-DDD	2.6
			4,4′-DDT	11.7
			Dieldrin	5.8
			Endrin	2.6
			Endrin Ketone	1.9
			Heptachlor Epoxide	3.1
			Acenaphthene	74.6
			Anthracene	11.4
			Benz(a)anthracene	14.6
			Benzo(a)pyrene	10.3
			Benzo(ghi)perylene	9.1
			Benzo(k)fluoranthene	8.2
			Chrysene	14.3

Table 2-2. SYW-12 BERA RISK SUMMARY				
Receptor Population / Community	**Representative Receptor**	**Exposure Media**	**COPC(s) with HQs > 1***	**COPC-Specific HQ**
			Dibenz(a,h)anthracene	8.3
			Fluoranthene	14.6
			Fluorene	5.7
			Hexachlorobenzene	6.2
			Indeno(1,2,3-cd)pyrene	5.7
			Naphthalene	1.8
			Phenanthrene	23.1
			Phenol	2.2
			Pyrene	18.0
			m,p-Xylenes	2.7
			2,3,7,8-TCDD Equiv. (Birds)	3.3
			2,3,7,8-TCDD Equiv. (Mammals)	2.0

* For wildlife receptors, column pertains to exceedances of lowest-observed adverse effect level (LOAEL) dose. For community receptors, column pertains to ratio of average COPC concentration and screening value (from Efroymson et al. 1997a, b; USEPA Eco-SSLs).
** First value is for wildlife protection, second value is for aquatic organisms.
*** Evaluated as sediment.
HQ = Hazard Quotient

TABLE 3-1. POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRITE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) MATERIALS

Medium Location / Action	Citation	Requirements	Comments	Potential ARAR	Potential TBC
Potential Chemical-Specific ARARs and TBCs					
Soil / fill material	6 NYCRR Part 375-6 Remedial Program Soil Cleanup Objectives (SCOs)	Promulgated state regulation that provides guidance for SCOs for various restricted property uses (industrial, commercial, restricted residential, and residential), for the protection of groundwater and ecological resources, and for unrestricted property use. Commercial use includes passive recreational use that refers to recreational uses with limited potential for soil contact, such as: (1) artificial surface fields; (2) outdoor tennis or basketball courts; (3) other paved recreational facilities used for roller hockey, roller skating, shuffle board, etc.; (4) outdoor pools; (5) indoor sports or recreational facilities; (6) golf courses; and (7) paved (raised) bike or walking paths [DER-10 (NYSDEC 2010)].	SCOs for restricted use (commercial, protection of ecological resources) are potentially relevant and appropriate to SYW-12 Site soil/fill material give the current and reasonably anticipated future land use for commercial purposes, including a passive recreational use, as well as consideration of the seasonal presence of eagles at the SYW-12 Site. SCOs for unrestricted use may not be applicable, relevant or appropriate given the current and reasonably anticipated future land use; however, were considered for the purpose of evaluating unrestricted conditions. SCOs for the protection of groundwater are also considered.	Yes	No[1]
	USEPA Soil Screening Guidance: User's Guide (1996)	Guidance that provides methodology for developing site-specific soil screening levels. Also provides generic soil screening levels based on default assumptions.	Potentially relevant and appropriate to SYW-12 Site soil/fill material.	No	Yes
	USEPA Regional Screening Levels	Guidance that provides human health risk-based screening values for soil at industrial sites. Screening levels are calculated based on human health exposure assumptions and toxicity data.	Industrial worker, outdoor worker and recreator soil screening levels are potentially applicable for the screening of soil/fill material.	No	Yes
	USEPA Ecological Screening Levels	Guidance that provides ecological risk-based screening values. Screening levels are based on ecological exposure assumptions and toxicity data.	To be considered. Ecological screening values are not promulgated cleanup levels.	No	Yes
Groundwater	6 NYCRR Part 703 – Class GA Groundwater Quality Standards	Promulgated water quality standards for fresh groundwater, including narrative and constituent-specific standards.	Potentially applicable for SYW-12 Site groundwater.	Yes	No
	NYS TOGS 1.1.1 – Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations	Guidance that summarizes groundwater standards and guidance values. Guidance values are provided where standards are not available.	Potentially applicable for SYW-12 Site groundwater.	Yes	No

[1] USEPA Region 2 considered 6 NYCRR Part 375-6 Remedial Program SCOs to be a TBC.

TABLE 3-1. POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRITE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) MATERIALS

Medium Location / Action	Citation	Requirements	Comments	Potential ARAR	Potential TBC
	40 CFR Part 141 – Drinking Water Standards	Promulgated federal regulation that establishes primary drinking water regulations applicable to public water systems.	Potentially applicable for SYW-12 Site groundwater. Groundwater is not used as a drinking water source as municipal water is available.	Yes	No
Potential Location-Specific ARARs and TBCs					
Construction of buildings	NYSDOH's October 2006 Guidance for Evaluating Soil Vapor Intrusion in the State of New York	Guidance document that provides thresholds for indoor air and sub-slab soil vapor above which vapor mitigation is required.	Not currently applicable, because no buildings are present on the SYW-12 Site. Potentially applicable if future buildings are constructed at the SYW-12 Site.	No	Yes
	OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air, OSWER Publication 9200.2-154, June 2015	Technical guidance that provides recommendations on assessment of vapor intrusion pathways that pose an unacceptable risk to human health.	Not currently applicable, because no buildings are present on the SYW-12 Site. Potentially applicable if future buildings are constructed at the SYW-12 Site.	No	Yes
Water bodies	6 NYCRR 608 – Use and Protection of Waters Program	Regulatory and permit requirements for work affecting New York State lakes, rivers, streams, and ponds.	Potentially applicable to remedial actions at the SYW-12 Site given the overlap of the 100-year floodplain, and potential actions below mean high water for Onondaga Lake, Ley Creek, and Onondaga Creek.	Yes	No
	Article 15 – Water Resources – New York Environmental Conservation Law	Regulatory and permit requirements for work affecting New York State lakes, rivers, streams, and ponds.	Potentially applicable to work affecting Onondaga Lake, Ley Creek, and Onondaga Creek.	Yes	No
	33 CFR 320 - 330 - Navigation and Navigable Waters	Regulatory policies and permit requirements for work affecting waters of the United States and navigable waterways.	Substantive, non-administrative requirements potentially applicable to work affecting Onondaga Lake, Ley Creek, and Onondaga Creek.	Yes	No
	16 USC 661 - Fish and Wildlife Coordination Act	Requires protection of fish and wildlife in a stream or other water body when performing activities that modify a stream or river.		Yes	No
Wetlands	6 NYCRR 663 - Freshwater wetland permit requirements	Actions occurring in a designated freshwater wetland (within 100 feet) must be approved by NYSDEC or its designee. Activities occurring adjacent to freshwater wetlands must: be compatible with preservation, protection, and conservation of wetlands and benefits; result in no more than insubstantial degradation to or loss of any part of the wetland; and be compatible with public health and welfare.	SYW-12 is a New York State-regulated wetland. Potentially applicable to remedial actions at the SYW-12 Site and within 100 feet of wetlands as designated freshwater wetlands regulated by NYSDEC.	Yes	No
	Clean Water Act Section 404 33 CFR Parts 320 - 330	Regulatory policies and permit requirements for work affecting waters of the United States, including wetlands.	Potentially applicable; the SYW-12 Site is a delineated wetland.	Yes	No
	Clean Water Act Section 404 40 CFR Parts 230-231	Provides for restoration and maintenance of integrity of waters of the United States, including wetlands, through the control of dredged or fill material discharge.		Yes	No
	Executive Order 11990 - Protection of Wetlands	Executive order requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or loss of wetlands if a practical alternative exists.		Yes	No

TABLE 3-1. POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRITE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) MATERIALS

Medium Location / Action	Citation	Requirements	Comments	Potential ARAR	Potential TBC
Wetlands & floodplains	Policy on Floodplains and Wetland Assessments for CERCLA Actions (OSWER Directive 9280.0-2; 1985)	Policy and guidance requiring Superfund actions to meet substantive requirements of Executive Orders 11988 and 11990. Describes requirements for floodplain assessment during remedial action planning.	To be considered during the remedial design. Potentially applicable to the SYW-12 Site, a delineated wetland. Potentially applicable as the SYW-12 Site is within the 100- and 500-year floodplains.	Yes	No
Potential Location-Specific ARARs and TBCs (continued)					
Wetlands & floodplains	40 CFR Part 6, Appendix A - Statement of Procedures on Floodplains Management and Wetlands Protection (January 5, 1979)	Policy and guidance for implementing Executive Orders 11988 and 11990. Requires federal agencies to evaluate the potential effects of action proposed in wetlands and floodplains to avoid, to the extent possible, adverse effects. Federal agencies are required to evaluate alternatives to actions in wetlands or floodplains and to avoid or minimize adverse impacts if not practical alternatives exist.	To be considered during the remedial design. Potentially applicable to the SYW-12 Site, a delineated wetland. Potentially applicable as the SYW-12 Site is within the 100- and 500-year floodplains. Requires a floodplain assessment if the selected alternative includes remedial activities that would potentially impact the floodplain.	Yes	No
Floodplains	6 NYCRR 373-2.2 - Location standards for hazardous waste treatment, storage, and disposal facilities -100-yr floodplain	Hazardous waste treatment, storage, or disposal facilities located in a 100-yr floodplain must be designed, constructed, operated and maintained to prevent washout of hazardous waste during a 100-year flood.	Not applicable or relevant and appropriate. The SYW-12 Site is within the 100-year floodplain; however, no hazardous waste treatment, storage, or disposal facilities are planned to be located on the SYW-12 Site.	No	No
	40 CFR Part 264.18(b) - Location Standards - Floodplains	Hazardous waste treatment, storage, or disposal facilities located in a 100-yr floodplain must be designed, constructed, operated and maintained to prevent washout of hazardous waste during a 100-year flood.	Not applicable or relevant and appropriate. The SYW-12 Site is within the 100-year floodplain; however, no hazardous waste treatment, storage, or disposal facilities are planned to be located on the SYW-12 Site.	No	No
	Executive Order 11988 - Floodplain Management	USEPA is required to conduct activities to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupation or modification of floodplains. The procedures also require USEPA to avoid direct or indirect support of floodplain development wherever there are practicable alternatives and minimize potential harm to floodplains when there are no practicable alternatives.	Potentially applicable or relevant and appropriate. The SYW-12 Site is located within the 100- and 500-year floodplains. Requires a floodplain assessment if the selected alternative includes remedial activities that would potentially impact the floodplain.	Yes	No
	Executive Order 13690 - Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input	Executive order establishes a Federal Flood Risk Management Standard (FFRMS), a Process for Further Soliciting and Considering Stakeholder Input, and amends Executive Order 11988. The FFRMS establishes a construction standard and framework for Federally funded projects constructed in, and affecting, floodplains, to reduce the risks and cost of floods. Under the FFRMS, federal agency management is expanded from the current base flood level to a higher vertical elevation and corresponding horizontal floodplain to address current and future flood risk to increase resiliency of projects funded with federal funds. The Executive Order also sets forth a process for solicitation and consideration of public input, prior to implementation of the FFRMS.	Potentially applicable or relevant and appropriate. The SYW-12 Site is location within the 100-year and 500-year floodplains. Requires a floodplain assessment if the selected alternative includes remedial activities that would potentially impact the floodplain.	Yes	No

TABLE 3-1. POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRITE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) MATERIALS

Medium Location / Action	Citation	Requirements	Comments	Potential ARAR	Potential TBC
	6 NYCRR 500 - Floodplain Management Regulations Development Permits	Promulgated state regulations providing permit requirements for development in areas of special flood hazard (floodplain within a community subject to a one percent or greater chance of flooding in any given year).	Requires remedial activities to be conducted in accordance with the local and state statutory requirements if conducted within the 100-year and/or 500-year floodplains as defined by FEMA. The 100-year and 500-year floodplains exist along the general lakeshore area immediately adjacent to Onondaga Lake and includes the SYW-12 Site.	Yes	No
Railroad	Article 3, Sections 90 – 95 - New York Railroad Law	Promulgated state regulation that provides requirements for the construction, operation and management of New York State railroads.	Potentially applicable or relevant and appropriate. The SYW-12 Site is bound by CSX railroad tracks to the north and east.	Yes	No
Potential Location-Specific ARARs and TBCs (continued)					
Within 61 meters (200 feet) of a fault displaced in Holocene time	40 CFR Part 264.18(a) - Location Standards - Seismic considerations	New treatment, storage, or disposal of hazardous waste is not allowed.	Not applicable or relevant and appropriate. SYW-12 Site is not located within 200 feet of a fault displaced in Holocene time, as listed in 40 CFR 264 Appendix VI. None listed in New York State.	No	No
Within salt dome or bed formation, underground mine, or cave	40 CFR Part 264.18 (c) - Location standards; salt dome formations, salt bed formations, underground mines and caves.	Placement of non-containerized or bulk liquid hazardous waste is not allowed.	Not applicable or relevant and appropriate. No salt dome formations, salt bed formations, underground mines or caves present at the SYW-12 Site.	No	No
Habitat of an endangered or threatened species	6 NYCRR 182	Promulgated state regulation that provides requirements to minimize damage to habitat of an endangered species.	Potentially applicable or relevant and appropriate. No rare, endangered or threatened wildlife species, rare plants or significant habitats were identified at the SYW-12 Site (Revised Baseline Ecological Risk Assessment, OBG 2011); however, the SYW-12 Site serves as a winter roost site and seasonal concentration area for bald eagles (currently listed as threatened pursuant to 6 NYCRR 182.5[b]6.iii). In accordance with 6 NYCRR 182.8, activities that are likely to result in a 'take' of listed species are generally prohibited, including any adverse modification of habitat or modification of essential behavior. The occupation of the SYW-12 Site by bald eagle is recognized by the US Fish and Wildlife Service and the NYSDEC. Measures to ensure the continued integrity of the roost site will be considered. One threatened plant within 2 miles of SYW-12 Site on north shore of Onondaga Lake not anticipated to be impacted by SYW-12 Site activities.	Yes	No
	Endangered Species Act	Provides a means for conserving various species of fish, wildlife, and plants that are threatened with extinction.		No	No
	50 CFR Part 17 - Endangered and Threatened Wildlife and Plants and 50 CFR Part 402 - Interagency Cooperation	Promulgated federal regulation that requires that federal agencies ensure authorized, funded, or executed actions will not destroy or have adverse modification of critical habitat.		No	No
	16 U.S.C. 668 et seq - Bald and Golden Eagle Protection Act	Promulgated federal regulation prohibiting take of bald eagles, unless otherwise permitted by USFWS. Take is further defined to include pursuit, hoot, shoot at, poison, wound, kill, capture, collect, molest, or disturb.	Potentially applicable or relevant and appropriate. The SYW-12 Site serves as a winter roost site and seasonal concentration area for bald eagles (currently State-listed as Threatened). Measures to ensure the continued integrity of the roost site will be considered.	Yes	No
	Migratory Bird Treaty Act of 1918	Promulgated federal regulation for protection of migratory birds.		Yes	No

TABLE 3-1. POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRITE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) MATERIALS

Medium Location / Action	Citation	Requirements	Comments	Potential ARAR	Potential TBC
	United States Fish and Wildlife National Bald Eagle Management Guidelines (2007)	Guidance that provides recommendations to minimize impacts to bald eagles, particularly related to human activities with the potential to disturb bald eagles and their ability to forage, nest and breed.		No	Yes
	Conservation Plan for Bald Eagles in New York State (March 2016)	Guidance that provides recommendations for long-term management and conservation of bald eagles in New York.		No	Yes
Historical property or district	National Historic Preservation Act 36 CFR 800- Preservation of Historic Properties Owned by a Federal Agency	Remedial actions are required to account for the effects of remedial activities on any historic properties included on or eligible for inclusion on the National Register of Historic Places.	Potentially applicable. A Phase 1A assessment identified the potential for historic resources at the SYW-12 Site.	Yes	No
	National Historic Preservation Act 36 CFR Part 65 - National Historic Landmarks Program	Promulgated federal regulation requiring that actions must be taken to preserve and recover historical/archeological artifacts found.		Yes	No
	New York State Historic Preservation Act of 1980 9 NYCRR Parts 426 - 428	State law and regulations requiring the protection of historic, architectural, archeological and cultural property.		Yes	No
Wilderness area	Wilderness Act 50 CFR Part 35 - Wilderness Preservation and Management	Provides for protection of federally-owned designated wilderness areas.	Not applicable or relevant and appropriate. SYW-12 Site not located in wilderness area.	No	No
Wild, scenic, or recreational river	Wild and Scenic Rivers Act	Provides for protection of areas specified as wild, scenic, or recreational.	Not applicable or relevant and appropriate. SYW-12 Site not located near wild, scenic or recreational river.	No	No
Coastal zone	Coastal Zone Management Act	Requires activities be conducted consistent with approved State management programs.	Not applicable or relevant and appropriate. SYW-12 Site not located in coastal zone.	No	No
Coastal barrier	Coastal Barrier Resources Act	Prohibits any new Federal expenditure within the Coastal Barrier Resource System.	Not applicable or relevant and appropriate. SYW-12 Site not located in coastal barrier.	No	No
Protection of waters	33 U.S.C. 1341 - Clean Water Act Section 401, State Water Quality Certification Program	States have the authority to veto or place conditions on federally permitted activities that may result in water pollution.	Potentially applicable to the SYW-12 Site.	Yes	Yes
Potential Action-Specific ARARs and TBCs					
Institutional controls	NYSDEC DER-33 Institutional Controls: A Guide to Drafting and Recording Institutional Controls, December 2010	Technical guidance document that provides guidelines for proper development and recording of institutional controls as part of a site remedial program.	Potentially applicable TBC when institutional controls are implemented as a component of the selected remedy.	No	Yes

TABLE 3-1. POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRITE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) MATERIALS

Medium Location / Action	Citation	Requirements	Comments	Potential ARAR	Potential TBC
Cover systems	NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, May 2010	Technical guidance document that provides guidelines for cover thicknesses as they relate to property use in areas where exposed surface soil exceeds NYCRR Part 375 SCOs. Specifically, where the exposed surface soil at the site exceeds the applicable soil cleanup objective for protection of human health and/or ecological resources, the soil cover for restricted residential use, is to be two feet; for commercial or industrial use, is to be one foot; or when an ecological resource has been identified is to be a minimum of two feet; and when such a concern is identified by NYSDEC, consideration should be given to supplementing the demarcation layer to serve as an impediment to burrowing.	Potentially applicable TBC for cover alternatives.	No	Yes
	RCRA Subtitle D, 40 CFR Part 358.60 – Closure Criteria	Regulations established under Subtitle D set federal closure requirements including installation of a final cover system that is designed to minimize infiltration and erosion, for owners and operators of municipal solid waste landfill units.	Not applicable or relevant and appropriate. The SYW-12 Site is not considered a Waste Management Area or municipal landfill for which closure criteria for final cover systems may be relevant.	No	No
Landfill	40 CFR Part 257 - Criteria for Classification of Solid Waste Disposal Facilities and Practices	Promulgated federal regulation that provides criteria for solid waste disposal facilities to protect health and the environment.	Landfilling of wastes may be applicable for the SYW-12 Site.	Yes	No
	40 CFR Parts 264 and 265, Subpart N – Landfills	Promulgated federal regulation that provides requirements for hazardous waste landfill units.		Yes	No
Principal threat and low level threat waste	A Guide to Principal Threat and Low Level Threat Wastes – Quick Reference Fact Sheet (OSWER Superfund Publication 9380.3-06FS, November 1991)	Guidance that outlines federal expectations, definitions, and documentation requirements related to waste considered principal or low level threat waste.	Potentially applicable TBC.	No	Yes
Generation and management of solid waste	6 NYCRR 360 - Solid Waste Management Facilities	Promulgated state regulation that provides requirements for management of solid wastes, including disposal and closure of disposal facilities.	Potentially applicable to alternatives including disposal of residuals generated by treatment processes as well as capping alternatives.	Yes	No
Land disposal	6 NYCRR 376 - Land Disposal Restrictions	Promulgated federal and state regulations that provide treatment standards to be met prior to land disposal of hazardous wastes.	Potentially applicable to residuals generated by treatment processes if found to be hazardous waste and disposed at a landfill. Applicable for off-site treatment and disposal if excavated soil/fill material does not meet land disposal restrictions.	Yes	No
	40 CFR Part 268 - Land Disposal Restrictions				
	62 CFR 25997 - Phase IV Supplemental Proposal on Land Disposal of Mineral Processing Wastes				

TABLE 3-1. POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRITE REQUIREMENTS (ARARS) AND TO BE CONSIDERED (TBC) MATERIALS

Medium Location / Action	Citation	Requirements	Comments	Potential ARAR	Potential TBC
Potential Action-Specific ARARs and TBCs					
Green remediation	NYSDEC DER-31 Green Remediation Program Policy, January 2011 Superfund Green Remediation Strategy, September 2010	State and federal technical guidance documents that provide guidelines for the development of site remediation strategies in a manner that minimizes environmental impacts and applies green remediation concepts (e.*g.,* reduction in greenhouse gas emissions, energy consumption and resource use, promotion of recycling of materials and conservations of water, land and habitat).	Potentially applicable TBC.	No	Yes
General excavation	6 NYCRR 200-203, 211-212 - Prevention and Control of Air Contamination and Air Pollution	Provides requirements for air emission sources.	Portions potentially applicable to volatile emissions during excavation	Yes	No
	6 NYCRR 257 - Air Quality Standards	Promulgated state regulation that provides specific limits on generation of SO_2, particulates, CO_2, photochemical oxidants, hydrocarbons (non-methane), NO_2, fluorides, beryllium and H2S from point sources.	Not applicable or relevant and appropriate. Dust emissions would not be generated from a point source. Potential TBC during dust generating activities such as during earth moving, grading, and excavation.	No	Yes
	40 CFR Part 50.1 - 50.12 - National Ambient Air Quality Standards	Promulgated federal regulation that provides air quality standards for pollutants considered harmful to public health and the environment. The six principal pollutants are carbon monoxide, lead, nitrogen dioxide, particulates, ozone, and sulfur oxides.	Potentially applicable to alternatives during which dust generation may result, such as during earth moving, grading, and excavation.	Yes	No
	NYS TAGM 4031 - Dust Suppressing and Particle Monitoring at Inactive Hazardous Waste Disposal Sites	State guidance document that provides limitations on dust emissions.	To be considered material where more stringent than air-related ARARs.	No	Yes
Transportation	6 NYCRR 364 - Waste Transporter Permits	Promulgated state regulation requiring that hazardous waste transport must be conducted by a hauler permitted under 6 NYCRR 364.	Potentially applicable for off-site transport of hazardous waste.	Yes	No
	49 CFR 107, 171-174 and 177-179 - Department of Transportation Regulations	Promulgated federal regulation requiring that hazardous waste transport to off-site disposal facilities must be conducted in accordance with applicable Department of Transportation requirements.	Potentially applicable for off-site transport of hazardous waste to off-site treatment/disposal facilities.	Yes	No

Notes:

ARARs - Applicable or Relevant and Appropriate Requirements
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
CFR - Code of Federal Regulations
DER - Division of Environmental Remediation
FEMA – Federal Emergency Management Agency
FS - Feasibility Study
NYCRR - New York Code of Rules and Regulations
NYS - New York State
NYSDEC - New York State Department of Environmental Conservation
NYSDOH - New York State Department of Health
OSWER - Office of Solid Waste and Emergency Response
RCRA – Resource Conservation and Recovery Act
SCOs - Soil Cleanup Objectives
TAGM - Technical and Administrative Guidance Memorandum (NYSDEC)
TBC - To be Considered
TOGS – Technical and Operational Guidance Series
USC - United States Code
USEPA or EPA - United States Environmental Protection Agency

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL/FILL MATERIAL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
No action	No action	No action*	No remedial action to address SYW-12 Site soil/fill material.	Readily implementable.	Not effective in mitigating the potential for migration of or exposure to soil/fill material.	No capital No O&M	Potentially applicable. Retained for further consideration. Required for consideration by the NCP (40 CFR Part 300.430) and NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation.
Institutional controls/ Limited actions	Monitoring	Biota Monitoring*	Periodic sampling and analysis of biota as a means of assessing protectiveness to ecological receptors.	Implementable. Would require property owner agreement.	Effective means for monitoring remedy effectiveness.	Low capital Low O&M	Potentially applicable. Would require access agreement with property owner and coordination with CSX. Retained for further consideration.
Institutional controls/ Limited actions	Access/use restrictions/ administrative control(s)	Institutional controls*	Implementation and documentation of access and land use restrictions that would require activities that would potentially disturb or expose contaminated soil/fill material (and require health and safety precautions) be conducted in accordance with the site management plan. Institutional controls would also provide provisions to evaluate and address potential soil vapor intrusion, as necessary, if a new building(s) is constructed at the SYW-12 Site.	Implementable. Would require property owner agreement/implementation.	Effective means of controlling site use for the protection of human health.	Low capital No O&M	Potentially applicable. Would require property owner agreement/implementation. Retained for further consideration.
	Site controls	Site management plan*	Documentation of site restrictions and provisions for continued operation and maintenance of the remedy. Presents site engineering and institutional controls and physical components of the selected remedy requiring operation, maintenance and monitoring to provide continued effectiveness. The site management plan would also present provisions for periodic site reviews.	Implementable. Would require property owner agreement/implementation.	Effective means of controlling site use for protection of human health. Effective means of communicating soil management/handling procedures, site use restrictions and remedy components, including operation, maintenance, and monitoring requirements.	Low capital No O&M	Potentially applicable. Would require property owner agreement/implementation. Retained for further consideration.

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL/FILL MATERIAL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
Institutional controls/ Limited actions (continued)	Periodic reviews	Periodic site reviews*	Periodic reviews are required by 6 NYCRR Part 375 and DER-10 where institutional and engineering controls, monitoring plans, and/or operations and maintenance activities are implemented on a site. The purpose of the reviews is to evaluate the areas in regard to the continuing protection of human health and the environment and to provide documentation of remedy effectiveness. In accordance with 6 NYCRR Part 375-1.8(h)(3), the frequency of periodic reviews should be annual, unless a different frequency is approved the by NYSDEC. Periodic site reviews would include performance of supplemental Five Year Reviews in accordance with 40 CFR 300.430(f)(4)ii.	Readily implementable. Would require property owner agreement/implementation.	Effective means of evaluating continued protection to human health and the environment.	No capital Low O&M	Potentially applicable. Would require property owner agreement/implementation. Retained for further consideration.
Natural Recovery	Natural attenuations	Natural attenuation	The natural degradation of organic contaminants by *in situ* physical, chemical and/or biological processes. Over time, contaminants' toxicity, mobility and/or volume can be reduced by processes that include biodegradation, sorption, dilution, volatilization, and/or transformation.	Potentially implementable	Potentially effective over the long-term for reduction of contaminant concentrations. Evaluation of attenuation mechanisms would be necessary.	Low capital No O&M	Potentially applicable. Evaluation of naturally occurring attenuation processes would be required.
Containment	Cover system	Vegetation enhancement	Use of enhanced vegetative growth to reduce erosion of surface soil/fill material. Can be applied using hydroseeding techniques (*i.e.*, blown or sprayed on), and can be mixed with wood or paper mulch during application.	Implementable. Routine cover maintenance and inspection would be necessary to maintain cover system integrity.	Effective for reducing surface soil/fill material erosion due to surface water/storm water flow or wind. Thick vegetation is effective at inhibiting contact with soil/fill material. Potentially effective means of improving evapotranspiration. Effectiveness relies on maintaining integrity of cover system.	Low capital Low O&M	Potentially applicable. Retained for further consideration where surface soil/fill material exhibit concentration above NYCRR Part 375 SCOs corresponding to site use.
		Engineered cover*	Use of vegetated soil/granular material, gravel or asphalt to reduce erosion of surface soil/fill material and prevent direct contact with soil/fill material. Grading would be performed such that drainage is promoted, erosion is minimized, and cover integrity is protected.	Implementable. Routine cover maintenance and inspection would be necessary to maintain cover system integrity.	Effective means of minimizing erosion of, and contact with exposed surface soil and soil/fill material. Effective means of minimizing erosion of soil/fill material that could result in surface water contamination. Potentially effective means of improving evapotranspiration. Effectiveness relies on maintaining integrity of cover system.	Medium capital Medium O&M	Potentially applicable. Retained for further consideration in area where surface soil/fill material exhibit constituent concentrations above NYCRR Part 375 SCOs corresponding to the site use.

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL/FILL MATERIAL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
Containment (continued)	Cover system (continued)	Low permeability cover	Use of a low permeability cover to minimize surface water infiltration, encourage runoff and control erosion, and isolate and contain impacted soil/fill material. Low permeability cover components may consist of low permeability clay or a geomembrane system. Vegetation, asphalt, or gravel may be utilized as the top layer based upon site use and restoration requirements within the covered area.	Implementable. Routine cover maintenance and inspection would be necessary to maintain cover system integrity.	Effective means of minimizing erosion of, and contact with exposed soil/fill material. Effective means of minimizing erosion of soil/fill material that could result in surface water contamination. Results in reduction in infiltration that could reduce leaching of contaminants in soil/fill material to groundwater, and reduce mobilization of contaminants. Potentially effective means of improving evapotranspiration. Effectiveness relies on maintaining integrity of cover system.	High capital Med O&M	Potentially applicable. Retained for further consideration in areas where surface soil/fill material exhibit concentrations above NYCRR Part 375 SCOs corresponding to site use.
In situ treatment	Biological	Enhanced bioremediation	Injection of microbial populations and potential nutrient sources/electron donors into subsurface to enhance biological degradation of organic constituents.	Potentially implementable. Nutrient addition and/or altering of soil redox conditions may be needed to facilitate biodegradation. Limitations to implementability would exist in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site. Implementation may be difficult in areas prone to flooding.	Potentially effective for degradation of VOCs and SVOCs in saturated and unsaturated soil/fill material. Not effective for treatment of organics. Effectiveness potentially limited by heterogeneous subsurface conditions, which could result in uneven distribution and limited contact of electron donors and/or microorganisms, resulting in areas of untreated contaminants. Treatability study would be required.	Medium capital Low O&M	Variety of contaminant types in soil/fill material could limit effectiveness. Not applicable for treatment of inorganics. Subsurface conditions likely to limit treatment effectiveness. Access limitations would limit implementability. Targeted *in situ* treatment potentially implementable. Retained for further consideration for focused treatment of soil/fill material.
		Bioventing	Introduction of low air flow rates to the subsurface to provide enough oxygen to sustain microbial activity, thereby stimulating the natural *in situ* biodegradation of aerobically degradable compounds in soil.	Implementability limited. Heterogeneity of subsurface materials would result in uneven oxygen flow. Limitations to implementability would exist in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site. Implementation may be difficult in areas prone to flooding.	Potentially effective for degradation of petroleum hydrocarbons and non-chlorinated solvents in the unsaturated zone. Not effective for inorganics. Effectiveness potentially limited by heterogeneous subsurface conditions, which could limit effective distribution of air flow within the, resulting in areas of untreated soil/fill material. Effectiveness also potentially limited by presence of underground utilities and obstructions, which may provide preferential pathways or obstructions to air flow. Treatability study would be required.	Medium capital Low O&M	Not retained for further consideration, because not practical for SYW-12 Site wetland area in floodplain adjacent to lake. SYW-12 Site and subsurface conditions likely to limit implementability and treatment effectiveness.
		Phytoremediation	Use of plants to remove, transfer, stabilize, or destroy contaminants in shallow soil.	Potentially implementable for shallow soil. Watering, fertilization, and insecticide application potentially required. Non-growing season would limit implementability.	Potentially effective for reducing VOCs, SVOC, and inorganics in shallow soil. Potentially effective for providing habitat and erosion control. Not effective at depths below plant root zone. Treatability study would be required.	Low capital Low O&M	Not retained for further consideration. Seasonal limitations and depth of root zone limit implementability and effectiveness.
	Physical/ Chemical	Chemical oxidation	*In situ* treatment of soil/fill material using oxidants such as ozone, hydrogen peroxide, hypochlorites, permanganate, and/or sodium persulfide. Oxidation reactions chemically convert constituents to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. Oxidation agents can be applied to the subsurface via injection points, deep soil mixing, or soil fracturing.	Potentially implementable. Soil saturation potentially required for implementation. Large quantities of oxidant potentially required. Potentially implementable for targeted treatment of soil/fill material. Limitations to implementability would exist in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site. Implementation may be difficult in areas prone to flooding.	Potentially effectives for treatment of VOCs and SVOCs in saturated soil. Not effective for treatment of inorganics. Effectiveness potentially limited by heterogeneous subsurface conditions, which could result in uneven distribution and limited contact of oxidant, resulting in areas of untreated contaminants. Treatability study would be required. Potential for production of hazardous intermediates if incomplete	High capital Low to medium O&M	Not practicable for site-wide treatment of constituents exceeding SCOs. Variety of contaminant types in soil/fill material could limit effectiveness. Not applicable for treatment of inorganics. Subsurface conditions likely to limit treatment effectiveness. Access limitations would limit implementability. Targeted i*n situ* treatment potentially implementable. Retained for further

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL/FILL MATERIAL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
					oxidation occurs. Potential for mobilization of contamination with injection of fluids.		consideration for focused treatment of soil/fill material.
In situ treatment (continued)	Physical/ Chemical (continued)	Soil-vapor extraction (SVE)	Vacuum is applied through extraction wells within the vadose zone to create a pressure/concentration gradient that induces organics sorbed on the soil/fill material, and/or dissolved in pore water to volatilize. Extracted vapors are removed through extraction wells and treated *ex situ* as needed.	Implementability limited. Heterogeneous subsurface conditions could limit radius of influence of SVE points. Not implementable below the water table. A pilot/pumping test would be necessary to identify radius of influence and implementability in heterogeneous soil/fill material. Limitations to implementability would exist in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site. Implementation may be difficult in areas prone to flooding.	Potentially effective for treatment of VOCs and SVOCs in the unsaturated zone. Not effective for treatment of inorganics. Effectiveness limited by heterogeneous subsurface conditions which could limit effective distribution of air flow, resulting in areas of untreated soil/fill material. Underground utilities may provide preferential pathways for vapor migration, potentially causing short circuiting, and affecting treatment effectiveness. Effectiveness dependent on application of pressure/concentration gradient, which would be limited by subsurface heterogeneity. Treatability study would be required.	Medium capital Medium O&M	Not retained for further consideration because not practical for SYW-12 Site wetland area floodplain adjacent to lake. SYW-12 Site and subsurface conditions likely to limit implementability and treatment effectiveness.
		Multi-phase extraction	Vacuum is applied to remove various combinations of contaminated groundwater, separate-phase petroleum product, and vapors from the subsurface. The system lowers the water table around the well, exposing more of the formation. Contaminants in the newly exposed vadose zone are then accessible to vapor extraction. Once above ground, vapors are treated.	Implementability limited. Heterogeneous subsurface conditions could limit radius of influence of MPE points. A pilot/pumping test would be necessary to identify radius of influence and implementability in heterogeneous soil/fill material. Limitations to implementability would exist in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site. Implementation may be difficult in areas prone to flooding.	Potentially effective for treatment of VOCs and SVOCs in the saturated and unsaturated zone. Not effective for treatment of inorganics. Effectiveness limited by heterogeneous subsurface conditions, which could limit effective distribution of air flow, resulting in areas of untreated soil/fill material. Underground utilities may provide preferential pathways for vapor migration, potentially causing short circuiting, and affecting treatment effectiveness. Effectiveness dependent on application of pressure/concentration gradient, which would be limited by subsurface heterogeneity. Treatability study would be required.	Medium capital Medium O&M	Not retained for further consideration because not practical for SYW-12 Site wetland area floodplain adjacent to lake. SYW-12 Site and subsurface conditions likely to limit implementability and treatment effectiveness.
		Solidification/ Stabilization	Contaminants are physically bound or enclosed within a stabilized mass (solidification), and/or chemical reactions are induced between stabilizing agent and contaminants to reduce their mobility (stabilization), toxicity, and leachability.	Potentially implementable. Not implementable for saturated soil without dewatering. Volume increases with agent addition. Surface water diversion potentially required during implementation in areas prone to flooding. Potentially implementable for targeted treatment of soil/fill material. Advanced delivery techniques would likely be required due to heterogeneous subsurface material (*i.e., in situ* mixing, tight injection well spacing). Targeted *in situ* mixing potentially implementable to address focused areas of soil/fill material. Limitations to implementability would exist in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-	Potentially effective for *in situ* stabilization and reduction in mobility of VOCs, SVOCs and metals. Effective for reducing the permeability of the treatment zone. *In situ* mixing potentially effective for distribution of reagents. Treatability study would be required to evaluate effectiveness and selection of reagents.	Medium capital No O&M	Not practicable for site-wide treatment of constituents exceeding SCOs. Variety of contaminant types in soil/fill material could limit effectiveness. *In situ* mixing of solidification/stabilization reagents is a potentially effective and implementable. Access limitations would limit implementability. Targeted i*n situ* treatment potentially implementable. Retained for further consideration for focused treatment of soil/fill material.

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL/FILL MATERIAL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
				12 Site. Surface stability and equipment access would require consideration in area prone to flooding/high groundwater levels.			
In situ treatment (continued)	Physical/ Chemical (continued)	Flushing	Water, aqueous solution, surfactants, or cosolvents are injected into the soil or groundwater. The extraction fluid is utilized to enhance contaminant solubility. Contaminants are leached into the groundwater and subsequently removed through a collection system and treated *ex situ*.	Implementability limited due to presence of heterogeneous subsurface conditions. Recovery, management and treatment of flushing fluids and mobilized contaminants would be required. Limitations to implementability would exist in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site. Implementation may be difficult in areas prone to flooding.	Potentially effective for treatment of VOCs, SVOCs and inorganics in saturated and unsaturated zones. A treatability study would be necessary to evaluate effectiveness. Effectiveness potentially limited due to presence of heterogeneous soil/fill material which could result in uneven distribution and recovery of the flushing solution.	Medium capital No O&M	Not retained for further consideration, because subsurface conditions likely to limit implementability and treatment effectiveness.
		Electrokinetic separation	A low-intensity current is passed through the contaminated soil between ceramic electrodes. Electrochemical and electrokinetic processes cause inorganics and organic contaminants to desorb from low permeability materials. A processing solution, concentrated with contaminants, is then extracted and treated *ex situ*.	Implementability limited due to presence of heterogeneous subsurface conditions. Mobilized contaminants would require recovery and treatment/management. Limitations to implementability would exist in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site. Implementation may be difficult in areas prone to flooding.	Potentially effective for treatment of polar organics and inorganics in the saturated and unsaturated zones. Effectiveness potentially limited by heterogeneous subsurface conditions, which could result in uneven recovery of processing solution and/or mobilized contaminants.	Medium capital Medium O&M	Not retained for further consideration, because subsurface conditions likely to limit implementability and treatment effectiveness.
	Thermal	Hot water injection	Injection of hot water through injection wells to enhance the recovery of organic constituents. The injected hot water heats the subsurface, increasing dissolution of organic contaminants, with subsequent collection and treatment through a series of groundwater and vapor extraction wells.	Implementability limited due to presence of heterogeneous subsurface conditions. Potentially requires implementation in conjunction with vapor recovery and/or hydraulic control systems. Limitations to implementability would exist in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site. Implementation may be difficult in areas prone to flooding.	Not effective for treatment of inorganics. Potentially effective for treatment of VOCs and SVOCs in the unsaturated and saturated zones. A treatability study would be necessary to evaluate effectiveness. Effectiveness potentially limited by heterogeneous subsurface conditions which could limit effectiveness of SVE or MPE systems, resulting in areas of untreated soil/fill material and unrecovered vapor and/or mobilized contaminants.	Very High capital No O&M	Not retained for further consideration, because subsurface conditions likely to limit implementability and treatment effectiveness Not retained due to risk of uncontrolled migration of contaminants in floodplain adjacent to the lake.
		Steam injection	Injection of steam through injection wells to enhance the recovery of organic contaminants. The injected steam heats the surrounding subsurface, volatilizing, mobilizing, or oxidizing organic contaminants, with subsequent collection and treatment through a series of water and vapor extraction wells.	Implementability limited due to presence of heterogeneous subsurface conditions. Potentially requires implementation in conjunction with vapor recovery and/or hydraulic control systems. Limitations to implementability would exist in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site. Implementation may be difficult in areas prone to flooding.	Not effective for treatment of inorganics. Potentially effective for treatment of VOCs and SVOCs in the unsaturated and saturated zones. A treatability study would be necessary to evaluate effectiveness. Effectiveness potentially limited by heterogeneous subsurface conditions which could limit effectiveness of SVE or MPE systems, resulting in areas of untreated soil/fill material and unrecovered vapor and/or mobilized contaminants.	Very high capital No O&M	Not retained for further consideration, because subsurface conditions likely to limit implementability and treatment effectiveness. Not retained due to risk of uncontrolled migration of contaminants in floodplain adjacent to the lake.

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL/FILL MATERIAL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
In situ treatment (continued)	Thermal (continued)	Electrical resistance heating	A series of electrodes are installed around a central neutral electrode. Volatilized contaminants, produced by the heating of the subsurface surrounding the electrodes, are recovered using extraction wells and subsequently treated at the surface.	Implementability limited due to presence of heterogeneous subsurface conditions. Potentially requires implementation in conjunction with vapor recovery and/or hydraulic control systems. Limitations to implementability would exist in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site. Implementation may be difficult in areas prone to flooding. *In situ* heating could potentially cause soil fracturing. High energy requirements and potential for related hazards.	Not effective for treatment of inorganics. Potentially effective for treatment of VOCs and SVOCs and in the unsaturated and saturated zones. A treatability study would be necessary to evaluate effectiveness. Effectiveness potentially limited by heterogeneous subsurface conditions which could limit effectiveness of SVE or MPE systems, resulting in areas of untreated soil/fill material and unrecovered vapor and/or mobilized contaminants.	High capital No O&M	Not retained for further consideration, because subsurface conditions likely to limit implementability and treatment effectiveness. Not retained due to risk of uncontrolled migration of contaminants in floodplain adjacent to the lake.
		Radio frequency heating	Heating of soil using a configuration of electrodes to enhance the recovery of organic constituents. Heated soil is bound by two rows of electrodes that act as ground electrodes. A third row of electrodes is implanted halfway between the ground rows, acting as a capacitor. Electromagnetic energy is applied, heating the surrounding soil volume, causing organic contaminants to vaporize. Extraction wells remove contaminant vapors for *ex situ* treatment.	Implementability limited due to presence of heterogeneous subsurface conditions. Potentially requires implementation in conjunction with vapor recovery and/or hydraulic control systems. Limitations to implementability would exist in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site. Implementation may be difficult in areas prone to flooding. *In situ* heating could potentially cause soil fracturing. High energy requirements and potential for related hazards.	Not effective for treatment of inorganics. Potentially effective for treatment of VOCs and SVOCs in the unsaturated zone. A treatability study would be necessary to evaluate effectiveness. Effectiveness potentially limited by heterogeneous subsurface conditions which could limit effectiveness of SVE or MPE systems, resulting in areas of untreated soil/fill material and unrecovered vapor and/or mobilized contaminants.	High capital No O&M	Not retained for further consideration, because subsurface conditions likely to limit implementability and treatment effectiveness and risk of uncontrolled migration of contaminants and in floodplain adjacent to the lake.
		Thermal conduction	Heat is applied to the subsurface through steel wells or thermal blankets. Organic contaminants are volatilized through heating, and subsequently collected for treatment at the surface.	Implementability limited due to presence of heterogeneous subsurface conditions. Potentially requires implementation in conjunction with vapor recovery and/or hydraulic control systems. Limitations to implementability would exist in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site. Implementation may be difficult in areas prone to flooding. *In situ* soil heating could potentially cause soil fracturing. High energy requirements and potential for related hazards.	Not effective for treatment of inorganics. Potentially effective for treatment of VOCs, and SVOCs in the unsaturated and saturated zones. A treatability study would be necessary to evaluate effectiveness. Effectiveness potentially limited by heterogeneous subsurface conditions which could limit effectiveness of SVE or MPE systems, resulting in areas of untreated soil/fill material and unrecovered vapor and mobilized contaminants.	High capital No O&M	Not retained for further consideration, because not practicable for site-wide treatment of constituents exceeding SCOs, and subsurface conditions likely to limit implementability and treatment effectiveness and risk of uncontrolled migration of contaminants in floodplain adjacent to the lake.
		Vitrification	An electric current is utilized to melt soil at extremely high temperatures (2,900 to 3,650 °F) and thereby immobilize most inorganics and destroy organics by pyrolysis.	Implementability limited due to access limitations and underground utilities. Potentially requires implementation in conjunction with vapor recovery and/or hydraulic control systems. Limitations to implementability would exist in the immediate vicinity of subsurface utilities	Potentially effective for treatment of VOCs, SVOCs, and inorganics in the unsaturated zone. A treatability study would be necessary to evaluate effectiveness. Effectiveness potentially limited by heterogeneous subsurface conditions which could limit effectiveness of SVE or MPE systems, resulting in areas of untreated soil/fill	Very high capital No O&M	Not retained for further consideration, because subsurface conditions likely to limit implementability and treatment effectiveness and risk of uncontrolled migration of contaminants in floodplain adjacent to the lake.

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL/FILL MATERIAL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
				and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site. Implementation may be difficult in areas prone to flooding. *In situ* soil heating could potentially cause soil fracturing. High energy requirements and potential for related hazards.	material and unrecovered vapor and mobilized contaminants.		
Removal	Excavation	Mechanical excavation*	Use of construction equipment to remove soil/fill material. Due to physical characteristics of soil/fill material and presence below groundwater table, dewatering and water treatment would likely be required. It is anticipated that in addition to dewatering, sludge management may also be required to render the excavated material sufficiently dry for management and transportation. Excavated areas would be backfilled, graded and restored based on restoration requirements. Soil/fill material would be transported and disposed off-site. Treated water would be discharged locally to a water body.	Implementable for soil/fill material. Implementability of excavations limited by depth of impacted materials. Shoring or side slopes required for deep excavations. Water management required for saturated soil. Further management of excavated soil required. Limitations to implementability would exist in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site. Implementation may be difficult in areas prone to flooding. SYW-12 Site-wide excavation not practical due to excessive volume. Potentially implementable for targeted removal of soil/fill material.	Effective means of reducing the toxicity, mobility, and volume of impacted soil/fill material (where accessible). Dewatering and/or stabilization may be required prior to management, treatment, and disposal.	High capital No O&M	Not practicable for site-wide removal of constituents exceeding SCOs. Limitations to implementability in the immediate vicinity of subsurface utilities and the railroad tracks. Potentially applicable for targeted removal of soil/fill material and. Retained for further consideration.
Ex situ treatment	Biological	Biopiles	Excavated soil/fill material is mixed with soil amendments and placed in aboveground enclosures. Compost is formed into piles and aerated with blowers or vacuum pumps using an aerated static pile composting process.	Potential community and local government acceptance issues related to noise, and odor/dust/emissions. Access limitations would limit implementability at the SYW-12 Site. Control and treatment of emissions from *ex situ* treatment process may be required. Treated soil/fill material would require further off-site management unless allowed to be re-used as fill material and/or consolidated on-site. Design, construction and testing of a pilot system would be necessary to evaluate implementability.	Potentially effective for degradation of VOCs and SVOCs in excavated soil/fill material. Not effective for treatment of inorganics. A treatability study and identification of effective soil amendments would be required.	High capital Medium O&M	Not practicable for site-wide treatment of constituents exceeding SCOs. *Ex situ* soil treatment potentially incompatible with anticipated SYW-12 Site use. Not retained for further consideration.
		Landfarming	Contaminated soil/fill material is excavated, applied into lined beds, and periodically turned over or tilled to aerate the waste.	Potential community and local government acceptance issues related to noise, and odor/dust/emissions. Access limitations would limit implementability at the SYW-12 Site. Control and treatment of emissions from *ex situ* treatment process may be required. Treated soil/fill material would require further off-site management unless allowed to be re-used as fill material and/or consolidated on-site. Design, construction and testing of a pilot system would be necessary to evaluate implementability.	Potentially effective for degradation of VOCs and SVOCs in excavated soil/fill material. Not effective for treatment of inorganics. A treatability study and identification of effective soil amendments would be required.	High capital Medium O&M	Not practicable for site-wide treatment of constituents exceeding SCOs. *Ex situ* soil treatment potentially incompatible with anticipated SYW-12 Site use. Not retained for further consideration.

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL/FILL MATERIAL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
Ex situ treatment (continued)	Biological (continued)	Slurry-phase bioreactor	An aqueous slurry is created by combining soil/fill material with water and other additives. The slurry is mixed to keep solids suspended and microorganisms in contact with the soil contaminants. The slurry is dewatered and the treated soil disposed of upon completion of the process.	Potential community and local government acceptance issues related to noise, and odor/dust/emissions. Access limitations would limit implementability at the SYW-12 Site. Control and treatment of emissions from *ex situ* treatment process may be required. Treated soil/fill material would require further off-site management unless allowed to be re-used as fill material and/or consolidated on-site. Design, construction and testing of a pilot system would be necessary to evaluate implementability.	Potentially effective for removal of VOCs and SVOCs. Treatability study would be required. Not effective for inorganics. A treatability study and identification of effective soil amendments would be required.	High capital Medium O&M	Not practicable for site-wide treatment of constituents exceeding SCOs. *Ex situ* soil treatment potentially incompatible with anticipated SYW-12 Site use. Not retained for further consideration.
	Chemical	Chemical Oxidation	*Ex situ* treatment of contaminated soil/fill material using oxidants such as ozone, hydrogen peroxide, hypochlorites, permanganate, and/or persulfate. Oxidation reactions chemically convert constituents to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.	Potential community and local government acceptance issues related to noise, and odor/dust/emissions. Access limitations would limit implementability at the SYW-12 Site. Control and treatment of emissions from *ex situ* treatment process may be required. Treated soil/fill material would require further off-site management unless allowed to be re-used as fill material and/or consolidated on-site. Design, construction and testing of a pilot system would be necessary to evaluate implementability.	Potentially effective for treatment of VOCs, SVOCs in excavated soil/fill material. Not effective for treatment of inorganics. A treatability study and oxidant demand study would be necessary to evaluate effectiveness.	High capital Medium O&M	Not practicable for site-wide treatment of constituents exceeding SCOs. *Ex situ* soil treatment potentially incompatible with anticipated SYW-12 Site use. Not retained for further consideration.
		Extraction/ washing	Soil/fill material and extractant are mixed in an extractor, thereby dissolving the contaminants. The extracted solution is then placed in a separator, where the contaminants and extractant are separated for treatment and further use. Fine materials containing organics are also separated from coarse materials using this process. Treated soil/fill material could be re-used as backfill.	Potential community and local government acceptance issues related to noise, and odor/dust/emissions. Access limitations would limit implementability at the SYW-12 Site. Control and treatment of emissions from *ex situ* treatment process may be required. Treated soil/fill material would require further off-site management unless allowed to be re-used as fill material and/or consolidated on-site. Extraction solution treatment/management would also be required. Design, construction and testing of a pilot system would be necessary to evaluate implementability.	Potentially effective for removal of VOCs, SVOCs, PCBs, and inorganics from excavated soil/fill material. Heterogeneous soil/fill material may reduce effectiveness. A treatability study would be necessary to evaluate effectiveness.	Medium capital Medium O&M	Not practicable for site-wide treatment of constituents exceeding SCOs. *Ex situ* soil treatment potentially incompatible with anticipated SYW-12 Site use. Not retained for further consideration.
		Dehalogenation	Reagents are added to soil/fill material contaminated with halogenated organics, then heated in a reactor. The dehalogenation process is achieved by either the replacement of the halogen molecules or decomposition and partial volatilization of the contaminants.	Potential community and local government acceptance issues related to noise, and odor/dust/emissions. Access limitations would limit implementability at the SYW-12 Site. Control and treatment of emissions from *ex situ* treatment process may be required. Treated soil/fill material would require further off-site management unless allowed to be re-	Not effective for treatment of other VOCs, SVOCs, and inorganics.	High capital Medium O&M	Not effective for treatment of other VOCs, SVOCs, and inorganics. *Ex situ* soil treatment potentially incompatible with anticipated SYW-12 Site use. Not retained for further consideration.

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL/FILL MATERIAL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
				used as fill material and/or consolidated on-site. Reagent treatment/management would also be required. Design, construction and testing of a pilot system would be necessary to evaluate implementability.			
Ex situ treatment (continued)	Physical	Particle size separation	Sieves and screens of different sizes are used to concentrate contaminants in smaller volumes. Most organic and inorganic contaminants tend to bind, either chemically or physically, to other soil/fill particles. Separating the fine particles from the coarser particles will effectively concentrate the contaminants into a smaller volume of soil that could be further treated or disposed.	Potentially implementable. Further treatment and management of separated soil/fill material would be required.	Effective for separation of particle sizes and debris removal for further treatment and disposal. A treatability study would be necessary to evaluate effectiveness.	Low capital Low O&M	Not practicable for site-wide treatment constituents exceeding SCOs. *Ex situ* soil treatment potentially incompatible with anticipated SYW-12 Site use. Soil/fill material would require further treatment. Not retained for further consideration.
		Solidification/ stabilization	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between stabilizing agent and contaminants to reduce their mobility (stabilization). Solidification and stabilization involve mixing treatment agents with the contaminated soil yielding a crystalline, glassy, or polymeric framework around the contaminants.	Potential community and local government acceptance issues related to noise, and odor/dust/emissions. Access limitations would limit implementability at the SYW-12 Site. Control and treatment of emissions from *ex situ* treatment process may be required. Treated soil/fill material would require further off-site management unless allowed to be re-used as fill material and/or consolidated on-site.	Potentially effective for reducing the mobility of VOCs, SVOCs, and inorganics. A treatability study would be necessary to evaluate effectiveness.	Medium capital Low O&M	Not practicable for site-wide treatment of constituents exceeding SCOs. *Ex situ* soil treatment potentially incompatible with anticipated SYW-12 Site use. Not retained for further consideration.
	Thermal	Low temperature thermal desorption	Use of direct or indirect heat to volatilize organic contaminants at temperatures generally between 200 and 600 °F. Further treatment of vapor phase potentially required.	Control and treatment of emissions from thermal treatment processes would be required for organics and mercury. Significant permitting issues and potential community and local government acceptance issues related to noise, and odor/dust/emissions. Access limitations would limit implementability at the SYW-12 Site. Treated soil/fill material would require further off-site management unless allowed to be re-used as fill material and/or consolidated on-site.	Potentially effective for treatment of VOCs and SVOCs. Not effective for treatment of inorganics. A treatability study would be necessary to evaluate effectiveness.	Medium capital Medium O&M	Not retained due to implementability limitations and community acceptance. *Ex situ* soil treatment potentially incompatible with anticipated SYW-12 Site use. Variety of contaminant types in soil/fill material would limit effectiveness. Not retained for further consideration.
		Pyrolysis	Chemical decomposition of organic materials is induced by heat in the absence of oxygen at temperatures around 800 °F. Organic materials are transformed into gaseous components and solid residue (coke) containing fixed carbon and ash.	Control and treatment of emissions from thermal treatment processes would be required. Control of mercury emissions is difficult. Significant permitting issues and potential community and local government acceptance issues related to noise, and odor/dust/emissions. Access limitations would limit implementability at the SYW-12 Site. Treated soil/fill material would require further off-site management unless allowed to be re-used as fill material and/or consolidated on-site.	Likely effective for treatment of VOCs and SVOCs. Not effective for treatment of inorganics. A treatability study would be necessary to evaluate effectiveness.	High capital High O&M	Not retained due to implementability limitations and community acceptance. *Ex situ* soil treatment potentially incompatible with anticipated SYW-12 Site use. Variety of contaminant types in soil/fill material would limit effectiveness. Not retained for further consideration.

TABLE 3-2. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR SOIL/FILL MATERIAL

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
Ex situ treatment (continued)	Thermal (continued)	Incineration	Combustion of organic contaminants present in soil/fill material in commercial incinerator at temperature generally between 1,600 and 2,200 °F.	Control and treatment of emissions from thermal treatment processes would be required. Control of mercury emissions is difficult. Significant permitting issues and potential community and local government acceptance issues related to noise, and odor/dust/emissions. Access limitations would limit implementability at the SYW-12 Site. Treated soil/fill material would require further off-site management unless allowed to be re-used as fill material and/or consolidated on-site.	Likely effective for destruction of VOCs and SVOCs. Not effective for treatment of inorganics. A treatability study would be necessary to evaluate effectiveness.	High capital High O&M	Not retained due to implementability limitations and community acceptance. *Ex situ* soil treatment potentially incompatible with anticipated SYW-12 Site use. Variety of contaminant types in soil/fill material would limit effectiveness. Not retained for further consideration.
Disposal	On-site disposal	On-site consolidation/ reuse*	Placement of excavated soil/fill material in an on-site containment system (*i.e.*, consolidation) or reused on-site (*e.g.*, fill material for site development).	Potentially implementable for limited quantities of excavated/treated soil/fill material that meet Part 375 SCOs based on land use.	Effective means for management of excavated/treated soil/fill material on-site. Excavated soil/fill material may require treatment prior to on-site consolidation/reuse.	Medium capital Medium O&M	Potentially applicable. Retained for further consideration for targeted quantities of soil/fill material.
	Off-site disposal	Off-site commercial landfill*	Excavated soil/fill material would be transported to a permitted commercial landfill, if it meets land disposal restriction requirements. Due to physical characteristics of soil/fill material and presence below groundwater table, dewatering and water treatment would likely be required.	Potentially implementable for limited quantities of soil/fill material that meets land disposal restrictions.	Effective for management of excavated soil/fill material.	High capital No O&M	Potentially applicable. Retained for further consideration for targeted quantities of soil/fill material.
	Off-site treatment/ disposal	Off-site treatment facility	Excavated soil/fill material would be transported to a permitted hazardous commercial landfill. Soil/fill material that does not meet land disposal restriction requirements would be treated prior to disposal. Due to physical characteristics of soil/fill material and presence below groundwater table, dewatering and water treatment would likely be required.	Potentially implementable for limited quantities of soil/fill material that does not meet land disposal restrictions.	Effective for treatment and management of excavated soil/fill material. A treatability study would be required to evaluate treatment capabilities and capacities of off-site commercial treatment/disposal facilities.	High capital No O&M	Potentially applicable. Retained for further consideration for targeted quantities of soil/fill material.

Notes:
* Representative Process Option
Shaded cells – Process option not retained for further consideration.

Abbreviations/Acronyms:
CFR - Code of Federal Regulations
DER - Division of Environmental Remediation
°F - degrees Fahrenheit
MPE – Multi-phase extraction
NYCRR - New York Code of Rules and Regulations
NYSDEC – New York State Department of Environmental Conservation
NCP - National Oil and Hazardous Substances Pollution Contingency Plan
O&M – Operation and Maintenance
SCO – Soil cleanup objective
SVOC – Semi-Volatile Organic Compound
VOC – Volatile Organic Compound

TABLE 3-3. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
No action	No action	No action*	No remedial action to address SYW-12 Site groundwater.	Readily implementable.	Not effective for monitoring potential for constituent migration in groundwater to Onondaga Lake and Ley Creek, or for mitigating unacceptable risks.	No capital No O&M	Potentially applicable. Retained for further consideration. Required for consideration by the NCP (40 CFR Part 300.430) and NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation.
Institutional controls/Limited actions	Monitoring	Groundwater monitoring*	Periodic sampling and analysis of media as a means of detecting changes in constituent concentrations and provides a means of evaluating natural attenuation.	Implementable. Would require property owner agreement.	Effective method for monitoring changes in constituent concentrations and natural attenuation over time. Effective means for monitoring remedy effectiveness.	Low capital Low O&M	Potentially applicable. Would require access agreement with property owner and coordination with CSX. Retained for further consideration.
	Access/use restrictions/ administrative control(s)	Institutional controls*	Implementation and documentation of groundwater use, access and land use restrictions that would require activities that would potentially disturb or expose contaminated groundwater (and require health and safety precautions) be conducted in accordance with the site management plan. Institutional controls would also provide provisions to evaluate and address potential soil vapor intrusion, as necessary, if a new building(s) is constructed at the SYW-12 Site.	Implementable. Would require property owner agreement/implementation.	Effective means of controlling use of groundwater and site use.	Low capital No O&M	Potentially applicable. Would require property owner agreement/implementation. Retained for further consideration.
	Site controls	Site management plan*	Documentation of site restrictions and provisions for continued operation and maintenance of the remedy. Presents site engineering and institutional controls and physical components of the selected remedy requiring operation, maintenance and monitoring to provide continued effectiveness. The site management plan would also present requirements for groundwater monitoring and provisions for periodic site reviews.	Implementable. Would require property owner agreement/implementation.	Effective means of documenting site use restrictions and remedy components, including operation, maintenance, and monitoring requirements.	Low capital No O&M	Potentially applicable. Would require property owner agreement/implementation. Retained for further consideration.
	Periodic reviews	Periodic site reviews*	Periodic reviews are required by 6 NYCRR Part 375 and DER-10 where institutional and engineering controls, monitoring plans, and/or operations and maintenance activities are implemented on a site. The purpose of the reviews is to evaluate the areas in regard to the continuing protection of human health and the environment and to provide documentation of remedy effectiveness. In accordance with 6 NYCRR Part 375-1.8(h)(3), the frequency of periodic reviews should be annual, unless a different frequency is approved by NYSDEC. Periodic site reviews would include the performance of supplemental Five Year Reviews in accordance with 40 CFR 300.430(f)(4)ii.	Implementable. Would require property owner agreement/implementation.	Effective means of evaluating continued protection to human health and the environment.	No capital Low O&M	Potentially applicable. Would require property owner agreement/implementation. Retained for further consideration.

TABLE 3-3. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
Natural recovery	Natural attenuation	Natural attenuation*	The natural degradation of organic contaminants by *in situ* physical, chemical and/or biological processes. Over time, contaminants' toxicity, mobility and/or volume can be reduced by processes that include biodegradation, sorption, dilution, volatilization, and/or transformation.	Potentially implementable.	Potentially effective over the long-term for reduction of contaminant concentrations. The groundwater restoration timeframe is unknown; however, groundwater sampling conducted in 2019 indicated that naphthalene was the only organic that exceeded the Class GA guidance value, with lower detected concentrations in 2019 than historical detections. Geochemical conditions are favorable for natural attenuation to occur. Evaluation of attenuation mechanisms may be necessary.	No capital No O&M	Potentially applicable. Evaluation of naturally occurring attenuation processes may be required. Retained for further consideration.
		Monitored natural attenuation*	Long-term monitoring of natural degradation of organic contaminants by *in situ* physical, chemical and/or biological processes.	Potentially implementable. Long-term monitoring of groundwater could be included to evaluate natural attenuation.	Potentially effective method for monitoring the natural degradation of organic contaminants over time. Groundwater sampling conducted in 2019 indicated that naphthalene was the only organic that exceeded the Class GA guidance value at only one monitoring location. Geochemical conditions are favorable for natural attenuation to occur.	Low capital Low O&M	Potentially applicable for MNA of naphthalene in groundwater. Retained for further consideration.
Hydraulic control	Physical barrier wall	Slurry wall	Soil- or cement-bentonite slurry wall placed along the perimeter of the area of contamination to contain groundwater from discharge to other resources. Containment wall should extend into a confining layer.	Implementability potentially limited due to depth of confining layer. A pre-design study would be necessary to evaluate depth and presence of a confining layer and compatibility of bentonite with SYW-12 Site groundwater conditions (*i.e.,* saline). Limitations to implementability would exist in areas in the immediate vicinity of subsurface utilities and the railroad tracks.	Potentially effective at hydraulically containing groundwater discharge if used in conjunction with a groundwater extraction system. Effective containment method for VOCs, SVOCs, and inorganics in groundwater.	High capital Low O&M	Potentially applicable. A pre-design study would be necessary to evaluate depth and presence of confining later and slurry wall compatibility with SYW-12 Site groundwater.
		Sheet piles	Sheet piles installed along the area of contamination to contain groundwater discharge to other resources. Sheet pile materials include HDPE, fiberglass, vinyl and steel. Sheet piles should extend into a confining layer.	Potentially implementable. A pre-design investigation would be necessary to evaluate depth and presence of a confining layer. Limitations to implementability would exist in areas in the immediate vicinity of subsurface utilities and the railroad tracks.	Effective at hydraulically containing groundwater discharge if used in conjunction with a groundwater extraction system. Effective containment method for VOCs, SVOCs, and inorganics in groundwater.	High capital Low O&M	Potentially applicable. Retained for further consideration. A pre-design study would be necessary to evaluate depth and presence of confining later.
	Extraction	Extraction wells (vertical or horizontal)	Removal of groundwater by pumping from one or more recovery wells for hydraulic control.	Potentially implementable. A pilot/pumping test would be necessary to design extraction wells. Recovered groundwater would require management (*i.e.,* on-site or off-site treatment, or discharge to a publicly owner treatment works). Limitations to implementability would exist in areas in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site.	Effective at collecting groundwater and hydraulically controlling groundwater discharge. Long-term maintenance would potentially be required due to the effects of natural groundwater geochemistry.	Medium capital Medium O&M	Potentially applicable. Access limitations and surrounding infrastructure would limit implementability. Retained for further consideration.

TABLE 3-3. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
Hydraulic control (continued)	Extraction (continued)	Collection trench	Collection trench installed to provide hydraulic control of groundwater that intercepts the collection trench.	Potentially implementable. Recovered groundwater would require management (*i.e.*, on-site or off-site treatment, or discharge to a publicly owner treatment works). Limitations to implementability would exist in areas in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site.	Effective for hydraulic control of groundwater. Long-term maintenance would potentially be required due to the effects of natural groundwater geochemistry.	Medium capital Medium O&M	Potentially applicable. Access limitations and surrounding infrastructure would limit implementability. Retained for further consideration.
		Multi-phase extraction (MPE)	Simultaneous extraction of groundwater and/or soil vapor from one or more MPE wells.	Potentially implementable. Recovered groundwater and/or soil vapor would require management. A pilot/pumping test would be necessary to identify radius of influence and implementability. Limitations to implementability would exist in areas in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site.	Potentially effective for removal of VOCs and SVOCs in the unsaturated and saturated zone. Potentially effective for removal of inorganics in the saturated zone. Long-term maintenance would potentially be required due to the effects of natural groundwater geochemistry. A treatability study would be required.	Medium capital High O&M	Potentially applicable. Access limitations and surrounding infrastructure would limit implementability. Retained for further consideration.
In situ treatment	Biological	Enhanced bioremediation	Injection of microbial populations and potentially nutrient sources/electron donors into groundwater to enhance biological degradation of organic constituents.	Potentially implementable. Potential for injection well fouling. Groundwater would potentially require nutrients and/or altering of redox conditions to facilitate biodegradation. Treatability study would be required to evaluate SYW-12 Site groundwater geochemistry and microbiological conditions. Limitations to implementability would also exist in areas in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site.	Potentially effective for treatment of dissolved phase VOCs and SVOCs in groundwater. Not effective for treatment of inorganics. Subsurface heterogeneity could cause uneven distribution of electron donors and/or microorganisms, resulting in pockets of untreated contaminants. Treatability study would be required.	Medium capital Low O&M	Variety of contaminant types in groundwater could limit effectiveness. Not applicable for treatment of inorganics. Effectiveness potentially limited due to heterogeneous conditions. Access limitations would limit implementability.

TABLE 3-3. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
In situ treatment (continued)	Chemical	Chemical oxidation	*In situ* treatment of groundwater using oxidants such as ozone, hydrogen peroxide, hypochlorites, permanganate, and/or sodium persulfide. Oxidation reactions chemically convert constituents to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.	Potentially implementable. Potential for injection well fouling. Potential for health and safety issues when handling large volumes of oxidant chemicals and working near potentially aggressive reactions. Limitations to implementability would also exist in areas in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site.	Potentially effective for treatment of dissolved phase VOCs and SVOCs in groundwater. Not effective for treatment of inorganics. Subsurface heterogeneity could cause uneven distribution of oxidants, resulting in pockets of untreated contaminants. Oxidant injections can move with the contaminant plume. Could potentially disrupt natural attenuation processes. Treatability study would be required.	Medium capital High O&M	Variety of contaminant types in groundwater could limit effectiveness. Not applicable for treatment of inorganics. Effectiveness potentially limited due to heterogeneous conditions. Access limitations would limit implementability.
	Physical	In-well air stripping	Injection of air into the water column within a well to volatilize constituents. Groundwater circulation is performed *in situ*, with groundwater entering the well at one screen interval, and being discharged through a second screen interval. Air is collected and treated *ex situ* as needed.	Injection of air could result in precipitation of ionic constituents that would result in reduction of formation permeability. Potentially difficult to implement in conjunction with a SVE system due to proximity to lake and potential for flooding. Limitations to implementability exist in areas in the immediate vicinity of subsurface utilities, the railroad tracks, and in areas prone to flooding (SYW-12 Site lakeshore).	Potentially effective for removal of VOCs, and some SVOCs, inorganics in groundwater. Groundwater aquifers limit process effectiveness. Effectiveness of air injection and vapor collection potentially reduced due to heterogeneity of unsaturated zone. Effectiveness dependent on application of air into the water column. Treatability study would be required.	Medium capital Medium O&M	Variety of contaminant types in groundwater could limit effectiveness. Not implementable and not effective due to heterogeneous conditions and proximity to the lake. Not retained for further consideration.
		Air sparging	Injection of air into the saturated zone to volatilize constituents within groundwater. Emissions are then collected in the unsaturated zone using a soil vapor extraction system.	Injection of air could result in precipitation of ionic constituents that would further reduce formation permeability. Potentially difficult to implement in conjunction with a SVE system due to proximity to lake and potential for flooding. Limitations to implementability would also exist in areas in the immediate vicinity of subsurface utilities, the railroad tracks, and in areas prone to flooding (SYW-12 Site lakeshore).	Potentially effective for removal of VOCs in groundwater. Not effective for removal of SVOCs or inorganics. Potential exists for uncontrolled movement of vapors. Subsurface heterogeneity could result in untreated zones. Collection of volatilized contaminants may be difficult due to heterogeneity of unsaturated zone. Treatability study would be required.	Medium capital Medium O&M	Variety of contaminant types in groundwater could limit effectiveness. Not applicable for removal of SVOCs and inorganics. Not implementable and not effective due to heterogeneous conditions and proximity to the lake. Not retained for further consideration.
		Circulation wells	Groundwater is pumped to the surface and aerated, removing the majority of the volatile vapors, and the aerated groundwater is then used as recharge to the groundwater table within an area of contaminated soil. The aerated water carries oxygen to the subsurface soil, promoting biodegradation. The combined process of biological treatment and physical extraction reduces the time required to achieve remediation goals and lowers contaminant concentrations.	Implementability limited due potential for fouling and variability of geochemical conditions. Limitations to implementability would also exist in areas in the immediate vicinity of subsurface utilities, the railroad tracks, and in areas prone to flooding (SYW-12 Site lakeshore).	Potentially effective for volatilizing VOCs in saturated zone. Not effective for treatment of SVOCs or inorganics. Limited effectiveness in groundwater due to heterogeneous conditions.	Medium to high capital Medium O&M	Variety of contaminant types in groundwater could limit effectiveness. Not applicable for treatment of SVOCs and inorganics. Implementability and effectiveness limited due to heterogeneous conditions and proximity to lake. Not retained for further consideration.
	Treatment wall	Permeable reactive barrier	Construction of a reactive material wall, air sparging zone, or biobarrier to treat groundwater as it flows through the treatment zone.	Potentially implementable. Limitations to implementability would exist in areas in the immediate vicinity of subsurface utilities and the railroad tracks. Access limitations would also limit implementability at the SYW-12 Site.	Generally effective for treating VOCs, SVOCs and inorganics. Variety of dissolved constituents would limit effectiveness. There is a potential for fouling of reactive materials due to saline groundwater conditions. Periodic replacement of reactive material would be anticipated. Treatability study would be required.	High capital Low O&M	Not effective for variety of constituents and potential for fouling of reactive materials. Not retained for further consideration.

TABLE 3-3. SCREENING AND EVALUATION OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS FOR GROUNDWATER

General Response Action	Remedial Technology	Process Option	Description	Implementability	Effectiveness	Relative Cost	Screening and Evaluation Comments
Ex situ treatment	Biological/Physical	Constructed treatment wetland	Engineered wetlands developed specifically to treat contaminants in collected groundwater that flows through them.	Implementable for treatment of soluble groundwater constituents. Non-growing season would limit implementability.	Potentially effective for treating VOCs, SVOCs and inorganics. Effectiveness limited by precipitation of calcite anticipated to be present in treated discharge water and seasonal nature of treatment wetlands. Treatability study would be required.	Medium capital Low O&M	Not applicable and implementable due to season nature of treatment wetlands, groundwater geochemistry, and variety of constituents. Not retained for further consideration.
	Off-site Physical/Chemical	Willis-Semet Groundwater Treatment Plant (GWTP) and/or Metro WWTP	Treatment of collected groundwater at the Willis-Semet GWTP with subsequent discharge to the Metro WWTP or directly to Onondaga Lake.	Potentially implementable in conjunction with groundwater recovery technology. Limitations to implementability (*i.e.,* routing of discharge piping) due to site access limitations and in the immediate vicinity of subsurface utilities and the railroad tracks. Discharge of treated water from the Willis-Semet GWTP to Metro WWTP and Onondaga Lake (during temporary Metro WWTP shutdowns) would need to comply with pretreatment requirement identified in the Industrial Wastewater Discharge Permit issued by Onondaga County and direct discharge. requirements identified in the SPDES requirements, respectively.	Effective for treating VOCs, SVOCs, and most inorganics.	High capital Medium O&M	Potentially applicable. Limitations to implementability would exist due to access limitations and in the immediate vicinity of roadways, subsurface utilities and the railroad tracks. Retained for further consideration.

Notes:
* Representative Process Option
Shaded cells – Process option not retained for further consideration.

Abbreviations/Acronyms:
CFR - Code of Federal Regulations
DER - Division of Environmental Remediation
GWTP – Groundwater Treatment Plant
HDPE – High Density Polyethylene
Metro WWTP – Onondaga County Department of Water Environment Protection (OCDWEP) Metropolitan Wastewater Treatment Plant (WWTP)
NYCRR - New York Code of Rules and Regulations
NYSDEC – New York State Department of Environmental Conservation
NCP - National Oil and Hazardous Substances Pollution Contingency Plan
O&M – Operation and Maintenance
SPDES – State Pollutant Discharge Elimination System
SVE – Soil Vapor Extraction
SVOC – Semi-Volatile Organic Compound
VOC – Volatile Organic Compound

TABLE 4-1. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Criterion	Alternative 1 No Action	Alternative 3 Engineered Cover on Perimeter Area (8.2 acres), Wetland Restoration/Creation, Biota Monitoring, and MNA	Alternative 4A Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and On-Site Reuse	Alternative 4B Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and Off-Site Disposal	Alternative 5 Full removal (including all trees) and off-site disposal (23.5 acres) with MNA
		Common Remedial Components for Alternatives 3 through 5: Institutional controls, Site Management Plan/periodic reviews, groundwater monitoring, monitored natural attenuation			
	• No action	• Surface soil PDI • Tree survey PDI • Engineered soil cover system – non-forested wetland and upland • Wetland restoration/mitigation • Biota monitoring	• Surface soil PDI • Tree survey PDI • Engineered soil cover system – upland • Mechanical excavation of soil/fill material (0-2 ft) – non-forested wetland • On-site reuse of excavated soil/fill material • Wetland restoration/mitigation • Biota monitoring	• Surface soil PDI • Tree survey PDI • Engineered soil cover system – upland • Mechanical excavation of soil/fill material (0-2 ft) – non-forested wetland • Off-site transportation and disposal of excavated soil/fill material • Wetland restoration/mitigation • Biota monitoring	• Clearing mature tree stands • Mechanical excavation of soil/fill material (0-16 ft) • Off-site transportation and disposal of excavated soil/fill material • Wetland mitigation
Overall protection of human health and the environment					
Overall protection of human health	Protection of human health relative to potential exposure to soil/fill material would not be provided. The Site owner plans to construct a multi-use recreational trail. Human health risks associated with recreational use are acceptable under current conditions. Not protective of human health relative to potential exposure to groundwater. Alternative would not provide a means of limiting site use, restricting groundwater use, or monitoring constituent concentrations and the progress of natural attenuation.	Protection of human health would be provided. The Site owner plans to construct a multi-use recreational trail. Human health risks associated with recreational use are acceptable under current conditions. Alternative 3 would provide protectiveness through placement of an engineered cover within areas of the non-forested wetland and upland with institutional controls. Potential for remedial footprint expansion provides added protectiveness based on PDI. Access restrictions, a site management plan, and periodic reviews would limit site use. Groundwater use restrictions would minimize potentially unacceptable risks to human health associated with groundwater exceeding Class GA standards. Groundwater monitoring would be protective of human health as a means of monitoring constituent concentrations and the progress of natural attenuation.	Protection of human health would be provided. The Site owner plans to construct a multi-use recreational trail. Human health risks associated with recreational use are acceptable under current conditions. Alternative 4A would provide protectiveness through removal and wetland restoration of surface soil/fill material within non-forested wetlands in combination with on-site reuse with placement of engineered cover system within upland areas, and institutional controls. Potential for placement of additional engineered cover and added protectiveness based on PDI. Access restrictions, a site management plan, and periodic reviews would limit site use. Groundwater use restrictions would minimize potentially unacceptable risks to human health associated with groundwater exceeding Class GA standards. Groundwater monitoring would be protective of human health as a means of monitoring constituent concentrations and the progress of natural attenuation.	Protection of human health would be provided. The Site owner plans to construct a multi-use recreational trail. Human health risks associated with recreational use are acceptable under current conditions. Alternative 4B would provide protectiveness through removal and wetland restoration of surface soil/fill material within non-forested wetlands in combination with off-site disposal with placement of engineered cover system within upland areas, and institutional controls. Potential for placement of additional engineered cover and added protectiveness based on PDI. Access restrictions, a site management plan, and periodic reviews would limit site use. Groundwater use restrictions would minimize potentially unacceptable risks to human health associated with groundwater exceeding Class GA standards. Groundwater monitoring would be protective of human health as a means of monitoring constituent concentrations and the progress of natural attenuation.	Protection of human health would be provided. The Site owner plans to construct a multi-use recreational trail. Human health risks associated with recreational use are acceptable under current conditions. Removal of soil/fill material would provide for unrestricted use of the Site, except within the required setbacks from the adjacent railroad tracks. Institutional controls and groundwater monitoring would be implemented, as necessary, should impacted soil remain following implementation of Alternative 6.
Overall protection of the environment	Limited protection of environment relative to potential exposure to soil/fill material would be provided. Alternative would not provide a means of	Protection of the environment would be provided within areas of the non-forested wetland and upland, while preserving trees in the forested	Protection of the environment would be provided within non-forested wetland and upland areas, while preserving trees in the forested wetland.	Protection of the environment would be provided within non-forested wetland and upland areas, while preserving trees in the forested wetland.	Protection of the environment would be provided Site-wide but would require clearing of trees. Removal and restoration of soil/fill material would

TABLE 4-1. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Criterion	Alternative 1 No Action	Alternative 3 Engineered Cover on Perimeter Area (8.2 acres), Wetland Restoration/Creation, Biota Monitoring, and MNA	Alternative 4A Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and On-Site Reuse	Alternative 4B Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and Off-Site Disposal	Alternative 5 Full removal (including all trees) and off-site disposal (23.5 acres) with MNA
	addressing potential erosion of constituents from surface soil to surface water, or potentially unacceptable ecological exposures outside of the trail. Alternative does not provide a means for monitoring constituent concentrations, the progress of natural attenuation, and the protection of ecological resources. Preservation of valuable forested habitat and trees utilized seasonally by bald eagles for foraging and roosting would be provided.	wetland. Alternative 3 would not require the removal of trees. The engineered cover system would reduce potentially unacceptable risks to the environment associated with potential ecological exposure to constituents in soil/fill material, and potential migration of constituents from surface soil to surface water within areas of non-forested wetland and upland. Potential for remedial footprint expansion provides added protectiveness based on PDI. Maintenance of remedy components, a site management plan, and periodic reviews would minimize potentially unacceptable risks to human health and the environment associated with soil/fill material. Groundwater monitoring would provide a means of monitoring constituent concentrations and the progress of natural attenuation. Biota monitoring would also be included as a means of monitoring protection of ecological resources and remedy effectiveness. Alternative would not address soil/fill material within forested wetland area; however, would provide for the preservation of forested habitat and trees utilized seasonally by bald eagles for foraging and roosting.	Alternative 4A would require some tree removal for access purposes. Removal and restoration of surface soil/fill material and wetland restoration within the non-forested wetland in combination with an upland engineered cover system would reduce potentially unacceptable risks to the environment associated with potential ecological exposure to constituents in soil/fill material, and potential migration of constituents from surface soil to surface water. Potential for placement of additional engineered cover and added protectiveness based on PDI. Maintenance of remedy components, a site management plan, and periodic reviews would minimize potentially unacceptable risks to the environment associated with soil/fill material. Groundwater monitoring would provide a means of monitoring constituent concentrations and the progress of natural attenuation. Biota monitoring would also be included as a means of monitoring protection of ecological resources and remedy effectiveness. Alternative would not address soil/fill material within forested wetland area; however, would provide for the preservation of forested habitat and trees utilized seasonally by bald eagles for foraging and roosting.	Alternative 4B would require some tree removal for access purposes. Removal and restoration of surface soil/fill material and wetland restoration within the non-forested wetland in combination with an upland engineered cover system would reduce potentially unacceptable risks to the environment associated with potential ecological exposure to constituents in soil/fill material, and potential migration of constituents from surface soil to surface water. Potential for placement of additional engineered cover and added protectiveness based on PDI. Maintenance of remedy components, a site management plan, and periodic reviews would minimize potentially unacceptable risks to the environment associated with soil/fill material. Groundwater monitoring would provide a means of monitoring constituent concentrations and the progress of natural attenuation. Biota monitoring would also be included as a means of monitoring protection of ecological resources and remedy effectiveness. Alternative would not address soil/fill material within forested wetland area; however, would provide for the preservation of forested habitat and trees utilized seasonally by bald eagles for foraging and roosting.	address potentially unacceptable risks to the human health and the environment associated with potential exposure to constituents in soil/fill material, and potential migration of constituents from soil to groundwater and/or surface water, but would require clearing of trees, including valuable habitat and those utilized seasonally by bald eagles for foraging and roosting. Groundwater monitoring would provide a means of monitoring constituent concentrations and the progress of natural attenuation should impacted soil remain following implementation of Alternative 6.
Attainment of Remedial Action Objectives (RAOs)	Based on available data, Site-related groundwater contamination is limited to groundwater in the vicinity of two monitoring well locations and there are no unacceptable human health inhalation risks for reasonable current and future use of the Site. RAOs related to migration (*e.g.*, erosion) of constituents in soil/fill material and RAOs related to human and ecological exposure via ingestion/direct contact with soil/fill material would not be addressed by this Alternative.	Based on available data, Site-related groundwater contamination is limited to groundwater in the vicinity of two monitoring well locations and there are no unacceptable human health inhalation risks for reasonable current and future use of the Site. Alternative would address RAOs for the protection of human health through placement of an engineered cover system within areas of non-forested wetland and upland, and through institutional controls, a site management plan, periodic reviews, and monitoring. RAOs related to migration (*e.g.*, erosion) of and ecological exposure to constituents in soil/fill material would be addressed through placement of the engineered cover system within areas of the non-	Based on available data, Site-related groundwater contamination is limited to groundwater in the vicinity of two monitoring well locations and there are no unacceptable human health inhalation risks for reasonable current and future use of the Site. Alternative would address RAOs for the protection of human health through removal and restoration of surface soil/fill material within the non-forested wetland in combination with an engineered cover system within non-forested upland areas, and through institutional controls, a site management plan, periodic reviews, and monitoring. RAOs related to migration (*e.g.*, erosion) of and ecological exposure to constituents in soil/fill material would be addressed	Based on available data, Site-related groundwater contamination is limited to groundwater in the vicinity of two monitoring well locations and there are no unacceptable human health inhalation risks for reasonable current and future use of the Site. Alternative would address RAOs for the protection of human health through removal and restoration of surface soil/fill material within the non-forested wetland in combination with an engineered cover system within non-forested upland areas, and through institutional controls, a site management plan, periodic reviews, and monitoring. RAOs related to migration (*e.g.*, erosion) of and ecological exposure to constituents in soil/fill material would be addressed	Based on available data, Site-related groundwater contamination is limited to groundwater in the vicinity of two monitoring well locations and there are no unacceptable human health inhalation risks for reasonable current and future use of the Site. Alternative would address RAOs for the protection of human health through Site-wide removal of soil/fill material. RAOs related to migration and ecological exposure to constituents in soil/fill material would be addressed through Site-wide removal of surface and subsurface soil. Alternative would also address RAOs for the protection of human health should impacted soil remain following implementation of

TABLE 4-1. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Criterion	**Alternative 1** **No Action**	**Alternative 3** **Engineered Cover on Perimeter Area (8.2 acres), Wetland Restoration/Creation, Biota Monitoring, and MNA**	**Alternative 4A** **Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and On-Site Reuse**	**Alternative 4B** **Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and Off-Site Disposal**	**Alternative 5** **Full removal (including all trees) and off-site disposal (23.5 acres) with MNA**
		forested wetland and upland. Biota monitoring would also be included to address the ecological exposure RAOs.	through removal and restoration within non-forested wetland with placement of an engineered cover within upland areas. Biota monitoring would also be included to address the ecological exposure RAOs.	through removal and restoration within non-forested wetland with placement of an engineered cover within upland areas. Biota monitoring would also be included to address the ecological exposure RAOs.	Alternative 6 through institutional controls and monitoring.
Compliance with applicable, relevant and appropriate requirements (ARARs) and to be considered material (TBCs)					
Compliance with chemical-specific ARARs and consideration of TBCs	Alternative does not provide a means of addressing soil exceeding SCOs. Alternative does not provide a means of monitoring the progress of natural attenuation to attain groundwater standards.	Installation of the engineered cover system would address soil exceeding SCOs within portions of the non-forested wetland and portions of non-forested upland where accessible and not detrimental to the environment (e.g., tree removal, disturbance of bald eagles). Institutional controls, a site management plan, periodic reviews would also address potential exposure to soil/fill material and groundwater exceeding SCOs and Class GA, respectively. Alternative provides a means of monitoring remedy effectiveness and the progress of natural attenuation through groundwater monitoring. Biota monitoring would also be included as a means of monitoring protection of ecological resources and remedy effectiveness.	Removal of surface soil/fill material and restoration with clean material in combination with an engineered cover system would address soil exceeding SCOs within the non-forested wetland and portions of non-forested upland where accessible and not detrimental to the environment (e.g., tree removal, disturbance of bald eagles). Institutional controls, a site management plan, and periodic reviews would address potential exposure to soil/fill material and groundwater exceeding SCOs and Class GA, respectively. Alternative provides a means of monitoring remedy effectiveness and the progress of natural attenuation through groundwater monitoring. Biota monitoring would also be included as a means of monitoring protection of ecological resources and remedy effectiveness.	Removal of surface soil/fill material and restoration with clean material in combination with an engineered cover system would address soil exceeding SCOs within the non-forested wetland and portions of non-forested upland where accessible and not detrimental to the environment (e.g., tree removal, disturbance of bald eagles). Institutional controls, a site management plan, and periodic reviews would address potential exposure to soil/fill material and groundwater exceeding SCOs and Class GA, respectively. Alternative provides a means of monitoring remedy effectiveness and the progress of natural attenuation through groundwater monitoring. Biota monitoring would also be included as a means of monitoring protection of ecological resources and remedy effectiveness.	Removal of surface and subsurface soil/fill material and restoration with clean material would address soil exceeding SCOs for unrestricted use within forested and non-forested wetland. Should impacted soil remain on-Site following implementation of Alternative 6, institutional controls, a site management plan, and periodic reviews would address potential exposure to soil/fill material and groundwater exceeding SCOs and Class GA, respectively.
Compliance with location-specific ARARs and consideration of TBCs	No location-specific ARARs triggered for this alternative.	Proposed actions would be conducted in a manner consistent with federal and state floodplain and wetland requirements. Activities would also be conducted consistent with federal and state requirements for cultural, archaeological, and historical resources. Activities would be conducted consistent with Fish and Wildlife Coordination Act requirements for protection of Onondaga Lake and for areas proximate to Onondaga Lake. Activities would be conducted consistent with navigable waterway requirements and New York Railroad Law. Activities would also be conducted in accordance with state and federal TBCs for the protection of eagles and their habitat.	Proposed actions would be conducted in a manner consistent with federal and state floodplain and wetland requirements. Activities would also be conducted consistent with federal and state requirements for cultural, archaeological, and historical resources. Activities would be conducted consistent with Fish and Wildlife Coordination Act requirements for protection of Onondaga Lake and for areas proximate to Onondaga Lake. Activities would be conducted consistent with navigable waterway requirements and New York Railroad Law. Activities would also be conducted in accordance with state and federal TBCs for the protection of eagles and their habitat.	Proposed actions would be conducted in a manner consistent with federal and state floodplain and wetland requirements. Activities would also be conducted consistent with federal and state requirements for cultural, archaeological, and historical resources. Activities would be conducted consistent with Fish and Wildlife Coordination Act requirements for protection of Onondaga Lake and for areas proximate to Onondaga Lake. Activities would be conducted consistent with navigable waterway requirements and New York Railroad Law. Activities would also be conducted in accordance with state and federal TBCs for the protection of eagles and their habitat.	Proposed actions would be conducted in a manner consistent with federal and state floodplain and wetland requirements. Activities would also be conducted consistent with federal and state requirements for cultural, archaeological, and historical resources. Activities would be conducted consistent with Fish and Wildlife Coordination Act requirements for protection of Onondaga Lake and for areas proximate to Onondaga Lake. Activities would be conducted consistent with navigable waterway requirements and New York Railroad Law. Removal of trees required to implement this alternative is not consistent with state and federal TBCs for the protection of eagles and their habitat.

TABLE 4-1. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Criterion	Alternative 1 No Action	Alternative 3 Engineered Cover on Perimeter Area (8.2 acres), Wetland Restoration/Creation, Biota Monitoring, and MNA	Alternative 4A Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and On-Site Reuse	Alternative 4B Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and Off-Site Disposal	Alternative 5 Full removal (including all trees) and off-site disposal (23.5 acres) with MNA
Compliance with action-specific ARARs and Consideration of TBCs	No action-specific ARARs triggered for this alternative.	Engineered cover system would be constructed consistent with applicable standards and DER-10. Excavated soil/fill material, if any, would be reused on-Site or managed off-Site in accordance with applicable Federal and State regulations. Solid wastes, if any, would be managed in accordance with applicable Federal and State regulations. Earth moving activities would be conducted consistent with air quality standards. Transportation activities would be completed in accordance with applicable State and Federal requirements, by licensed and permitted haulers. Institutional controls would be implemented in general conformance with NYSDEC DER-33 and USEPA guidance and policy.	Excavated soil/fill material, would be consolidated on-site and managed in accordance with applicable Federal and State regulations. Solid wastes, if any, would be managed in accordance with applicable Federal and State regulations. Earth moving activities would be conducted consistent with air quality standards. Transportation activities would be completed in accordance with applicable State and Federal requirements, by licensed and permitted haulers. Engineered cover system would be constructed consistent with applicable standards and DER-10. Institutional controls would be implemented in general conformance with NYSDEC DER-33 and USEPA guidance and policy.	Excavated soil/fill material, would be managed in accordance with applicable Federal and State regulations. Solid wastes, if any, would be managed in accordance with applicable Federal and State regulations. Earth moving activities would be conducted consistent with air quality standards. Transportation activities would be completed in accordance with applicable State and Federal requirements, by licensed and permitted haulers. Engineered cover system would be constructed consistent with applicable standards and DER-10. Institutional controls would be implemented in general conformance with NYSDEC DER-33 and USEPA guidance and policy.	Excavated soil/fill material, would be managed in accordance with applicable Federal and State regulations. Solid wastes, if any, would be managed in accordance with applicable Federal and State regulations. Earth moving activities would be conducted consistent with air quality standards. Transportation activities would be completed in accordance with applicable State and Federal requirements, by licensed and permitted haulers. Institutional controls would be implemented in general conformance with NYSDEC DER-33 and USEPA guidance and policy.
Long-term effectiveness and permanence					
Magnitude of residual risk	Human health risks associated with recreational use are acceptable under current conditions. Residual risks associated with soil/fill material and groundwater would remain. Potential risks associated with erosion and migration of soil/fill material would remain.	Human health risks associated with recreational use are acceptable under current conditions. Residual risks associated with soil/fill material would be mitigated through implementation of an engineered cover system (areas of non-forested wetland and upland), potential expansion of the remedial footprint based on the results of the PDI, wetland restoration, institutional controls, a site management plan, and period reviews. Surface soil within forested wetland would not be addressed; however, mature tree stands utilized seasonally by bald eagles for foraging and roosting would be maintained. Residual risks associated with groundwater would be addressed through institutional controls and groundwater monitoring. Biota monitoring would also be included as a means of monitoring residual risks to ecological resources.	Human health risks associated with recreational use are acceptable under current conditions. Residual risks associated with soil/fill material would be mitigated through removal of surface soil/fill material (non-forested wetland), implementation of an engineered cover system (portion of non-forested wetland), wetland restoration/mitigation, institutional controls, a site management plan, and period reviews. Surface soil within forested wetland would not be addressed; however, mature tree stands utilized seasonally by bald eagles for foraging and roosting would be maintained. Residual risks associated with groundwater would be addressed through institutional controls and groundwater monitoring. Biota monitoring would also be included as a means of monitoring residual risks to ecological resources.	Human health risks associated with recreational use are acceptable under current conditions. Residual risks associated with soil/fill material would be mitigated through removal of surface soil/fill material (non-forested wetland), implementation of an engineered cover system (portion of non-forested wetland), wetland restoration/mitigation, institutional controls, a site management plan, and period reviews. Surface soil within forested wetland would not be addressed; however, mature tree stands utilized seasonally by bald eagles for foraging and roosting would be maintained. Residual risks associated with groundwater would be addressed through institutional controls and groundwater monitoring. Biota monitoring would also be included as a means of monitoring residual risks to ecological resources.	Human health risks associated with recreational use are acceptable under current conditions. Residual risks associated with soil/fill material would be mitigated through removal of soil/fill material (wetland), institutional controls, a site management plan, and period reviews. Surface and subsurface soil within forested and non-forested wetland areas would be addressed; however, clearing the site of mature tree stands would remove valuable habitat on the site.
Adequacy and reliability of controls	Alternative does not provide adequate and reliable means of restricting activities resulting in potential human or ecological exposure to soil/fill material. Alternative also does not provide adequate and reliable means of addressing the potential for migration	Placement and maintenance of the engineered cover system with wetland restoration would provide adequate and reliable means of controlling erosion of and exposure to soil/fill material within areas of the non-forested wetland and upland. Institutional controls are	Excavation, restoration, on-site consolidation, and placement and maintenance of the engineered cover system and wetland mitigation would provide adequate and reliable means of controlling erosion of and exposure to soil/fill material within non-forested	Excavation, restoration, proper off-site management and maintenance of the engineered cover system and wetland mitigation would provide adequate and reliable means of controlling erosion of and exposure to soil/fill material within non-forested wetland and upland	Excavation and proper off-site management is an adequate and reliable means of controlling erosion of and exposure to Site-wide soil/fill material. Should impacted soil remain on-Site following implementation of Alternative 6, institutional controls are

TABLE 4-1. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Criterion	Alternative 1 No Action	Alternative 3 Engineered Cover on Perimeter Area (8.2 acres), Wetland Restoration/Creation, Biota Monitoring, and MNA	Alternative 4A Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and On-Site Reuse	Alternative 4B Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and Off-Site Disposal	Alternative 5 Full removal (including all trees) and off-site disposal (23.5 acres) with MNA
	of constituents in soil/fill material to surface water. Alternative does not provide a means for monitoring constituent concentrations and the progress of natural attenuation.	adequate and reliable means of controlling site use. Groundwater monitoring provides an adequate and reliable means of monitoring constituent concentrations in groundwater and the progress of natural attenuation. Biota monitoring would be included as an adequate and reliable means of monitoring protectiveness of ecological resources and remedy effectiveness.	wetland and upland areas. Institutional controls are adequate and reliable means of controlling site use. Groundwater monitoring provides an adequate and reliable means of monitoring constituent concentrations and the progress of natural attenuation. Biota monitoring would be included as an adequate and reliable means of monitoring protectiveness of ecological resources and remedy effectiveness.	areas. Institutional controls are adequate and reliable means of controlling site use. Groundwater monitoring provides an adequate and reliable means of monitoring constituent concentrations and the progress of natural attenuation. Biota monitoring would be included as an adequate and reliable means of monitoring protectiveness of ecological resources and remedy effectiveness.	adequate and reliable means of controlling site use. Groundwater monitoring provides an adequate and reliable means of monitoring constituent concentrations and the progress of natural attenuation.
Long-term sustainability	No fuel/energy use/greenhouse gas emissions associated with the no action alternative. No impacts to water or ecology.	Minimal fuel/energy use/greenhouse gas emissions associated with long-term maintenance and monitoring. Impacts would also be minimal to water or ecology, with limited water and resource use associated with cover system and wetland maintenance and groundwater and biota monitoring.	Minimal fuel/energy use/greenhouse gas emissions associated with long-term maintenance and monitoring. Impacts would also be minimal to water or ecology, with limited water and resource use associated with cover system and wetland maintenance and groundwater and biota monitoring.	Minimal fuel/energy use/greenhouse gas emissions associated with long-term maintenance and monitoring. Impacts would also be minimal to water or ecology, with limited water and resource use associated with cover system and wetland maintenance and groundwater and biota monitoring.	No long-term fuel/energy use/greenhouse gas emissions associated with Alternative 6. No impacts to water or ecology over the long-term.
Reduction of toxicity, mobility, or volume through treatment					
Treatment process used and materials treated	Treatment is not included under this alternative.	Treatment is not included under this alternative.	Treatment is not included under this alternative.	Treatment is not included under this alternative.	Excavated soil exceeding LDRs would be treated prior to off-site disposal, if necessary. A temporary water treatment facility would be utilized to treat construction water.
Amount of hazardous material destroyed or treated	None.	None. Should the results of the PDI result in expansion of the remedial footprint, up to 4,200 cubic yards of soil/fill material may be reused on-Site and/or transported off-Site.	Approximately 21,000 cubic yards of soil/fill material would be removed and consolidated on-Site.	Approximately 21,000 cubic yards of soil/fill material would be removed and transported off-site.	Approximately 400,000 cubic yards of soil/fill material would be removed and transported off-site.
Degree of expected reduction in toxicity, mobility, or volume	Natural attenuation is expected to reduce contaminant concentrations over the long-term.	The mobility of COCs (*i.e.,* associated with erosion) in surface soil/fill material in non-forested wetland and upland areas would be reduced by installation of the 8.2 AC engineered cover system. Potential for expansion of the remedial footprint would potentially reduce the toxicity, mobility, and/or volume of COCs based on PDI. Natural attenuation is expected to reduce contaminant concentrations over the long-term.	The toxicity, mobility, and volume of surface soil/fill material in the eastern and western portions of the non-forested wetland would be reduced through removal of approximately 21,000 cubic yards of surface soil/fill material. The mobility of COCs (*i.e.,* associated with erosion) in surface soil/fill material in non-forested wetland and upland areas would be reduced through placement of excavated soil/fill material under portions of a 10 AC engineered cover system. Potential for placement of additional engineered cover and reduced mobility of COCs based on PDI. Natural attenuation is expected	The toxicity, mobility, and volume of surface soil/fill material in the eastern and western portions of the non-forested wetland would be reduced through removal of approximately 21,000 cubic yards of surface soil/fill material. The mobility of COCs (*i.e.,* associated with erosion) in surface soil/fill material in non-forested wetland and upland areas would be reduced through placement of excavated soil/fill material under portions of a 10 AC engineered cover system. Potential for placement of additional engineered cover and reduced mobility of COCs based on PDI. Natural attenuation is expected	The toxicity, mobility, and volume of Site-wide surface and subsurface soil/fill material would be reduced through removal of approximately 400,000 cubic yards of soil/fill material. Natural attenuation is expected to reduce contaminant concentrations over the long-term.

TABLE 4-1. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Criterion	Alternative 1 No Action	Alternative 3 Engineered Cover on Perimeter Area (8.2 acres), Wetland Restoration/Creation, Biota Monitoring, and MNA	Alternative 4A Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and On-Site Reuse	Alternative 4B Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and Off-Site Disposal	Alternative 5 Full removal (including all trees) and off-site disposal (23.5 acres) with MNA
			to reduce contaminant concentrations over the long-term.	to reduce contaminant concentrations over the long-term.	
Degree to which treatment is irreversible	Treatment is not included under this alternative.	Treatment is not included under this alternative.	Treatment is not included under this alternative.	Treatment is not included under this alternative.	Treatment of construction water is irreversible.
Type and quantity of residuals remaining after treatment	Treatment is not included under this alternative.	Treatment is not included under this alternative. Contaminated soil/fill material within non-forested wetland and upland areas would be contained by an engineered cover system but would remain in-place at the Site.	Treatment is not included under this alternative. Excavated surface soil/fill material from non-forested wetland areas would be contained by an engineered cover system but would remain in-place at the Site. Contaminated soil/fill material within upland areas would be contained by an engineered cover system but would remain in-place at the Site.	Treatment is not included under this alternative. Excavated surface soil/fill material from non-forested wetland areas would be contained by an engineered cover system but would remain in-place at the Site. Contaminated soil/fill material within upland areas would be contained by an engineered cover system but would remain in-place at the Site.	Minimal treatment residuals associated with treatment of construction water. Minimal residuals associated with surface and subsurface soil/fill material would remain following Site-wide excavation.
Short-term effectiveness					
Protection of community during remedial actions	No active remedial components under this alternative.	Dust and volatile emissions, if any, would be controlled during construction activities. Cover construction and wetland restoration would result in impacts to the community relative to truck traffic and noise during the construction.	Dust and volatile emissions, if any, would be controlled during construction activities. Cover construction, wetland restoration/mitigation, and excavation would result in impacts to the community relative to truck traffic and noise during the construction. On-site reuse of excavated soil/fill material would reduce impacts to the community relative to truck traffic and noise during the construction.	Dust and volatile emissions, if any, would be controlled during construction activities. Cover construction, wetland restoration/mitigation, and excavation would result in impacts to the community relative to truck traffic and noise during the construction. Off-site disposal of excavated soil/fill material would result in impacts to the community relative to truck traffic and noise during the construction.	Dust and volatile emissions, if any, would be controlled during construction activities. Excavation and off-site disposal of surface and subsurface soil/fill material (410,000 cubic yards) and organic debris (900 tons), and wetland restoration would result in significant impacts to the community relative to truck traffic and noise during the construction.
Protection of workers during remedial actions	Not applicable. No active remedial components under this alternative.	Proper health and safety measures would be established and implemented during remedial activities, to protect workers from exposure to contaminants.	Proper health and safety measures would be established and implemented during remedial activities, to protect workers from exposure to contaminants.	Proper health and safety measures would be established and implemented during remedial activities, to protect workers from exposure to contaminants.	Proper health and safety measures would be established and implemented during remedial activities, to protect workers from exposure to contaminants.
Environmental impacts	No active remedial components under this alternative. Alternative 1 would maintain mature tree stands utilized seasonally by bald eagles for foraging and roosting.	Dust, volatile emissions, and surface runoff controls would be instituted to minimize impacts to the environment during implementation of this alternative. Minimal clearing would be required prior to installation of the engineered cover system. Alternative 3 would maintain mature tree stands utilized seasonally by bald eagles for foraging and roosting.	Dust, volatile emissions, and surface runoff controls would be instituted to minimize impacts to the environment during implementation of this alternative. Minimal clearing would be required prior to excavation and installation of the engineered cover system. Alternative 4A would maintain mature tree stands utilized seasonally by bald eagles for foraging and roosting.	Dust, volatile emissions, and surface runoff controls would be instituted to minimize impacts to the environment during implementation of this alternative. Minimal clearing would be required prior to excavation and installation of the engineered cover system. Alternative 4B would maintain mature tree stands utilized seasonally by bald eagles for foraging and roosting.	Dust, volatile emissions, and surface runoff controls would be instituted to minimize impacts to the environment during implementation of this alternative. Clearing of approximately 900 tons of organic debris would be required prior to excavation. Clearing the site of mature tree stands would remove valuable habitat on the Site.

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Criterion	Alternative 1 No Action	Alternative 3 Engineered Cover on Perimeter Area (8.2 acres), Wetland Restoration/Creation, Biota Monitoring, and MNA	Alternative 4A Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and On-Site Reuse	Alternative 4B Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and Off-Site Disposal	Alternative 5 Full removal (including all trees) and off-site disposal (23.5 acres) with MNA
Time until RAOs are achieved	Under current conditions, constituent migration from soil to groundwater and from groundwater to Onondaga Lake appears to be minimal and there are no unacceptable human health inhalation risks. RAOs related to protection of the environment would not be attained Site-wide with this alternative.	Under current conditions, constituent migration from soil to groundwater and from groundwater to Onondaga Lake appears to be minimal and there are no unacceptable human health inhalation risks. RAOs related to protection of the environment would be met in non-forested wetland areas upon installation of the 2-ft engineered cover. Construction of Alternative 3 is anticipated to be completed within one construction season.	Under current conditions, constituent migration from soil to groundwater and from groundwater to Onondaga Lake appears to be minimal and there are no unacceptable human health inhalation risks. RAOs related to protection of the environment would be met in non-forested wetland areas upon completion of surface soil/fill material removal, restoration, and installation of the 2-ft engineered cover. Construction of Alternative 4A is anticipated to be completed within one to two construction seasons.	Under current conditions, constituent migration from soil to groundwater and from groundwater to Onondaga Lake appears to be minimal and there are no unacceptable human health inhalation risks. RAOs related to protection of the environment would be met in non-forested wetland areas upon completion of surface soil/fill material removal, restoration, and installation of the 2-ft engineered cover. Construction of Alternative 4B is anticipated to be completed within one to two construction seasons.	Under current conditions, constituent migration from soil to groundwater and from groundwater to Onondaga Lake appears to be minimal and there are no unacceptable human health inhalation risks. RAOs related to protection of the environment would be met in non-forested wetland areas upon completion of soil/fill material removal and restoration. Construction of Alternative 6 is anticipated to be completed within five to seven construction seasons.
Short-term sustainability	No fuel/energy consumption, greenhouse gas or pollutant emissions, no water or resource use, no impacts to water or ecology.	Greenhouse gas emissions associated with fuel/energy use by construction equipment and transportation of materials on-site during cover installation and wetland restoration is estimated at approximately 375 MTCO2e.	Greenhouse gas emissions associated with fuel/energy use by construction equipment and transportation of materials on-site during excavation, cover installation, and wetland mitigation/restoration is estimated at approximately 375 MTCO2e.	Greenhouse gas emissions associated with fuel/energy use by construction equipment and transportation of materials on-site during excavation, cover installation, and wetland mitigation/restoration is estimated at approximately 850 MTCO2e.	Greenhouse gas emissions associated with fuel/energy use by construction equipment and transportation of materials on-site during excavation and wetland restoration is estimated at approximately 15,500 MTCO2e.
Implementability					
Ability to construct and operate the technology	Not applicable. No active remedial components under this alternative.	An engineered cover system is readily constructed and maintained. Groundwater monitoring is readily implementable. Installation of additional monitoring wells, if necessary, are readily constructible. Implementation of remedy components would require consideration of Site access across the CSX Railroad tracks and work in proximity to the railroad, Onondaga Lake, Ley Creek, and Onondaga Creek.	Excavation of surface soil/fill material and wetland restoration/mitigation in combination with on-site consolidation with an engineered cover system is readily implementable and constructible. Groundwater monitoring is readily implementable. Installation of additional monitoring wells, if necessary, are readily constructible. Implementation of remedy components would require consideration of Site access across the CSX Railroad tracks and work in proximity to the railroad, Onondaga Lake, Ley Creek, and Onondaga Creek.	Excavation of surface soil/fill material and wetland restoration/mitigation in combination with off-site transport and disposal with an engineered cover system is readily implementable and constructible. Groundwater monitoring is readily implementable. Installation of additional monitoring wells, if necessary, are readily constructible. Implementation of remedy components would require consideration of Site access across the CSX Railroad tracks and work in proximity to the railroad, Onondaga Lake, Ley Creek, and Onondaga Creek.	Not considered implementable. Excavation and offsite disposal of 410,000 CY of soil/fill material, specifically excavation of soil/fill material up to depths of 16-ft bgs is not readily constructible. Addition of sheeting along the railroad tracks and bulkhead installation along the shorelines and subsurface utilities would result in significant implementability challenges. Implementation of remedy components would require consideration of Site access across the CSX Railroad tracks and work in proximity to the railroad, Onondaga Lake, Ley Creek, and Onondaga Creek.
Reliability of technology	Not applicable. No active remedial components under this alternative.	An engineered cover system is a reliable technology to address surface soil contamination.	Excavation, on-site reuse and engineered cover systems are reliable technologies to address surface soil contamination.	Excavation, off-site disposal and engineered cover systems are reliable technologies to address surface soil contamination.	Excavation and disposal are reliable technologies to address surface and subsurface soil contamination.
Ease of undertaking additional remedial actions, if necessary	Additional remedial actions, if necessary, would be implementable.	Additional remedial actions, if necessary, would be implementable.	Additional remedial actions, if necessary, would be implementable.	Additional remedial actions, if necessary, would be implementable.	Additional remedial actions, if necessary, would be implementable.

TABLE 4-1. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Criterion	Alternative 1 No Action	Alternative 3 Engineered Cover on Perimeter Area (8.2 acres), Wetland Restoration/Creation, Biota Monitoring, and MNA	Alternative 4A Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and On-Site Reuse	Alternative 4B Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and Off-Site Disposal	Alternative 5 Full removal (including all trees) and off-site disposal (23.5 acres) with MNA
Ability to monitor effectiveness of remedy	Not applicable. No active remedial components under this alternative. No monitoring included under this alternative.	Effectiveness of remedy could be monitored through inspection and maintenance of the engineered cover system to verify continued cover integrity, visual signs of erosion, and condition of the engineered cover. The restored wetland would also be monitored for signs of erosion, condition of vegetation, and presence of invasive species. A site management plan, periodic reviews, and biota and groundwater monitoring would provide means for monitoring remedy effectiveness.	Effectiveness of remedy could be monitored through inspection and maintenance of the engineered cover system to verify continued cover integrity, visual signs of erosion, and condition of the engineered cover. The restored wetlands would also be monitored for signs of erosion, condition of vegetation, and presence of invasive species. Groundwater monitoring would provide means for monitoring potential changes in groundwater concentrations as a result of removal of soil/fill material. A site management plan, periodic reviews, and biota and groundwater monitoring would provide means for monitoring remedy effectiveness.	Effectiveness of remedy could be monitored through inspection and maintenance of the engineered cover system to verify continued cover integrity, visual signs of erosion, and condition of the engineered cover. The restored wetlands would also be monitored for signs of erosion, condition of vegetation, and presence of invasive species. Groundwater monitoring would provide means for monitoring potential changes in groundwater concentrations as a result of removal of soil/fill material. A site management plan, periodic reviews, and biota and groundwater monitoring would provide means for monitoring remedy effectiveness.	The restored wetlands could be monitored for signs of erosion, condition of vegetation, and presence of invasive species. Should impacted soil remain on-Site following implementation of Alternative 6, a site management plan, periodic reviews, and groundwater monitoring would provide a means of monitoring remedy effectiveness.
Coordination with other agencies and property owners	Coordination with Onondaga County would be necessary to support multi-use recreational trail construction and maintenance.	Coordination with other agencies including NYSDEC, USEPA, NYSDOH, NYSDOT, USFWS, City of Syracuse, Onondaga Nation, and CSX Railroad would be necessary. Coordination with Onondaga County would also be necessary to support multi-use recreational trail construction and maintenance.	Coordination with other agencies including NYSDEC, USEPA, NYSDOH, NYSDOT, USFWS, City of Syracuse, Onondaga Nation, and CSX Railroad would be necessary. Coordination with Onondaga County would also be necessary to support multi-use recreational trail construction and maintenance.	Coordination with other agencies including NYSDEC, USEPA, NYSDOH, NYSDOT, USFWS, City of Syracuse, Onondaga Nation, and CSX Railroad would be necessary. Coordination with Onondaga County would also be necessary to support multi-use recreational trail construction and maintenance.	Coordination with other agencies including NYSDEC, USEPA, NYSDOH, NYSDOT, USFWS, City of Syracuse, Onondaga Nation, and CSX Railroad would be necessary. Coordination with Onondaga County would also be necessary to support multi-use recreational trail construction and maintenance.
Availability of off-site treatment storage and disposal services and capacities	None required. No active remedial components under this alternative.	Minimal disposal capacity required for sampling-related wastes.	Minimal disposal capacity required for sampling-related wastes.	Surface soil/fill material requiring off-site disposal may require confirmation of landfill capacity. Minimal disposal capacity required for sampling-related wastes.	Large quantities of soil/fill material requiring off-site disposal may require use of multiple landfills. Off-site construction water management using a temporary treatment system is available. Minimal disposal capacity required for sampling-related wastes.
Availability of necessary equipment, specialists, and materials	None required. No active remedial components under this alternative.	Equipment, specialists, and materials are readily available.	Equipment, specialists, and materials are readily available.	Equipment, specialists, and materials are readily available.	Equipment, specialists, and materials are readily available.
Costs					
Total estimated capital cost	$0	$7.5 M	$21.1 M	$26.2 M	$281 M
Present worth of operation and maintenance cost (30 years, 7% discount factor)	$0	$0.79 M	$0.80 M	$0.80 M	$0.18 M
Total estimated net present worth cost	$0	$8.3 M	$21.9 M	$27.0 M	$281 M

TABLE 4-1. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Criterion	Alternative 1 No Action	Alternative 3 Engineered Cover on Perimeter Area (8.2 acres), Wetland Restoration/Creation, Biota Monitoring, and MNA	Alternative 4A Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and On-Site Reuse	Alternative 4B Surface Excavation and Engineered Cover/Restoration on Perimeter and Interior Areas (10 acres), Biota Monitoring, and MNA, with Limited Tree Removal and Off-Site Disposal	Alternative 5 Full removal (including all trees) and off-site disposal (23.5 acres) with MNA
Land Use					
Consistency with proposed future use	Protective for current, intended, and reasonably anticipated future uses of the Site. The Site owner plans to construct a multi-use recreational trail. Human health risks associated with recreational use are acceptable under current conditions. Alternative would maintain mature tree stands utilized seasonally by bald eagles for foraging and roosting.	Placement of the engineered cover system and wetland within areas of non-forested wetland and upland with wetland restoration would be consistent with current, intended, and reasonably anticipated future uses of the Site. The Site owner plans to construct a multi-use recreational trail. Human health risks associated with recreational use are acceptable under current conditions. Alternative would maintain mature tree stands utilized seasonally by bald eagles for foraging and roosting.	Excavation and wetland restoration/mitigation within non-forested wetland and on-site reuse of surface soil/fill material with placement of the engineered cover system would be consistent with current, intended, and reasonably anticipated future uses of the Site upon remedy completion and wetland mitigation/restoration. The Site owner plans to construct a multi-use recreational trail. Human health risks associated with recreational use are acceptable under current conditions. Alternative would maintain mature tree stands utilized seasonally by bald eagles for foraging and roosting.	Excavation and wetland restoration/mitigation within non-forested wetland and off-site disposal of surface soil/fill material with placement of the engineered cover system would be consistent with current, intended, and reasonably anticipated future uses of the Site upon remedy completion and wetland mitigation/restoration. The Site owner plans to construct a multi-use recreational trail. Human health risks associated with recreational use are acceptable under current conditions. Alternative would maintain mature tree stands utilized seasonally by bald eagles for foraging and roosting.	Excavation of surface and subsurface soil/fill material within forested and non-forested wetland areas would support current, intended, and reasonably anticipated future recreational trail use upon remedy completion and wetland restoration, but clearing of mature tree stands would remove valuable habitat on the site. Implementation of this alternative would interfere with the recreational trail construction schedule.

LDR – Land Disposal Restrictions
MtCO2e - million metric tons of carbon dioxide equivalent
NYSDEC – New York State Department of Environmental Conservation
NYSDOH – New York State Department of Health
NYSDOT – New York State Department of Transportation
PDI – Pre-Design Investigation

Table 4-2. Alternative 1 Cost Estimate

Site: Honeywell Murphy's Island/SYW-12
Location: Geddes, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2022

Conceptual Basis: No Action

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
DIRECT CAPITAL COST					
			TOTAL ESTIMATED DIRECT CAPITAL COST:	**$0**	rounded
INDIRECT CAPITAL COST					
			Total Estimated Direct Capital Cost:	**$0**	
			Engineering / Management, Construction Oversight, OH&P	**$0**	6%, 8%, and 5% respectively
			Contingency	**$0**	Scope Contingency at 30%
			TOTAL ESTIMATED CAPITAL COST:	**$0**	rounded
OPERATION AND MAINTENANCE COSTS					
Annual				**$0**	
Years 5, 10, 15, 20, 25, 30				**$0**	

PRESENT WORTH ANALYSIS (YEARS 1-30)		DISCOUNT FACTOR	PRESENT WORTH	
	Cost	Df=7	(rounded)	
ESTIMATED CAPITAL COST - Year 0	$0.00	1.00	$0	
ANNUAL O&M - YEARS 1-30	$0.00	0.41	$0	Average discount factor for years 1-30
PERIODIC O&M - YEARS 5, 10, 15, 20, 25, 30	$0.00	0.36	$0	Average discount factor for years 5, 10, 15, 20, 25 and 30
		TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST:	**$0**	rounded

Table 4-3. Alternative 3 Cost Estimate

Site: Honeywell Murphy's Island/SYW-12
Location: Syracuse, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2022

Conceptual Basis: Engineered cover on perimeter area (8.2 acres)
Wetland restoration/creation, biota monitoring, and MNA
Excludes costs associated with wetland mitigation

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
DIRECT CAPITAL COST					
General Conditions	WK	15	$15,000	$225,000	Trailer, fuel, small tools, consumables and safety; 1 week Mob
Mobilization	EA	1	$65,000	$65,000	One per 36-wk construction season; reflects winter condition and eagle roosting no-work periods
Air Monitoring	LS	1	$45,000	$45,000	
Surveys and Layouts	EA	2	$4,500	$9,000	Pre-construction, post-construction
Irrigation	WK	4	$5,000	$20,000	Following seeding, 4 weeks per season
Railroad Protection	WK	15	$16,000	$240,000	1 Construction Manager and 1 Flagman
Temporary Fencing	LF	6,000	$10	$60,000	
Truck Wash	WK	15	$7,500	$112,500	Wash rack and operation
Dust Suppression/Control	WK	15	$3,500	$52,500	5,000 gallon water truck and operation
Permits	LS	1	$15,000	$15,000	Railroad Access Permit/ Agreement
Pre-Design Survey	LS	1	$40,000	$40,000	Topographic and Tree Surveys and borings/geological eval
Additional Surface Soil Sampling	LS	1	$50,000	$50,000	3 samples from each of 14 loc (3 each of four forested wetland and 2 from one upland area). For potential remedial footprint expansion.
Site-Wide Surface Soil Pre-Design Investigation	LS	1	$70,000	$70,000	16 locations, 3 samples each. Part 375 analysis.
Baseline Biota Monitoring					
Sediment Sampling	LS	1	$9,500	$9,500	1 sample from each of 8 locations; one event
Invertebrate Sampling and Analysis	LS	1	$20,500	$20,500	8 samples from each of 2 Events (spring and summer)
Small Mammal Sampling and Analysis	LS	1	$25,000	$25,000	8 samples from each of 2 Events (spring and summer)
Workplan and Reporting	LS	1	$11,500	$11,500	
Site Preparation					
Clearing and Grubbing	AC	8.2	$11,000	$90,200	Non-forested wetlands and uplands only; no tree clearing. Chipped and left onsite.
Rough Grading	AC	8.2	$4,000	$32,800	Non-forested wetlands and uplands
Railroad Crossing	EA	3	$25,000	$75,000	
Construction Entrance	LS	1	$16,000	$16,000	6-inch stone entrance, 50ft x 24ft, from access road along Ley Creek.
Working Pad	CY	1,500	$90	$135,000	4-ft stone, mirafi, 100 x 100-ft
Access Roadways - Installation	LF	3,000	$130	$390,000	2-ft stone, mirafi, built to 35-ft width (assume 2 lanes)
Site Access - Crane Mats	LS	1	$75,000	$75,000	Rental; 500 LF crane mats
Materials QA/QC Testing - Topsoil	EA	6	$2,500	$15,000	chemical and physical testing of imported materials; includes emerging contaminants
Materials QA/QC Testing - Fill and stone	EA	9	$2,200	$20,790	chemical and physical testing of imported materials; includes emerging contaminants
Compaction Testing	WK	8	$1,000	$8,000	during backfill only
Erosion and Sediment Control	LF	15,000	$8	$120,000	Reinforced silt fence along access road and site perimeter, twice along lakefront
Perched Wetland Construction (5.9 AC)					
Import and place 12-in topsoil	CY	9,500	$53	$503,500	Placement by conventional equipment in 6-inch lifts; Infertile topsoil.
Import and place 12-in clay	CY	10,450	$54	$564,300	Placement by conventional equipment in 6-inch lifts; assumes variable grading.
Import and place internal clay berms	CY	900	$54	$48,600	1.5-ft tall berms with 3V:1H side slopes
Wetland elevation grading and shaping	AC	2.5	$70,000	$175,000	average deepening of 12-inches (max. of 24-inches); includes clearing and access improvements
Wetland seeding	AC	5.9	$26,000	$153,400	Cost includes installation; hand sown at 30 pounds per acre
Hand Plantings	AC	5.9	$5,000	$29,500	Assumes 8000 live stakes per acre
Wetland Berm and Grading Construction (1.6 AC)					
Fine grading berm	AC	1.6	$9,000	$14,400	Grading of berm subgrade prior to placement of topsoil
Import and place 6-in topsoil	CY	1,400	$53	$74,200	Placement by conventional equipment in 6-inch lifts; 6-in infertile topsoil.
Import and place subgrade material	CY	4,800	$46	$220,800	Placement by conventional equipment in 6-inch lifts to within 3.5-ft. Includes 18-in cover materia
Geogrid Stabilization	AC	1.6	$47,000	$75,200	Placed between subgrade and topsoil
Seeding	AC	1.6	$19,000	$30,400	Modified old field successional with fertilizer and hydromulch; total berm surface area

Table 4-3. Alternative 3 Cost Estimate

Site: Honeywell Murphy's Island/SYW-12
Location: Syracuse, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2022

Conceptual Basis: Engineered cover on perimeter area (8.2 acres)
Wetland restoration/creation, biota monitoring, and MNA
Excludes costs associated with wetland mitigation

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
Upland Engineered Vegetative Cover (0.7 AC)					
Import and place 6-in topsoil	CY	600	$53	$31,800	Placement by conventional equipment in 6-inch lifts
Import and place 18-in subgrade material	CY	1,800	$46	$82,800	Placement by conventional equipment in 6-inch lifts
Non-wetland seeding	AC	0.7	$19,000	$13,300	Modified old field successional with fertilizer and hydromulch
Transportation and Disposal					
T&D of Roadway Material - C&D	TON	11,700	$80	$936,000	1.7 tons per cy; disposal at C&D landfill. Includes equipment/labor for removal
			TOTAL ESTIMATED DIRECT CAPITAL COST:	**$5,000,000**	rounded
INDIRECT CAPITAL COST					
			Total Estimated Direct Capital Cost:	**$5,000,000**	
			Engineering / Management, Construction Oversight, OH&P	**$950,000**	6%, 8%, and 5% respectively
			Contingency	**$1,500,000**	Scope Contingency at 30%
Institutional Controls					
Environmental Easement	LS	1	$30,000	$30,000	
Site Management Plan	LS	1	$50,000	$50,000	
			TOTAL ESTIMATED CAPITAL COST:	**$7,530,000**	rounded
OPERATION AND MAINTENANCE COSTS					
Annual Years 1 - 5					
Reporting and Recordkeeping	EA	1	$20,000	$20,000	
Cover inspection	LS	1	$2,400	$2,400	Assumes 2 scientists/engineers, 1 days, 8 hours/day, twice annually
Groundwater Monitoring					
Well inspection and sampling labor	LS	1	$9,600	$9,600	Assumes 2 scientists/engineers, 8 hours/day, twice annually, 4 days
Groundwater samples	LS	1	$12,600	$12,600	Assumes 14 samples (10 wells + QA/QC) twice annually; 28 samples total
On-site Cover Maintenance					
Wetland/Non-Forest Vegetation Maintenance	AC	0.3	$26,000	$7,800	Spot seeding (5% of all areas annually) and handpulling invasive species
Cover maintenance and incidental repairs	AC	8.2	$325	$2,665	Topsoil repair, 5 cy/acre annually
Annual Years 1, 3, 5					
Baseline Biota Monitoring					
Sediment Sampling	LS	1	$9,500	$9,500	1 sample from each of 8 locations; one event
Invertebrate Sampling and Analysis	LS	1	$20,500	$20,500	1 sample from each of 8 locations; one event
Small Mammal Sampling and Analysis	LS	1	$25,000	$25,000	1 sample from each of 8 locations; one event
Workplan and Reporting	LS	1	$11,500	$11,500	

Table 4-3. Alternative 3 Cost Estimate

Site: Honeywell Murphy's Island/SYW-12
Location: Syracuse, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2022

Conceptual Basis: Engineered cover on perimeter area (8.2 acres)
Wetland restoration/creation, biota monitoring, and MNA
Excludes costs associated with wetland mitigation

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
Annual Years 6 - 30					
Reporting and Recordkeeping	EA	1	$20,000	$20,000	
Cover inspection	LS	1	$2,400	$2,400	Assumes 2 scientists/engineers, 1 days, 8 hours/day, twice annually
Groundwater Monitoring					
Well inspection and sampling labor	LS	1	$9,600	$9,600	Assumes 2 scientists/engineers, 8 hours/day, twice annually, 4 days
Groundwater samples	LS	1	$12,600	$12,600	Assumes 14 samples (10 wells + QA/QC) twice annually; 28 samples total
Years 5, 10, 15, 20, 25, 30					
Five Year Review	EA	1	$15,000	$15,000	

PRESENT WORTH ANALYSIS (YEARS 1-30)	Cost	DISCOUNT FACTOR Df=7	PRESENT WORTH (rounded)	
ESTIMATED CAPITAL COST - Year 0	$7,530,000	1.00	$7,530,000	
ANNUAL O&M - YEARS 1-5	$55,065	0.82	$226,000	Average discount factor for years 1-5
ANNUAL O&M - YEARS 1, 3, 5	$66,500	0.82	$164,000	Average discount factor for years 1, 3, 5
ANNUAL O&M - YEARS 6-30	$44,600	0.33	$371,000	Average discount factor for years 6-30
PERIODIC O&M - YEARS 5, 10, 15, 20, 25, 30	$15,000	0.36	$32,000	Average discount factor for years 5, 10, 15, 20, 25 and 30
TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST:			**$8,300,000**	rounded

Table 4-4. Alternative 4A Cost Estimate

Site: Honeywell Murphy's Island/SYW-12

Location: Syracuse, NY

Phase: Feasibility Phase (+50% / -25%)

Base Year: 2022

Conceptual Basis: Surface excavation and engineered cover/restoration on perimeter and interior areas (10 acres - 9.5 acres cover and 0.5 ac disturbance/wetland restoration), limited tree removal

On-site consolidation

Excludes costs associated with wetland mitigation

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
DIRECT CAPITAL COST					
General Conditions	WK	27	$15,000	$405,000	Trailer, fuel, small tools, consumables and safety; 1 week Mob
Mobilization	EA	1	$65,000	$65,000	One per 36-wk construction season; reflects winter condition and eagle roosting no-work periods
Air Monitoring	LS	1	$45,000	$45,000	
Surveys and Layouts	EA	2	$4,500	$9,000	Pre-construction, post-construction
Irrigation	WK	4	$5,000	$20,000	Following seeding, 4 weeks per season
Railroad Protection	WK	27	$16,000	$432,000	1 Construction Manager and 1 Flagman
Temporary Fencing	LF	6,000	$10	$60,000	
Truck Wash/ Spoils control	WK	27	$7,500	$202,500	Wash rack and operation
Dust Suppression/Control	WK	27	$3,500	$94,500	5,000 gallon water truck and operation
Permits	LS	1	$15,000	$15,000	Railroad Access Permit/ Agreement, Onondaga County Wastewater Permit
Environmental Easement	LS	1	$30,000	$30,000	
Site Management Plan	LS	1	$50,000	$50,000	
Pre-Design Survey	LS	1	$40,000	$40,000	PDI includes Topographic and Tree Surveys and borings/geological eval
Additional Surface Soil Sampling	LS	1	$50,000	$50,000	3 samples from each of 8 loc (3 each of two forested wetland and 2 from one upland area). For potential remedial footprint expansion.
Site-Wide Surface Soil Pre-Design Investigation	LS	1	$70,000	$70,000	16 locations, 3 samples each. Part 375 analysis.
Baseline Biota Monitoring					
Sediment Sampling	LS	1	$9,500	$9,500	1 sample from each of 8 locations; one event
Invertebrate Sampling and Analysis	LS	1	$20,500	$20,500	8 samples from each of 2 Events (spring and summer)
Small Mammal Sampling and Analysis	LS	1	$25,000	$25,000	8 samples from each of 2 Events (spring and summer)
Workplan and Reporting	LS	1	$11,500	$11,500	
Site Preparation					
Clearing and Grubbing - underbrush	AC	9.5	$6,000	$57,000	Forested upland removal of underbrush for access purposes only
Clearing and Grubbing	AC	9.5	$11,000	$104,500	Non-forested wetlands and uplands only; no tree clearing. Chipped and left onsite.
Heavy Clearing and Grubbing	AC	1	$17,000	$17,000	Forested path to targeted surface soil removal areas
Rough Grading	AC	9.5	$4,000	$38,000	Non-forested wetlands and uplands
Sheeting and Shoring	SF	180,000	$45	$8,100,000	Assumes interlocking steel sheeting; installed along railroad to 60-ft
Railroad Crossing	EA	3	$25,000	$75,000	
Construction Entrance	LS	1	$16,000	$16,000	6-inch stone entrance, 50ft x 24ft, from access road along Ley Creek.
Working Pad	CY	1,500	$90	$135,000	4-ft stone, mirafi, 100 x 100-ft
Access Roadways - Installation	LF	3,000	$130	$390,000	2-ft stone, mirafi, built to 35-ft width (assume 2 lanes)
Site Access - Crane Mats	LS	1	$75,000	$75,000	Rental; 500 LF crane mats
Materials QA/QC Testing - Topsoil	EA	8	$2,500	$20,000	chemical and physical testing of imported materials; includes emerging contaminants
Materials QA/QC Testing - Fill and stone	EA	10	$2,200	$22,000	chemical and physical testing of imported materials; includes emerging contaminants
Compaction Testing	WK	9	$1,000	$9,000	during backfill only
Erosion and Sediment Control	LF	15,000	$8	$120,000	Reinforced silt fence along access road and site perimeter
Targeted Surface Soil Removal (6.5 AC)					
Excavation to 2-ft bgs within existing wetland area	CY	20,970	$16	$335,520	Remove 24-inch in the wet
Import and place 12-in topsoil	CY	10,500	$53	$556,500	Placement by conventional equipment in 6-inch lifts; infertile topsoil
Import and place 12-in subgrade material	CY	11,550	$46	$531,300	Placement by conventional equipment in 6-inch lifts; assumes variable grading.
Wetland seeding	AC	7.0	$26,000	$182,000	Cost includes installation; hand sown at 30 pounds per acre
Hand Plantings	AC	7.0	$5,000	$35,000	Assumes 8000 live stakes per acre

Table 4-4. Alternative 4A Cost Estimate

Site: Honeywell Murphy's Island/SYW-12
Location: Syracuse, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2022

Conceptual Basis: Surface excavation and engineered cover/restoration on perimeter and interior areas (10 acres - 9.5 acres cover and 0.5 ac disturbance/wetland restoration), limited tree removal
On-site consolidation
Excludes costs associated with wetland mitigation

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
Engineered Vegetative Cover (3 AC)					
Placement and grading of on-site spoils	CY	20,970	$9	$188,730	Reuse excavated material below cover
Placement of 6-in topsoil	CY	2,400	$53	$127,200	Placement by conventional equipment in 6-inch lifts
Placement of 18-in subgrade material	CY	7,200	$46	$331,200	Placement by conventional equipment in 6-inch lifts
Non-Wetland Seeding	AC	3	$19,000	$57,000	Modified old field successional with fertilizer and hydromulch
Transportation and Disposal					
T&D of Roadway Material - C&D	TON	11,700	$80	$936,000	1.7 tons per cy; disposal at C&D landfill. Includes equipment/labor for removal
			TOTAL ESTIMATED DIRECT CAPITAL COST:	**$14,113,000**	rounded
INDIRECT CAPITAL COST					
			Total Estimated Direct Capital Cost:	**$14,113,000**	
			Engineering / Management, Construction Oversight, OH&P	**$2,681,500**	6%, 8%, and 5% respectively
			Contingency	**$4,233,900**	Scope Contingency at 30%
Institutional Controls					
Environmental Easement	LS	1	$30,000	$30,000	
Site Management Plan	LS	1	$50,000	$50,000	
			TOTAL ESTIMATED CAPITAL COST:	**$21,108,000**	rounded
OPERATION AND MAINTENANCE COSTS					
Annual Years 1 - 5					
Reporting and Recordkeeping	EA	1	$20,000	$20,000	
Cover inspection	LS	1	$2,400	$2,400	Assumes 2 scientists/engineers, 1 days, 8 hours/day, twice annually
Groundwater Monitoring					
Well inspection and sampling labor	LS	1	$9,600	$9,600	Assumes 2 scientists/engineers, 8 hours/day, twice annually, 4 days
Groundwater samples	LS	1	$12,600	$12,600	Assumes 14 samples (10 wells + QA/QC) twice annually; 28 samples total
On-site Cover Maintenance					
Wetland/Non-Forest Vegetation Maintenance	AC	0.4	$26,000	$10,400	Spot seeding (5% of all areas annually) and handpulling invasive species
Cover maintenance and incidental repairs	AC	10.0	$325	$3,250	Topsoil repair, 5 cy/acre annually
Annual Years 1, 3, 5					
Baseline Biota Monitoring					
Sediment Sampling	LS	1	$9,500	$9,500	1 sample from each of 8 locations; one event
Invertebrate Sampling and Analysis	LS	1	$20,500	$20,500	1 sample from each of 8 locations; one event
Small Mammal Sampling and Analysis	LS	1	$25,000	$25,000	1 sample from each of 8 locations; one event
Workplan and Reporting	LS	1	$11,500	$11,500	

Table 4-4. Alternative 4A Cost Estimate

Site: Honeywell Murphy's Island/SYW-12

Location: Syracuse, NY

Phase: Feasibility Phase (+50% / -25%)

Base Year: 2022

Conceptual Basis: Surface excavation and engineered cover/restoration on perimeter and interior areas (10 acres - 9.5 acres cover and 0.5 ac disturbance/wetland restoration), limited tree removal

On-site consolidation

Excludes costs associated with wetland mitigation

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
Annual Years 6 - 30					
Reporting and Recordkeeping	EA	1	$20,000	$20,000	
Cover inspection	LS	1	$2,400	$2,400	Assumes 2 scientists/engineers, 1 days, 8 hours/day, twice annually
Groundwater Monitoring					
Well inspection and sampling labor	LS	1	$9,600	$9,600	Assumes 2 scientists/engineers, 8 hours/day, twice annually, 4 days
Groundwater samples	LS	1	$12,600	$12,600	Assumes 14 samples (10 wells + QA/QC) twice annually; 28 samples total
Years 5, 10, 15, 20, 25, 30					
Five Year Review	EA	1	$15,000	$15,000	

PRESENT WORTH ANALYSIS (YEARS 1-30)	Cost	DISCOUNT FACTOR Df=7	PRESENT WORTH (rounded)	
ESTIMATED CAPITAL COST - Year 0	$21,108,000	1.00	$21,110,000	
ANNUAL O&M - YEARS 1-5	$58,250	0.82	$239,000	Average discount factor for years 1-5
ANNUAL O&M - YEARS 1, 3, 5	$66,500	0.82	$164,000	Average discount factor for years 1, 3, 5
ANNUAL O&M - YEARS 6-30	$44,600	0.33	$371,000	Average discount factor for years 6-30
PERIODIC O&M - YEARS 5, 10, 15, 20, 25, 30	$15,000	0.36	$32,000	Average discount factor for years 5, 10, 15, 20, 25 and 30
TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST:			**$21,900,000**	rounded

Table 4-5. Alternative 4B Cost Estimate

Site: Honeywell Murphy's Island/SYW-12

Location: Syracuse, NY

Phase: Feasibility Phase (+50% / -25%)

Base Year: 2022

Conceptual Basis: Surface excavation and engineered cover/restoration on perimeter and interior areas (10 acres - 9.5 acres cover and 0.5 ac disturbance/wetland restoration), limited tree removal

Off-site disposal

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
DIRECT CAPITAL COST					
General Conditions	WK	22	$15,000	$330,000	Trailer, fuel, small tools, consumables and safety; 1 week Mob
Mobilization	EA	1	$65,000	$65,000	One per 36-wk construction season; reflects winter condition and eagle roosting no-work periods
Air Monitoring	LS	1	$45,000	$45,000	
Surveys and Layouts	EA	2	$4,500	$9,000	Pre-construction, post-construction
Irrigation	WK	4	$5,000	$20,000	Following seeding, 4 weeks per season
Railroad Protection	WK	22	$16,000	$352,000	1 Construction Manager and 1 Flagman
Temporary Fencing	LF	6,000	$10	$60,000	
Truck Wash/ Spoils control	WK	22	$7,500	$165,000	Wash rack and operation
Dust Suppression/Control	WK	22	$3,500	$77,000	5,000 gallon water truck and operation
Permits	LS	1	$15,000	$15,000	Railroad Access Permit/ Agreement, Onondaga County Wastewater Permit
Environmental Easement	LS	1	$30,000	$30,000	
Site Management Plan	LS	1	$50,000	$50,000	
Pre-Design Survey	LS	1	$40,000	$40,000	PDI includes Topographic and Tree Surveys and borings/geological eval
Additional Surface Soil Sampling	LS	1	$50,000	$50,000	3 samples from each of 8 loc (3 each of two forested wetland and 2 from one upland area). For potential remedial footprint expansion.
Site-Wide Surface Soil Pre-Design Investigation	LS	1	$70,000	$70,000	16 locations, 3 samples each. Part 375 analysis.
Baseline Biota Monitoring					
Sediment Sampling	LS	1	$9,500	$9,500	1 sample from each of 8 locations; one event
Invertebrate Sampling and Analysis	LS	1	$20,500	$20,500	8 samples from each of 2 Events (spring and summer)
Small Mammal Sampling and Analysis	LS	1	$25,000	$25,000	8 samples from each of 2 Events (spring and summer)
Workplan and Reporting	LS	1	$11,500	$11,500	
Site Preparation					
Clearing and Grubbing - underbrush	AC	9.5	$6,000	$57,000	Forested upland removal of underbrush for access purposes only
Clearing and Grubbing	AC	9.5	$11,000	$104,500	Non-forested wetlands and uplands only; no tree clearing. Chipped and left onsite.
Heavy Clearing and Grubbing	AC	1	$17,000	$17,000	Forested path to targeted surface soil removal areas
Rough Grading	AC	9.5	$4,000	$38,000	Non-forested wetlands and uplands
Sheeting and Shoring	SF	180,000	$45	$8,100,000	Assumes interlocking steel sheeting; installed along railroad to 60-ft
Railroad Crossing	EA	3	$25,000	$75,000	
Construction Entrance	LS	1	$16,000	$16,000	6-inch stone entrance, 50ft x 24ft, from access road along Ley Creek.
Working Pad	CY	1,500	$90	$135,000	4-ft stone, mirafi, 100 x 100-ft
Access Roadways - Installation	LF	3,000	$130	$390,000	2-ft stone, mirafi, built to 35-ft width (assume 2 lanes)
Site Access - Crane Mats	LS	1	$75,000	$75,000	Rental; 500 LF crane mats
Materials QA/QC Testing - Topsoil	EA	8	$2,500	$20,000	chemical and physical testing of imported materials; includes emerging contaminants
Materials QA/QC Testing - Fill and stone	EA	10	$2,200	$22,000	chemical and physical testing of imported materials; includes emerging contaminants
Compaction Testing	WK	9	$1,000	$9,000	during backfill only
Erosion and Sediment Control	LF	15,000	$8	$120,000	Reinforced silt fence along access road and site perimeter
Targeted Surface Soil Removal (6.5 AC)					
Excavation to 2-ft bgs within existing wetland area	CY	20,970	$16	$335,520	Remove 24-inch in the wet
Import and place 12-in topsoil	CY	10,500	$53	$556,500	Placement by conventional equipment in 6-inch lifts; infertile topsoil
Import and place 12-in subgrade material	CY	11,550	$46	$531,300	Placement by conventional equipment in 6-inch lifts; assumes variable grading.
Wetland seeding	AC	7.0	$26,000	$182,000	Cost includes installation; hand sown at 30 pounds per acre
Hand Plantings	AC	7.0	$5,000	$35,000	Assumes 8000 live stakes per acre

Table 4-5. Alternative 4B Cost Estimate

Site: Honeywell Murphy's Island/SYW-12

Location: Syracuse, NY

Phase: Feasibility Phase (+50% / -25%)

Base Year: 2022

Conceptual Basis: Surface excavation and engineered cover/restoration on perimeter and interior areas (10 acres - 9.5 acres cover and 0.5 ac disturbance/wetland restoration), limited tree removal

Off-site disposal

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
Engineered Vegetative Cover (3 AC)					
Placement of 6-in topsoil	CY	2,400	$53	$127,200	Placement by conventional equipment in 6-inch lifts
Placement of 18-in subgrade material	CY	7,200	$46	$331,200	Placement by conventional equipment in 6-inch lifts
Non-Wetland Seeding	AC	3	$19,000	$57,000	Modified old field successional with fertilizer and hydromulch
Transportation and Disposal					
T&D of Roadway Material - C&D	TON	11,700	$80	$936,000	1.7 tons per cy; disposal at C&D landfill. Includes equipment/labor for removal
T&D by Truck - Non-Hazardous	TON	31,500	$120	$3,780,000	1.5 tons per cy; disposal at landfill
		TOTAL ESTIMATED DIRECT CAPITAL COST:		**$17,495,000**	rounded
INDIRECT CAPITAL COST					
		Total Estimated Direct Capital Cost:		**$17,495,000**	
		Engineering / Management, Construction Oversight, OH&P		**$3,324,100**	6%, 8%, and 5% respectively
		Contingency		**$5,248,500**	Scope Contingency at 30%
Institutional Controls					
Environmental Easement	LS	1	$30,000	$30,000	
Site Management Plan	LS	1	$50,000	$50,000	
		TOTAL ESTIMATED CAPITAL COST:		**$26,148,000**	rounded
OPERATION AND MAINTENANCE COSTS					
Annual Years 1 - 5					
Reporting and Recordkeeping	EA	1	$20,000	$20,000	
Cover inspection	LS	1	$2,400	$2,400	Assumes 2 scientists/engineers, 1 days, 8 hours/day, twice annually
Groundwater Monitoring					
Well inspection and sampling labor	LS	1	$9,600	$9,600	Assumes 2 scientists/engineers, 8 hours/day, twice annually, 4 days
Groundwater samples	LS	1	$12,600	$12,600	Assumes 14 samples (10 wells + QA/QC) twice annually; 28 samples total
On-site Cover Maintenance					
Wetland/Non-Forest Vegetation Maintenance	AC	0.4	$26,000	$10,400	Spot seeding (5% of all areas annually) and handpulling invasive species
Cover maintenance and incidental repairs	AC	10.0	$325	$3,250	Topsoil repair, 5 cy/acre annually
Annual Years 1, 3, 5					
Baseline Biota Monitoring					
Sediment Sampling	LS	1	$9,500	$9,500	1 sample from each of 8 locations; one event
Invertebrate Sampling and Analysis	LS	1	$20,500	$20,500	1 sample from each of 8 locations; one event
Small Mammal Sampling and Analysis	LS	1	$25,000	$25,000	1 sample from each of 8 locations; one event
Workplan and Reporting	LS	1	$11,500	$11,500	

Table 4-5. Alternative 4B Cost Estimate

Site: Honeywell Murphy's Island/SYW-12

Location: Syracuse, NY

Phase: Feasibility Phase (+50% / -25%)

Base Year: 2022

Conceptual Basis: Surface excavation and engineered cover/restoration on perimeter and interior areas (10 acres - 9.5 acres cover and 0.5 ac disturbance/wetland restoration), limited tree removal

Off-site disposal

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
Annual Years 6 - 30					
Reporting and Recordkeeping	EA	1	$20,000	$20,000	
Cover inspection	LS	1	$2,400	$2,400	Assumes 2 scientists/engineers, 1 days, 8 hours/day, twice annually
Groundwater Monitoring					
Well inspection and sampling labor	LS	1	$9,600	$9,600	Assumes 2 scientists/engineers, 8 hours/day, twice annually, 4 days
Groundwater samples	LS	1	$12,600	$12,600	Assumes 14 samples (10 wells + QA/QC) twice annually; 28 samples total
Years 5, 10, 15, 20, 25, 30					
Five Year Review	EA	1	$15,000	$15,000	

PRESENT WORTH ANALYSIS (YEARS 1-30)	Cost	DISCOUNT FACTOR Df=7	PRESENT WORTH (rounded)	
ESTIMATED CAPITAL COST - Year 0	$26,148,000	1.00	$26,150,000	
ANNUAL O&M - YEARS 1-5	$58,250	0.82	$239,000	Average discount factor for years 1-5
ANNUAL O&M - YEARS 1, 3, 5	$66,500	0.82	$164,000	Average discount factor for years 1, 3, 5
ANNUAL O&M - YEARS 6-30	$44,600	0.33	$371,000	Average discount factor for years 6-30
PERIODIC O&M - YEARS 5, 10, 15, 20, 25, 30	$15,000	0.36	$32,000	Average discount factor for years 5, 10, 15, 20, 25 and 30
TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST:			**$27,000,000**	rounded

Table 4-6. Alternative 5 Cost Estimate

Site: Honeywell Murphy's Island/SYW-12
Location: Syracuse, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2022

Conceptual Basis: Full removal (including all trees) and off-site disposal (23.5 acres)

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
Direct Capital Costs					
General Conditions	WK	267	$15,000	$4,005,000	Trailer, fuel, small tools, consumables and safety
Mobilization	EA	7	$65,000	$455,000	One per 36-wk construction season; reflects winter condition and eagle roosting no-work periods
Air Monitoring	WK	267	$45,000	$12,015,000	
Surveys and Layouts	EA	14	$4,500	$63,000	Assume twice annually
Irrigation	WK	28	$5,000	$140,000	Following seeding, 4 weeks per season
Railroad Protection	WK	267	$16,000	$4,272,000	1 Construction Manager and 1 Flagman
Temporary Fencing	LF	10,000	$10	$100,000	
Truck Wash/ Spoils control	WK	267	$7,500	$2,002,500	Wash rack and operation
Dust Suppression/Control	WK	267	$3,500	$934,500	5,000 gallon water truck and operation
Permits	LS	1	$15,000	$15,000	Railroad Access Permit/ Agreement, Onondaga County Wastewater Permit
Site Preparation					
Heavy Clearing and Grubbing	AC	14	$17,000	$236,300	Forested Wetlands and Uplands; trees to be transported off-site.
Clearing and Grubbing	AC	10	$11,000	$107,800	Non-Forested Wetlands and Uplands
Grading	AC	24	$9,000	$213,300	Forested and Non-Forested Areas, Site grade and prep
Sheeting and Shoring	SF	500,000	$45	$22,500,000	Assumes interlocking steel sheeting; installed to 2X depth of proposed excavation (noted below)
Dewatering	WK	217	$4,100	$891,000	Pumping 8-hr per day through 6" centrifugal pump; 500 GPM assumed
Off-site Water Treatment	GAL	312,920,000	$0	$9,387,600	
Construction Entrance	EA	7	$16,000	$112,000	1 location; annual replacement, Assumes 50ft x 24ft x 0.5ft
Access Roadways - Installation	LF	6,000	$130	$780,000	2-ft stone, mirafi, built to 35-ft width (assume 2 lanes)
Access Roadways - Improvement/Maintenance	CY	8,100	$40	$324,000	Assumes grading and 6-inches crushed stone improvement per year (years 2-4)
Site Access - Crane Mats	LS	1	$75,000	$75,000	Rental; 500 LF crane mats
Materials QA/QC Testing - Topsoil	EA	6	$2,500	$15,000	chemical and physical testing of imported materials; includes emerging contaminants
Materials QA/QC Testing - Fill and Stone	EA	12	$2,200	$26,400	chemical and physical testing of imported materials; includes emerging contaminants
Compaction Testing	WK	94	$1,000	$94,300	
Erosion and Sediment Control	LF	117,000	$8	$936,000	Reinforced silt fence along access road and site perimeter, Annual replacement
Excavation and Backfill within 2-ft of Finished Grade					
6-ft Excavation Area	CY	45,500	$16	$728,000	4.7 acres assumed
8-ft Excavation Area	CY	50,300	$16	$804,800	3.9 acres assumed
12-ft Excavation Area	CY	238,100	$16	$3,809,600	12.3 acres assumed
16-ft Excavation Area	CY	67,100	$16	$1,073,600	2.6 acres assumed
Backfill subgrade within 2-ft of existing grade	CY	332,300	$38	$12,627,400	Backfill to within 2-ft of finished grade
Constructed Wetland, 2-ft					
Placement of 12-in topsoil	CY	21,300	$53	$1,128,900	Placement by conventional equipment in 6-inch lifts
Placement of 12-in subgrade material	CY	23,430	$46	$1,077,800	Placement by conventional equipment in 6-inch lifts; assumes variable grading.
Tree Planting	EA	2,800	$45	$126,000	Cost includes installation; forested wetland area only (approx 6.5 acres)
Shrub Planting	EA	4,400	$20	$88,000	Cost includes installation; forested wetland area only (approx 6.5 acres)
Seeding	AC	24	$19,000	$450,300	Cost includes installation; hand sown at 30 pounds per acre
Hand Plantings	AC	23.7	$5,000	$118,500	Assumes 8000 live stakes per acre
Install Groundwater Monitoring Wells					
Shallow wells - 15 feet	VLF	45	$150	$6,750	Install and develop 3 2-inch PVC wells.

Table 4-6. Alternative 5 Cost Estimate

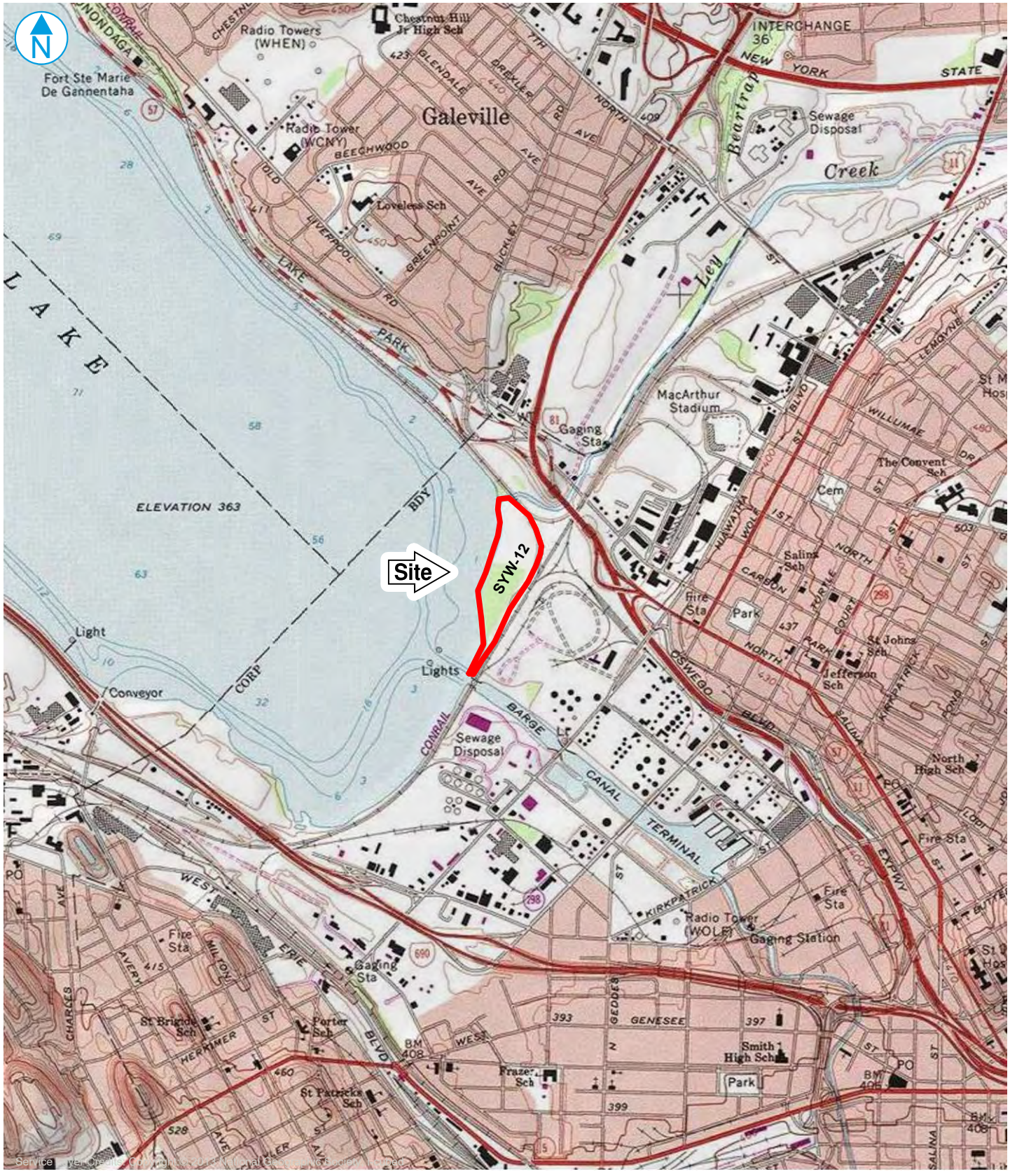
Site: Honeywell Murphy's Island/SYW-12
Location: Syracuse, NY
Phase: Feasibility Phase (+50% / -25%)
Base Year: 2022

Conceptual Basis: Full removal (including all trees) and off-site disposal (23.5 acres)

Item	Unit	Estimated Quantity	Estimated Unit Cost	Estimated Cost	Notes
Transportation and Disposal					
T&D by Truck - Organic Debris	TON	880	$50	$44,000	Assume 100 tons of trees per acre of forested wetland
T&D by Truck - Non-Hazardous	TON	549,000	$120	$65,880,000	1.5 tons per cy; disposal at landfill
T&D by Truck - Sludge-like material - Incineration	TON	52,500	$780	$40,950,000	Incineration at off-site facility
T&D by Truck - C&D Material	TON	300	$80	$24,000	1.7 tons per cy; disposal at C&D landfill
	TOTAL ESTIMATED DIRECT CAPITAL COST:			**$188,638,000**	rounded
INDIRECT CAPITAL COST					
	Total Estimated Direct Capital Cost:			**$188,638,000**	
	Engineering / Management, Construction Oversight, OH&P			**$35,841,200**	6%, 8%, and 5% respectively
	Contingency			**$56,591,400**	Scope Contingency at 30%
Institutional Controls					
Environmental Easement	LS	1	$30,000	$30,000	
Site Management Plan	LS	1	$50,000	$50,000	
	TOTAL ESTIMATED CAPITAL COST:			**$281,151,000**	rounded
OPERATION AND MAINTENANCE COSTS					
Annual Years 1 - 5					
Reporting and Recordkeeping	EA	1	$20,000	$20,000	
Groundwater Monitoring					
Well inspection and sampling labor	LS	1	$9,600	$9,600	Assumes 2 scientists/engineers, 8 hours/day, twice annually, 2 days
Groundwater samples	LS	1	$12,600	$12,600	**Assumes 7 samples (3 wells + QA/QC) twice annually; 14 samples total**
Year 5					
Five Year Review	EA	1	$15,000	$15,000	

PRESENT WORTH ANALYSIS (YEARS 1-30)	Cost	DISCOUNT FACTOR Df=7	PRESENT WORTH (rounded)	
ESTIMATED CAPITAL COST - Year 0	281,151,000	1.00	$281,150,000	
ANNUAL O&M - YEARS 1-5	$42,200	0.82	$173,000	Average discount factor for years 1-5
PERIODIC O&M - YEAR 5	15,000	0.71	$11,000	Average discount factor for year 5
TOTAL PRESENT WORTH ESTIMATED ALTERNATIVE COST:			**$281,300,000**	rounded

FIGURES



KEY MAP

Map Scale: 1:1:24,000;
Map Center: 76°10'33"W 43°4'17"N

0 1,000 2,000 Feet

SITE LOCATION

HONEYWELL INTERNATIONAL INC.
SYW-12 FEASIBILITY STUDY
SYRACUSE, NEW YORK

FIGURE 1-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

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NOTE:
THE WETLAND DELINEATION IS BASED ON A 2018 DELINEATION TO REEVALUATE WETLAND BOUNDARIES BETWEEN CSX RAILROAD TRACKS AND ONONDAGA CREEK (ANCHOR QEA 2018).

PROJECT: 1940065696 | DATED: 3/1/2022 | DESIGNER: MONETANT

- FORESTED UPLAND (7.4 AC)
- NONFORESTED UPLAND (3.0 AC)
- FORESTED WETLAND (6.6 AC)
- NONFORESTED WETLAND (6.5 AC)
- SITE BOUNDARY

0 125 250 Feet

SITE PLAN

HONEYWELL INTERNATIONAL INC.
SYW-12 FEASIBILITY STUDY
SYRACUSE, NEW YORK

FIGURE 1-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

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PROJECT: 1940065696 | DATED: 3/1/2022 | DESIGNER: MONETANT

100-YEAR FLOODPLAIN
500-YEAR FLOODPLAIN
FORESTED UPLAND (7.4 AC)
NONFORESTED UPLAND (3.0 AC)
FORESTED WETLAND (6.6 AC)
NONFORESTED WETLAND (6.5 AC)
SITE BOUNDARY

0 125 250 Feet

SYW-12 FEMA 100-YEAR AND 500-YEAR FLOODPLAINS

HONEYWELL INTERNATIONAL INC.
SYW-12 FEASIBILITY STUDY
SYRACUSE, NEW YORK

FIGURE 1-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

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PROJECT: 1940065696 | DATED: 3/1/2022 | DESIGNER: MONETANT

WETLAND SOIL BORING/GROUND WATER SCREENING

MONITORING WELL

WETLAND SOIL BORING

WETLAND SEDIMENT

SITE BOUNDARY

0 125 250 Feet

SYW-12 SAMPLE LOCATIONS

HONEYWELL INTERNATIONAL INC.
SYW-12 FEASIBILITY STUDY
SYRACUSE, NEW YORK

FIGURE 2-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

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PROJECT: 1940065696 | DATED: 3/4/2022 | DESIGNER: MONETANT

ONONDAGA LAKE

ENGINEERED COVER IN NON-FORESTED AREA
- PERCHED WETLAND COVER (5.9 ACRES)
- VEGETATED BERM AREA (1.6 ACRES)

UNDISTURBED EAGLE ROOSTING HABITAT
- UNDISTURBED FORESTED HABITAT (15.3 ACRES)

ENGINEERED SOIL COVER IN NON-FORESTED AREA
- UPLAND VEGETATED SOIL COVER (0.7 ACRES)

CSX RAILROAD TRACKS

Park St

Onondaga Lake Pkwy

LEY CREEK

370

24B 24A

Harborside Dr

ONONDAGA CREEK

Service Layer Credits: NYS GIS Program Office, Westchester County GIS

ALSO INCLUDES:
- WETLAND RESTORATION/MITIGATION
- GROUNDWATER MONITORING
- MONITORED NATURAL ATTENUATION
- ON-SITE REUSE AND/OR OFF-SITE DISPOSAL OF EXCAVATED SOIL/FILL MATERIAL
- INSTITUTIONAL CONTROLS
- BIOTA MONITORING
- PRE-DESIGN SOIL SAMPLING AND TREE SURVEY

POTENTIAL FUTURE TRAIL EXTENSION

PLANNED RECREATIONAL TRAIL ALIGNMENT

UPLAND VEGETATED SOIL COVER (0.7 AC)

PERCHED WETLAND COVER (5.9 AC)

SITE BOUNDARY

POTENTIAL ADDITIONAL REMEDIAL AREAS (E.G., BASED ON SOIL SAMPLING, TREE SURVEY)

0 125 250 Feet

SYW-12 ALTERNATIVE 3
ENGINEERED COVER ON PERIMETER AREA (8.2 ACRES), WETLAND RESTORATION / CREATION, BIOTA MONITORING, AND MNA

HONEYWELL INTERNATIONAL INC.
SYW-12 FEASIBILITY STUDY
SYRACUSE, NEW YORK

FIGURE 3-1

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

POTENTIAL FUTURE TRAIL EXTENSION

PLANNED RECREATIONAL TRAIL ALIGNMENT

UPLAND VEGETATED SOIL COVER (3 AC)

0 110 220 Feet

SURFACE EXCAVATION / WETLAND RESTORATION (6.5 AC)

ON-SITE CONSOLIDATION AREA (ALTERNATIVE 4A)

POTENTIAL ADDITIONAL REMEDIAL AREAS (E.G., BASED ON SOIL SAMPLING, TREE SURVEY)

SITE BOUNDARY

SYW-12 ALTERNATIVE 4A/B

SURFACE EXCAVATION AND ENGINEERED COVER / RESTORATION ON PERIMETER AND INTERIOR AREAS (10 ACRES), BIOTA MONITORING, AND MNA, WITH LIMITED TREE REMOVAL

HONEYWELL INTERNATIONAL INC.
SYW-12 FEASIBILITY STUDY
SYRACUSE, NEW YORK

FIGURE 3-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

PROJECT: 1940065696 | DATED: 3/2/2022 | DESIGNER: MONETANT
I:\Honeywell\1163\65696.Syw-12-Fs\Docs\DWG\MXD\DEVELOPMENT OF ALTERNATIVES\FS ALTERNATIVES JULY 2021\FIGURE_3-4_Rev_03012022.mxd

POTENTIAL FUTURE TRAIL EXTENSION

PLANNED RECREATIONAL TRAIL ALIGNMENT

FORESTED AND NON-FORESTED UPLAND (10.4 AC) | FORESTED AND NON-FORESTED WETLAND (13.1 AC)

EXCAVATION AREA (23.5 AC)

0 125 250 Feet

SYW-12 ALTERNATIVE 5
FULL REMOVAL (INCLUDING ALL TREES) AND OFF-SITE DISPOSAL (23.5 ACRES)

HONEYWELL INTERNATIONAL INC.
SYW-12 FEASIBILITY STUDY
SYRACUSE, NEW YORK

FIGURE 3-3

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

APPENDICES

APPENDIX 1
UPDATED RISK AND HAZARD TABLES

TABLE 7.3a. RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS - SYW-12
REASONABLE MAXIMUM EXPOSURE
HONEYWELL WASTEBED B/HARBOR BROOK SITE - GEDDES AND SYRACUSE, NEW YORK

Scenario Timeframe:	Current/Future
Receptor Population:	Utility Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil and Subsurface Soil	Exposure Unit 9	Dermal	2,3,7,8-TCDD Equivalent	3E-05	mg/kg	3E-13	mg/kg-day	2E+05	1/(mg/kg-day)	4E-08	7E-13	mg/kg-day	1E-09	mg/kg-day	7E-04
				ALUMINUM	5E+03	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	1E+00	mg/kg-day	
				ARSENIC	6E+00	mg/kg	5E-08	mg/kg-day	2E+00	1/(mg/kg-day)	7E-08	1E-07	mg/kg-day	3E-04	mg/kg-day	5E-04
				CADMIUM	2E+01	mg/kg	5E-09	mg/kg-day		1/(mg/kg-day)		1E-08	mg/kg-day	3E-05	mg/kg-day	6E-04
				CHROMIUM	1E+02	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	8E-05	mg/kg-day	
				COPPER	1E+02	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	4E-02	mg/kg-day	
				IRON	1E+04	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	7E-01	mg/kg-day	
				LEAD	2E+02	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day		mg/kg-day	
				MANGANESE	3E+02	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	6E-03	mg/kg-day	
				MERCURY	2E+00	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	2E-05	mg/kg-day	
				VANADIUM	1E+01	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	2E-04	mg/kg-day	
				HIGHLY CHLORINATED PCBs	9E-01	mg/kg	4E-08	mg/kg-day	2E+00	1/(mg/kg-day)	7E-08	1E-07	mg/kg-day	2E-05	mg/kg-day	5E-03
				LESS CHLORINATED PCBs	3E-02	mg/kg	1E-09	mg/kg-day	2E+00	1/(mg/kg-day)	2E-09	3E-09	mg/kg-day	7E-05	mg/kg-day	4E-05
				ACENAPHTHYLENE	2E+00	mg/kg	9E-08	mg/kg-day		1/(mg/kg-day)		2E-07	mg/kg-day	3E-02	mg/kg-day	8E-06
				BENZ(A)ANTHRACENE	9E+00	mg/kg	3E-07	mg/kg-day	1E-01	1/(mg/kg-day)	3E-08	9E-07	mg/kg-day		mg/kg-day	
				BENZO(A)PYRENE	7E+00	mg/kg	2E-07	mg/kg-day	1E+00	1/(mg/kg-day)	2E-07	7E-07	mg/kg-day	3E-04	mg/kg-day	8E-06
				BENZO(B)FLUORANTHENE	9E+00	mg/kg	3E-07	mg/kg-day	1E-01	1/(mg/kg-day)	3E-08	9E-07	mg/kg-day		mg/kg-day	
				BENZO(G,H,I)PERYLENE	2E+00	mg/kg	9E-08	mg/kg-day		1/(mg/kg-day)		2E-07	mg/kg-day	3E-02	mg/kg-day	8E-06
				BENZO(K)FLUORANTHENE	3E+00	mg/kg	1E-07	mg/kg-day	1E-02	1/(mg/kg-day)	1E-09	3E-07	mg/kg-day		mg/kg-day	
				CHRYSENE	9E+00	mg/kg	3E-07	mg/kg-day	1E-03	1/(mg/kg-day)	3E-10	9E-07	mg/kg-day		mg/kg-day	
				DIBENZ(A,H)ANTHRACENE	6E-01	mg/kg	2E-08	mg/kg-day	1E+00	1/(mg/kg-day)	2E-08	6E-08	mg/kg-day		mg/kg-day	
				DIBENZOFURAN	1E+00	mg/kg	4E-08	mg/kg-day		1/(mg/kg-day)		1E-07	mg/kg-day	1E-03	mg/kg-day	1E-04
				INDENO(1,2,3-CD)PYRENE	2E+00	mg/kg	7E-08	mg/kg-day	1E-01	1/(mg/kg-day)	7E-09	2E-07	mg/kg-day		mg/kg-day	
				NAPHTHALENE	2E+00	mg/kg	6E-08	mg/kg-day		1/(mg/kg-day)		2E-07	mg/kg-day	2E-02	mg/kg-day	9E-06
				PHENANTHRENE	1E+01	mg/kg	5E-07	mg/kg-day		1/(mg/kg-day)		1E-06	mg/kg-day	3E-02	mg/kg-day	5E-05
				BENZENE	2E-03	mg/kg		mg/kg-day	3E-02	1/(mg/kg-day)			mg/kg-day	4E-03	mg/kg-day	
			Exp. Route Total								**5E-07**					**7E-03**
			Ingestion	2,3,7,8-TCDD Equivalent	3E-05	mg/kg	3E-12	mg/kg-day	2E+05	1/(mg/kg-day)	4E-07	8E-12	mg/kg-day	1E-09	mg/kg-day	8E-03
				ALUMINUM	5E+03	mg/kg	5E-04	mg/kg-day		1/(mg/kg-day)		1E-03	mg/kg-day	1E+00	mg/kg-day	1E-03
				ARSENIC	6E+00	mg/kg	6E-07	mg/kg-day	2E+00	1/(mg/kg-day)	8E-07	2E-06	mg/kg-day	3E-04	mg/kg-day	5E-03
				CADMIUM	2E+01	mg/kg	2E-06	mg/kg-day		1/(mg/kg-day)		5E-06	mg/kg-day	1E-03	mg/kg-day	5E-03
				CHROMIUM	1E+02	mg/kg	1E-05	mg/kg-day		1/(mg/kg-day)		4E-05	mg/kg-day	3E-03	mg/kg-day	1E-02
				COPPER	1E+02	mg/kg	1E-05	mg/kg-day		1/(mg/kg-day)		3E-05	mg/kg-day	4E-02	mg/kg-day	8E-04
				IRON	1E+04	mg/kg	1E-03	mg/kg-day		1/(mg/kg-day)		3E-03	mg/kg-day	7E-01	mg/kg-day	5E-03
				LEAD	2E+02	mg/kg	1E-05	mg/kg-day		1/(mg/kg-day)		4E-05	mg/kg-day		mg/kg-day	
				MANGANESE	3E+02	mg/kg	3E-05	mg/kg-day		1/(mg/kg-day)		8E-05	mg/kg-day	1E-01	mg/kg-day	6E-04
				MERCURY	2E+00	mg/kg	2E-07	mg/kg-day		1/(mg/kg-day)		5E-07	mg/kg-day	3E-04	mg/kg-day	2E-03
				VANADIUM	1E+01	mg/kg	1E-06	mg/kg-day		1/(mg/kg-day)		4E-06	mg/kg-day	9E-03	mg/kg-day	4E-04
				HIGHLY CHLORINATED PCBs	9E-01	mg/kg	9E-08	mg/kg-day	2E+00	1/(mg/kg-day)	2E-07	2E-07	mg/kg-day	2E-05	mg/kg-day	1E-02
				LESS CHLORINATED PCBs	3E-02	mg/kg	3E-09	mg/kg-day	2E+00	1/(mg/kg-day)	5E-09	7E-09	mg/kg-day	7E-05	mg/kg-day	1E-04
				ACENAPHTHYLENE	2E+00	mg/kg	2E-07	mg/kg-day		1/(mg/kg-day)		6E-07	mg/kg-day	3E-02	mg/kg-day	2E-05
				BENZ(A)ANTHRACENE	9E+00	mg/kg	8E-07	mg/kg-day	1E-01	1/(mg/kg-day)	8E-08	2E-06	mg/kg-day		mg/kg-day	
				BENZO(A)PYRENE	7E+00	mg/kg	6E-07	mg/kg-day	1E+00	1/(mg/kg-day)	6E-07	2E-06	mg/kg-day	3E-04	mg/kg-day	6E-03
				BENZO(B)FLUORANTHENE	9E+00	mg/kg	9E-07	mg/kg-day	1E-01	1/(mg/kg-day)	9E-08	2E-06	mg/kg-day		mg/kg-day	
				BENZO(G,H,I)PERYLENE	2E+00	mg/kg	2E-07	mg/kg-day		1/(mg/kg-day)		6E-07	mg/kg-day	3E-02	mg/kg-day	2E-05
				BENZO(K)FLUORANTHENE	3E+00	mg/kg	3E-07	mg/kg-day	1E-02	1/(mg/kg-day)	3E-09	8E-07	mg/kg-day		mg/kg-day	
				CHRYSENE	9E+00	mg/kg	8E-07	mg/kg-day	1E-03	1/(mg/kg-day)	8E-10	2E-06	mg/kg-day		mg/kg-day	
				DIBENZ(A,H)ANTHRACENE	6E-01	mg/kg	6E-08	mg/kg-day	1E+00	1/(mg/kg-day)	6E-08	2E-07	mg/kg-day		mg/kg-day	
				DIBENZOFURAN	1E+00	mg/kg	1E-07	mg/kg-day		1/(mg/kg-day)		4E-07	mg/kg-day	1E-03	mg/kg-day	4E-04
				INDENO(1,2,3-CD)PYRENE	2E+00	mg/kg	2E-07	mg/kg-day	1E-01	1/(mg/kg-day)	2E-08	5E-07	mg/kg-day		mg/kg-day	
				NAPHTHALENE	2E+00	mg/kg	2E-07	mg/kg-day		1/(mg/kg-day)		5E-07	mg/kg-day	2E-02	mg/kg-day	2E-05
				PHENANTHRENE	1E+01	mg/kg	1E-06	mg/kg-day		1/(mg/kg-day)		4E-06	mg/kg-day	3E-02	mg/kg-day	1E-04
				BENZENE	2E-03	mg/kg	2E-10	mg/kg-day	6E-02	1/(mg/kg-day)	9E-12	5E-10	mg/kg-day	4E-03	mg/kg-day	1E-07
			Exp. Route Total								**2E-06**					**6E-02**
		Exp. Point Total									**3E-06**					**7E-02**
	Exp. Medium Total										**3E-06**					**7E-02**
Medium Total											**3E-06**					**7E-02**

TABLE 7.3a. RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS - SYW-12
REASONABLE MAXIMUM EXPOSURE
HONEYWELL WASTEBED B/HARBOR BROOK SITE - GEDDES AND SYRACUSE, NEW YORK

Scenario Timeframe:	Current/Future
Receptor Population:	Utility Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil and Subsurface Soil	Outdoor Air	Exposure Unit 9	Inhalation	2,3,7,8-TCDD Equivalent	1E-08	mg/m3	5E-11	mg/kg-day		1/(mg/kg-day)		1E-10	mg/kg-day		mg/kg-day	
				ALUMINUM	2E-06	mg/m3	8E-09	mg/kg-day		1/(mg/kg-day)		2E-08	mg/kg-day	1E-03	mg/kg-day	2E-05
				ARSENIC	3E-09	mg/m3	9E-12	mg/kg-day	2E+01	1/(mg/kg-day)	1E-10	2E-11	mg/kg-day	1E-05	mg/kg-day	2E-06
				CADMIUM	8E-09	mg/m3	3E-11	mg/kg-day	6E+00	1/(mg/kg-day)	2E-10	7E-11	mg/kg-day		mg/kg-day	
				CHROMIUM	6E-08	mg/m3	2E-10	mg/kg-day	4E+01	1/(mg/kg-day)	9E-09	6E-10	mg/kg-day	3E-05	mg/kg-day	2E-05
				COPPER	5E-08	mg/m3	2E-10	mg/kg-day		1/(mg/kg-day)		5E-10	mg/kg-day		mg/kg-day	
				IRON	6E-06	mg/m3	2E-08	mg/kg-day		1/(mg/kg-day)		5E-08	mg/kg-day		mg/kg-day	
				LEAD	7E-08	mg/m3	2E-10	mg/kg-day		1/(mg/kg-day)		7E-10	mg/kg-day		mg/kg-day	
				MANGANESE	1E-07	mg/m3	5E-10	mg/kg-day		1/(mg/kg-day)		1E-09	mg/kg-day	1E-05	mg/kg-day	9E-05
				MERCURY	8E-10	mg/m3	3E-12	mg/kg-day		1/(mg/kg-day)		7E-12	mg/kg-day	9E-05	mg/kg-day	8E-08
				VANADIUM	6E-09	mg/m3	2E-11	mg/kg-day		1/(mg/kg-day)		6E-11	mg/kg-day		mg/kg-day	
				HIGHLY CHLORINATED PCBs	4E-10	mg/m3	1E-12	mg/kg-day	2E+00	1/(mg/kg-day)	3E-12	4E-12	mg/kg-day		mg/kg-day	
				LESS CHLORINATED PCBs	1E-11	mg/m3	4E-14	mg/kg-day	2E+00	1/(mg/kg-day)	8E-14	1E-13	mg/kg-day		mg/kg-day	
				ACENAPHTHYLENE	1E-09	mg/m3	3E-12	mg/kg-day		1/(mg/kg-day)		1E-11	mg/kg-day		mg/kg-day	
				BENZ(A)ANTHRACENE	4E-09	mg/m3	1E-11	mg/kg-day	6E-02	1/(mg/kg-day)	8E-13	4E-11	mg/kg-day		mg/kg-day	
				BENZO(A)PYRENE	3E-09	mg/m3	1E-11	mg/kg-day	6E-01	1/(mg/kg-day)	6E-12	3E-11	mg/kg-day	2E-06	mg/kg-day	1E-05
				BENZO(B)FLUORANTHENE	4E-09	mg/m3	1E-11	mg/kg-day	6E-02	1/(mg/kg-day)	8E-13	4E-11	mg/kg-day		mg/kg-day	
				BENZO(G,H,I)PERYLENE	1E-09	mg/m3	4E-12	mg/kg-day		1/(mg/kg-day)		1E-11	mg/kg-day		mg/kg-day	
				BENZO(K)FLUORANTHENE	1E-09	mg/m3	5E-12	mg/kg-day	6E-03	1/(mg/kg-day)	3E-14	1E-11	mg/kg-day		mg/kg-day	
				CHRYSENE	4E-09	mg/m3	1E-11	mg/kg-day	6E-04	1/(mg/kg-day)	8E-15	4E-11	mg/kg-day		mg/kg-day	
				DIBENZ(A,H)ANTHRACENE	3E-10	mg/m3	9E-13	mg/kg-day	6E-01	1/(mg/kg-day)	6E-13	3E-12	mg/kg-day		mg/kg-day	
				DIBENZOFURAN	6E-10	mg/m3	2E-12	mg/kg-day		1/(mg/kg-day)		6E-12	mg/kg-day		mg/kg-day	
				INDENO(1,2,3-CD)PYRENE	8E-10	mg/m3	3E-12	mg/kg-day	6E-02	1/(mg/kg-day)	2E-13	8E-12	mg/kg-day		mg/kg-day	
				NAPHTHALENE	8E-10	mg/m3	3E-12	mg/kg-day	1E-01	1/(mg/kg-day)	3E-13	7E-12	mg/kg-day	9E-04	mg/kg-day	8E-09
				PHENANTHRENE	6E-09	mg/m3	2E-11	mg/kg-day		1/(mg/kg-day)		6E-11	mg/kg-day		mg/kg-day	
				BENZENE	9E-07	mg/m3	3E-09	mg/kg-day	3E-02	1/(mg/kg-day)	9E-11	9E-09	mg/kg-day	9E-03	mg/kg-day	1E-06
			Exp. Route Total								**9E-09**					**1E-04**
		Exp. Point Total									**9E-09**					**1E-04**
	Exp. Medium Total										**9E-09**					**1E-04**
Medium Total											**9E-09**					**1E-04**
Water	Shallow GW	Exposure Unit 9	Dermal	ALUMINUM	4E+04	ug/l	3E-04	mg/kg-day		1/(mg/kg-day)		9E-04	mg/kg-day	1E+00	mg/kg-day	9E-04
				ANTIMONY	6E+00	ug/l	4E-08	mg/kg-day		1/(mg/kg-day)		1E-07	mg/kg-day	6E-05	mg/kg-day	2E-03
				ARSENIC	2E+01	ug/l	1E-07	mg/kg-day	2E+00	1/(mg/kg-day)	2E-07	4E-07	mg/kg-day	3E-04	mg/kg-day	1E-03
				BARIUM	8E+02	ug/l	6E-06	mg/kg-day		1/(mg/kg-day)		2E-05	mg/kg-day	1E-02	mg/kg-day	1E-03
				CADMIUM	1E+01	ug/l	8E-08	mg/kg-day		1/(mg/kg-day)		2E-07	mg/kg-day	3E-05	mg/kg-day	9E-03
				CHROMIUM	2E+02	ug/l	2E-06	mg/kg-day		1/(mg/kg-day)		7E-06	mg/kg-day	8E-05	mg/kg-day	9E-02
				COPPER	3E+02	ug/l	2E-06	mg/kg-day		1/(mg/kg-day)		7E-06	mg/kg-day	4E-02	mg/kg-day	2E-04
				IRON	5E+04	ug/l	4E-04	mg/kg-day		1/(mg/kg-day)		1E-03	mg/kg-day	7E-01	mg/kg-day	1E-03
				LEAD	7E+02	ug/l	5E-07	mg/kg-day		1/(mg/kg-day)		1E-06	mg/kg-day		mg/kg-day	
				MANGANESE	1E+03	ug/l	9E-06	mg/kg-day		1/(mg/kg-day)		2E-05	mg/kg-day	6E-03	mg/kg-day	4E-03
				MERCURY	2E+00	ug/l	2E-08	mg/kg-day		1/(mg/kg-day)		5E-08	mg/kg-day	2E-05	mg/kg-day	2E-03
				NICKEL	7E+01	ug/l	1E-07	mg/kg-day		1/(mg/kg-day)		3E-07	mg/kg-day	8E-04	mg/kg-day	3E-04
				SELENIUM	1E+01	ug/l	8E-08	mg/kg-day		1/(mg/kg-day)		2E-07	mg/kg-day	5E-03	mg/kg-day	4E-05
				THALLIUM	2E+01	ug/l	2E-07	mg/kg-day		1/(mg/kg-day)		5E-07	mg/kg-day	8E-05	mg/kg-day	6E-03
				VANADIUM	7E+01	ug/l	5E-07	mg/kg-day		1/(mg/kg-day)		1E-06	mg/kg-day	2E-04	mg/kg-day	6E-03
				ZINC	5E+02	ug/l	2E-06	mg/kg-day		1/(mg/kg-day)		6E-06	mg/kg-day	3E-01	mg/kg-day	2E-05
				4-NITROPHENOL	1E+00	ug/l	5E-08	mg/kg-day		1/(mg/kg-day)		1E-07	mg/kg-day		mg/kg-day	
				ACENAPHTHENE	1E+01	ug/l		mg/kg-day		1/(mg/kg-day)			mg/kg-day	6E-02	mg/kg-day	
				ACENAPHTHYLENE	4E+00	ug/l		mg/kg-day		1/(mg/kg-day)			mg/kg-day	3E-02	mg/kg-day	
				ATRAZINE	5E+01	ug/l		mg/kg-day		1/(mg/kg-day)			mg/kg-day	4E-02	mg/kg-day	
				BENZ(A)ANTHRACENE	5E+00	ug/l	2E-05	mg/kg-day	1E-01	1/(mg/kg-day)	2E-06	7E-05	mg/kg-day		mg/kg-day	
				BENZO(A)PYRENE	6E+00	ug/l	5E-05	mg/kg-day	1E+00	1/(mg/kg-day)	5E-05	1E-04	mg/kg-day	3E-04	mg/kg-day	4E-01
				BENZO(B)FLUORANTHENE	7E+00	ug/l	6E-05	mg/kg-day	1E-01	1/(mg/kg-day)	6E-06	2E-04	mg/kg-day		mg/kg-day	
				BENZO(G,H,I)PERYLENE	5E+00	ug/l		mg/kg-day		1/(mg/kg-day)			mg/kg-day	3E-02	mg/kg-day	
				BENZO(K)FLUORANTHENE	5E+00	ug/l		mg/kg-day	1E-02	1/(mg/kg-day)			mg/kg-day		mg/kg-day	
				BIS(2-ETHYLHEXYL)PHTHALATE	5E+00	ug/l	3E-06	mg/kg-day	1E-02	1/(mg/kg-day)	5E-08	9E-06	mg/kg-day	2E-02	mg/kg-day	5E-04
				CARBAZOLE	4E+00	ug/l		mg/kg-day		1/(mg/kg-day)			mg/kg-day		mg/kg-day	
				CHRYSENE	5E+00	ug/l	2E-05	mg/kg-day	1E-03	1/(mg/kg-day)	2E-08	7E-05	mg/kg-day		mg/kg-day	
				NAPHTHALENE	1E+02	ug/l	4E-05	mg/kg-day		1/(mg/kg-day)		1E-04	mg/kg-day	2E-02	mg/kg-day	5E-03
				PHENANTHRENE	7E+00	ug/l	7E-06	mg/kg-day		1/(mg/kg-day)		2E-05	mg/kg-day	3E-02	mg/kg-day	7E-04
				PYRENE	7E+00	ug/l		mg/kg-day		1/(mg/kg-day)			mg/kg-day	3E-02	mg/kg-day	
				1,4-DICHLOROBENZENE	3E-01	ug/l	1E-07	mg/kg-day	5E-03	1/(mg/kg-day)	6E-10	3E-07	mg/kg-day	7E-02	mg/kg-day	4E-06
				BENZENE	9E-01	ug/l	1E-07	mg/kg-day	6E-02	1/(mg/kg-day)	5E-09	3E-07	mg/kg-day	4E-03	mg/kg-day	7E-05
			Exp. Route Total								**5E-05**					**6E-01**
		Exp. Point Total									**5E-05**					**6E-01**

TABLE 7.3a. RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS - SYW-12
REASONABLE MAXIMUM EXPOSURE
HONEYWELL WASTEBED B/HARBOR BROOK SITE - GEDDES AND SYRACUSE, NEW YORK

Scenario Timeframe:	Current/Future
Receptor Population:	Utility Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
	Exp. Medium Total										**5E-05**					**6E-01**
Medium Total											**5E-05**					**6E-01**
										Total of Receptor Risks Across All Media	**6E-05**				Total of Receptor Hazards Across All Media	**6E-01**

TABLE 7.4a RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -SYW-12
REASONABLE MAXIMUM EXPOSURE
HONEYWELL WASTEBED B/HARBOR BROOK SITE - GEDDES AND SYRACUSE, NEW YORK

Scenario Timeframe:	Future
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil and Subsurface Soil	Exposure Unit 9	Dermal	2,3,7,8-TCDD Equivalent	3E-05	mg/kg	1E-13	mg/kg-day	2E+05	1/(mg/kg-day)	2E-08	9E-12	mg/kg-day	1E-09	mg/kg-day	9E-03
				ALUMINUM	5E+03	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	1E+00	mg/kg-day	
				ARSENIC	6E+00	mg/kg	2E-08	mg/kg-day	2E+00	1/(mg/kg-day)	4E-08	2E-06	mg/kg-day	3E-04	mg/kg-day	6E-03
				CADMIUM	2E+01	mg/kg	2E-09	mg/kg-day		1/(mg/kg-day)		2E-07	mg/kg-day	3E-05	mg/kg-day	7E-03
				CHROMIUM	1E+02	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	8E-05	mg/kg-day	
				COPPER	1E+02	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	4E-02	mg/kg-day	
				IRON	1E+04	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	7E-01	mg/kg-day	
				LEAD	2E+02	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day		mg/kg-day	
				MANGANESE	3E+02	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	6E-03	mg/kg-day	
				MERCURY	2E+00	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	2E-05	mg/kg-day	
				VANADIUM	1E+01	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	2E-04	mg/kg-day	
				HIGHLY CHLORINATED PCBs	9E-01	mg/kg	2E-08	mg/kg-day	2E+00	1/(mg/kg-day)	4E-08	1E-06	mg/kg-day	2E-05	mg/kg-day	6E-02
				LESS CHLORINATED PCBs	3E-02	mg/kg	6E-10	mg/kg-day	2E+00	1/(mg/kg-day)	1E-09	4E-08	mg/kg-day	7E-05	mg/kg-day	6E-04
				ACENAPHTHYLENE	2E+00	mg/kg	4E-08	mg/kg-day		1/(mg/kg-day)		3E-06	mg/kg-day	3E-02	mg/kg-day	1E-04
				BENZ(A)ANTHRACENE	9E+00	mg/kg	2E-07	mg/kg-day	1E-01	1/(mg/kg-day)	2E-08	1E-05	mg/kg-day		mg/kg-day	
				BENZO(A)PYRENE	7E+00	mg/kg	1E-07	mg/kg-day	1E+00	1/(mg/kg-day)	1E-07	9E-06	mg/kg-day	3E-04	mg/kg-day	1E-04
				BENZO(B)FLUORANTHENE	9E+00	mg/kg	2E-07	mg/kg-day	1E-01	1/(mg/kg-day)	2E-08	1E-05	mg/kg-day		mg/kg-day	
				BENZO(G,H,I)PERYLENE	2E+00	mg/kg	4E-08	mg/kg-day		1/(mg/kg-day)		3E-06	mg/kg-day	3E-02	mg/kg-day	1E-04
				BENZO(K)FLUORANTHENE	3E+00	mg/kg	6E-08	mg/kg-day	1E-02	1/(mg/kg-day)	6E-10	4E-06	mg/kg-day		mg/kg-day	
				CHRYSENE	9E+00	mg/kg	2E-07	mg/kg-day	1E-03	1/(mg/kg-day)	2E-10	1E-05	mg/kg-day		mg/kg-day	
				DIBENZ(A,H)ANTHRACENE	6E-01	mg/kg	1E-08	mg/kg-day	1E+00	1/(mg/kg-day)	1E-08	8E-07	mg/kg-day		mg/kg-day	
				DIBENZOFURAN	1E+00	mg/kg	2E-08	mg/kg-day		1/(mg/kg-day)		1E-06	mg/kg-day	1E-03	mg/kg-day	1E-03
				INDENO(1,2,3-CD)PYRENE	2E+00	mg/kg	3E-08	mg/kg-day	1E-01	1/(mg/kg-day)	3E-09	2E-06	mg/kg-day		mg/kg-day	
				NAPHTHALENE	2E+00	mg/kg	3E-08	mg/kg-day		1/(mg/kg-day)		2E-06	mg/kg-day	2E-02	mg/kg-day	1E-04
				PHENANTHRENE	1E+01	mg/kg	3E-07	mg/kg-day		1/(mg/kg-day)		2E-05	mg/kg-day	3E-02	mg/kg-day	6E-04
				BENZENE	2E-03	mg/kg		mg/kg-day	6E-02	1/(mg/kg-day)			mg/kg-day	4E-03	mg/kg-day	
			Exp. Route Total								**3E-07**					**9E-02**
			Ingestion	2,3,7,8-TCDD Equivalent	3E-05	mg/kg	1E-12	mg/kg-day	2E+05	1/(mg/kg-day)	2E-07	1E-10	mg/kg-day	1E-09	mg/kg-day	1E-01
				ALUMINUM	5E+03	mg/kg	2E-04	mg/kg-day		1/(mg/kg-day)		2E-02	mg/kg-day	1E+00	mg/kg-day	2E-02
				ARSENIC	6E+00	mg/kg	3E-07	mg/kg-day	2E+00	1/(mg/kg-day)	4E-07	2E-05	mg/kg-day	3E-04	mg/kg-day	6E-02
				CADMIUM	2E+01	mg/kg	8E-07	mg/kg-day		1/(mg/kg-day)		6E-05	mg/kg-day	1E-03	mg/kg-day	6E-02
				CHROMIUM	1E+02	mg/kg	7E-06	mg/kg-day		1/(mg/kg-day)		5E-04	mg/kg-day	3E-03	mg/kg-day	2E-01
				COPPER	1E+02	mg/kg	5E-06	mg/kg-day		1/(mg/kg-day)		4E-04	mg/kg-day	4E-02	mg/kg-day	9E-03
				IRON	1E+04	mg/kg	6E-04	mg/kg-day		1/(mg/kg-day)		4E-02	mg/kg-day	7E-01	mg/kg-day	6E-02
				LEAD	2E+02	mg/kg	7E-06	mg/kg-day		1/(mg/kg-day)		5E-04	mg/kg-day		mg/kg-day	
				MANGANESE	3E+02	mg/kg	2E-05	mg/kg-day		1/(mg/kg-day)		1E-03	mg/kg-day	1E-01	mg/kg-day	8E-03
				MERCURY	2E+00	mg/kg	8E-08	mg/kg-day		1/(mg/kg-day)		6E-06	mg/kg-day	3E-04	mg/kg-day	2E-02
				VANADIUM	1E+01	mg/kg	6E-07	mg/kg-day		1/(mg/kg-day)		5E-05	mg/kg-day	9E-03	mg/kg-day	5E-03
				HIGHLY CHLORINATED PCBs	9E-01	mg/kg	4E-08	mg/kg-day	2E+00	1/(mg/kg-day)	9E-08	3E-06	mg/kg-day	2E-05	mg/kg-day	2E-01
				LESS CHLORINATED PCBs	3E-02	mg/kg	1E-09	mg/kg-day	2E+00	1/(mg/kg-day)	3E-09	9E-08	mg/kg-day	7E-05	mg/kg-day	1E-03
				ACENAPHTHYLENE	2E+00	mg/kg	1E-07	mg/kg-day		1/(mg/kg-day)		8E-06	mg/kg-day	3E-02	mg/kg-day	3E-04
				BENZ(A)ANTHRACENE	9E+00	mg/kg	4E-07	mg/kg-day	1E-01	1/(mg/kg-day)	4E-08	3E-05	mg/kg-day		mg/kg-day	
				BENZO(A)PYRENE	7E+00	mg/kg	3E-07	mg/kg-day	1E+00	1/(mg/kg-day)	3E-07	2E-05	mg/kg-day		mg/kg-day	
				BENZO(B)FLUORANTHENE	9E+00	mg/kg	4E-07	mg/kg-day	1E-01	1/(mg/kg-day)	4E-08	3E-05	mg/kg-day		mg/kg-day	
				BENZO(G,H,I)PERYLENE	2E+00	mg/kg	1E-07	mg/kg-day		1/(mg/kg-day)		8E-06	mg/kg-day	3E-02	mg/kg-day	3E-04
				BENZO(K)FLUORANTHENE	3E+00	mg/kg	1E-07	mg/kg-day	1E-02	1/(mg/kg-day)	1E-09	1E-05	mg/kg-day		mg/kg-day	
				CHRYSENE	9E+00	mg/kg	4E-07	mg/kg-day	1E-03	1/(mg/kg-day)	4E-10	3E-05	mg/kg-day		mg/kg-day	
				DIBENZ(A,H)ANTHRACENE	6E-01	mg/kg	3E-08	mg/kg-day	1E+00	1/(mg/kg-day)	3E-08	2E-06	mg/kg-day		mg/kg-day	
				DIBENZOFURAN	1E+00	mg/kg	7E-08	mg/kg-day		1/(mg/kg-day)		5E-06	mg/kg-day	1E-03	mg/kg-day	5E-03
				INDENO(1,2,3-CD)PYRENE	2E+00	mg/kg	9E-08	mg/kg-day	1E-01	1/(mg/kg-day)	9E-09	6E-06	mg/kg-day		mg/kg-day	
				NAPHTHALENE	2E+00	mg/kg	8E-08	mg/kg-day		1/(mg/kg-day)		6E-06	mg/kg-day	2E-02	mg/kg-day	3E-04
				PHENANTHRENE	1E+01	mg/kg	7E-07	mg/kg-day		1/(mg/kg-day)		5E-05	mg/kg-day	3E-02	mg/kg-day	2E-03
				BENZENE	2E-03	mg/kg	8E-11	mg/kg-day	6E-02	1/(mg/kg-day)	5E-12	6E-09	mg/kg-day	4E-03	mg/kg-day	1E-06
			Exp. Route Total								**1E-06**					**7E-01**
		Exp. Point Total									**1E-06**					**7E-01**
	Exp. Medium Total										**1E-06**					**7E-01**
Medium Total											**1E-06**					**7E-01**

TABLE 7.4a RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -SYW-12
REASONABLE MAXIMUM EXPOSURE
HONEYWELL WASTEBED B/HARBOR BROOK SITE - GEDDES AND SYRACUSE, NEW YORK

Scenario Timeframe:	Future
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil and Subsurface Soil	Outdoor Air	Exposure Unit 9	Inhalation	2,3,7,8-TCDD Equivalent	1E-08	mg/m3	5E-11	mg/kg-day		1/(mg/kg-day)		3E-09	mg/kg-day		mg/kg-day	
				ALUMINUM	2E-06	mg/m3	8E-09	mg/kg-day		1/(mg/kg-day)		6E-07	mg/kg-day	1E-03	mg/kg-day	4E-04
				ARSENIC	3E-09	mg/m3	9E-12	mg/kg-day	2E+01	1/(mg/kg-day)	1E-10	7E-10	mg/kg-day	1E-05	mg/kg-day	5E-05
				CADMIUM	8E-09	mg/m3	3E-11	mg/kg-day	6E+00	1/(mg/kg-day)	2E-10	2E-09	mg/kg-day		mg/kg-day	
				CHROMIUM	6E-08	mg/m3	2E-10	mg/kg-day	4E+01	1/(mg/kg-day)	1E-08	2E-08	mg/kg-day	3E-05	mg/kg-day	6E-04
				COPPER	5E-08	mg/m3	2E-10	mg/kg-day		1/(mg/kg-day)		1E-08	mg/kg-day		mg/kg-day	
				IRON	6E-06	mg/m3	2E-08	mg/kg-day		1/(mg/kg-day)		1E-06	mg/kg-day		mg/kg-day	
				LEAD	7E-08	mg/m3	2E-10	mg/kg-day		1/(mg/kg-day)		2E-08	mg/kg-day		mg/kg-day	
				MANGANESE	1E-07	mg/m3	5E-10	mg/kg-day		1/(mg/kg-day)		4E-08	mg/kg-day	1E-05	mg/kg-day	2E-03
				MERCURY	8E-10	mg/m3	3E-12	mg/kg-day		1/(mg/kg-day)		2E-10	mg/kg-day	9E-05	mg/kg-day	2E-06
				VANADIUM	6E-09	mg/m3	2E-11	mg/kg-day		1/(mg/kg-day)		2E-09	mg/kg-day		mg/kg-day	
				HIGHLY CHLORINATED PCBs	4E-10	mg/m3	1E-12	mg/kg-day	2E+00	1/(mg/kg-day)	3E-12	1E-10	mg/kg-day		mg/kg-day	
				LESS CHLORINATED PCBs	1E-11	mg/m3	4E-14	mg/kg-day	2E+00	1/(mg/kg-day)	9E-14	3E-12	mg/kg-day		mg/kg-day	
				ACENAPHTHYLENE	1E-09	mg/m3	4E-12	mg/kg-day		1/(mg/kg-day)		3E-10	mg/kg-day		mg/kg-day	
				BENZ(A)ANTHRACENE	4E-09	mg/m3	1E-11	mg/kg-day	6E-02	1/(mg/kg-day)	8E-13	1E-09	mg/kg-day		mg/kg-day	
				BENZO(A)PYRENE	3E-09	mg/m3	1E-11	mg/kg-day	6E-01	1/(mg/kg-day)	6E-12	7E-10	mg/kg-day	2E-06	mg/kg-day	4E-04
				BENZO(B)FLUORANTHENE	4E-09	mg/m3	1E-11	mg/kg-day	6E-02	1/(mg/kg-day)	9E-13	1E-09	mg/kg-day		mg/kg-day	
				BENZO(G,H,I)PERYLENE	1E-09	mg/m3	4E-12	mg/kg-day		1/(mg/kg-day)		3E-10	mg/kg-day		mg/kg-day	
				BENZO(K)FLUORANTHENE	1E-09	mg/m3	5E-12	mg/kg-day	6E-03	1/(mg/kg-day)	3E-14	3E-10	mg/kg-day		mg/kg-day	
				CHRYSENE	4E-09	mg/m3	1E-11	mg/kg-day	6E-04	1/(mg/kg-day)	8E-15	1E-09	mg/kg-day		mg/kg-day	
				DIBENZ(A,H)ANTHRACENE	3E-10	mg/m3	1E-12	mg/kg-day	6E-01	1/(mg/kg-day)	6E-13	7E-11	mg/kg-day		mg/kg-day	
				DIBENZOFURAN	6E-10	mg/m3	2E-12	mg/kg-day		1/(mg/kg-day)		2E-10	mg/kg-day		mg/kg-day	
				INDENO(1,2,3-CD)PYRENE	8E-10	mg/m3	3E-12	mg/kg-day	6E-02	1/(mg/kg-day)	2E-13	2E-10	mg/kg-day		mg/kg-day	
				NAPHTHALENE	8E-10	mg/m3	3E-12	mg/kg-day	1E-01	1/(mg/kg-day)	3E-13	2E-10	mg/kg-day	9E-04	mg/kg-day	2E-07
				PHENANTHRENE	6E-09	mg/m3	2E-11	mg/kg-day		1/(mg/kg-day)		2E-09	mg/kg-day		mg/kg-day	
				BENZENE	9E-07	mg/m3	3E-09	mg/kg-day	3E-02	1/(mg/kg-day)	9E-11	2E-07	mg/kg-day	9E-03	mg/kg-day	3E-05
			Exp. Route Total								**1E-08**					**4E-03**
		Exp. Point Total									**1E-08**					**4E-03**
	Exp. Medium Total										**1E-08**					**4E-03**
Medium Total											**1E-08**					**4E-03**
Ground Water	Shallow Ground Water	Exposure Unit 9	Dermal	ALUMINUM	4E+04	ug/l	2E-04	mg/kg-day		1/(mg/kg-day)		1E-02	mg/kg-day	1E+00	mg/kg-day	1E-02
				ANTIMONY	6E+00	ug/l	2E-08	mg/kg-day		1/(mg/kg-day)		1E-06	mg/kg-day	6E-05	mg/kg-day	2E-02
				ARSENIC	2E+01	ug/l	7E-08	mg/kg-day	2E+00	1/(mg/kg-day)	1E-07	5E-06	mg/kg-day	3E-04	mg/kg-day	2E-02
				BARIUM	8E+02	ug/l	3E-06	mg/kg-day		1/(mg/kg-day)		2E-04	mg/kg-day	1E-02	mg/kg-day	2E-02
				CADMIUM	1E+01	ug/l	4E-08	mg/kg-day		1/(mg/kg-day)		3E-06	mg/kg-day	3E-05	mg/kg-day	1E-01
				CHROMIUM	2E+02	ug/l	1E-06	mg/kg-day		1/(mg/kg-day)		9E-05	mg/kg-day	8E-05	mg/kg-day	1E+00
				COPPER	3E+02	ug/l	1E-06	mg/kg-day		1/(mg/kg-day)		8E-05	mg/kg-day	4E-02	mg/kg-day	2E-03
				IRON	5E+04	ug/l	2E-04	mg/kg-day		1/(mg/kg-day)		1E-02	mg/kg-day	7E-01	mg/kg-day	2E-02
				LEAD	7E+02	ug/l	3E-07	mg/kg-day		1/(mg/kg-day)		2E-05	mg/kg-day		mg/kg-day	
				MANGANESE	1E+03	ug/l	4E-06	mg/kg-day		1/(mg/kg-day)		3E-04	mg/kg-day	6E-03	mg/kg-day	5E-02
				MERCURY	2E+00	ug/l	8E-09	mg/kg-day		1/(mg/kg-day)		6E-07	mg/kg-day	2E-05	mg/kg-day	3E-02
				NICKEL	7E+01	ug/l	5E-08	mg/kg-day		1/(mg/kg-day)		3E-06	mg/kg-day	8E-04	mg/kg-day	4E-03
				SELENIUM	1E+01	ug/l	4E-08	mg/kg-day		1/(mg/kg-day)		3E-06	mg/kg-day	5E-03	mg/kg-day	5E-04
				THALLIUM	2E+01	ug/l	8E-08	mg/kg-day		1/(mg/kg-day)		6E-06	mg/kg-day	8E-05	mg/kg-day	7E-02
				VANADIUM	7E+01	ug/l	3E-07	mg/kg-day		1/(mg/kg-day)		2E-05	mg/kg-day	2E-04	mg/kg-day	8E-02
				ZINC	5E+02	ug/l	1E-06	mg/kg-day		1/(mg/kg-day)		7E-05	mg/kg-day	3E-01	mg/kg-day	2E-04
				4-NITROPHENOL	1E+00	ug/l	2E-08	mg/kg-day		1/(mg/kg-day)		2E-06	mg/kg-day		mg/kg-day	
				ACENAPHTHENE	1E+01	ug/l		mg/kg-day		1/(mg/kg-day)			mg/kg-day	6E-02	mg/kg-day	
				ACENAPHTHYLENE	4E+00	ug/l		mg/kg-day		1/(mg/kg-day)			mg/kg-day	3E-02	mg/kg-day	
				ATRAZINE	5E+01	ug/l		mg/kg-day		1/(mg/kg-day)			mg/kg-day	4E-02	mg/kg-day	
				BENZ(A)ANTHRACENE	5E+00	ug/l	1E-05	mg/kg-day	1E-01	1/(mg/kg-day)	1E-06	8E-04	mg/kg-day		mg/kg-day	
				BENZO(A)PYRENE	6E+00	ug/l	2E-05	mg/kg-day	1E+00	1/(mg/kg-day)	2E-05	2E-03	mg/kg-day	3E-04	mg/kg-day	7E-02
				BENZO(B)FLUORANTHENE	7E+00	ug/l	3E-05	mg/kg-day	1E-01	1/(mg/kg-day)	3E-06	2E-03	mg/kg-day		mg/kg-day	
				BENZO(G,H,I)PERYLENE	5E+00	ug/l		mg/kg-day		1/(mg/kg-day)			mg/kg-day	3E-02	mg/kg-day	
				BENZO(K)FLUORANTHENE	5E+00	ug/l		mg/kg-day	1E-02	1/(mg/kg-day)			mg/kg-day		mg/kg-day	
				BIS(2-ETHYLHEXYL)PHTHALATE	5E+00	ug/l	2E-06	mg/kg-day	1E-02	1/(mg/kg-day)	2E-08	1E-04	mg/kg-day	2E-02	mg/kg-day	6E-03
				CARBAZOLE	4E+00	ug/l		mg/kg-day		1/(mg/kg-day)			mg/kg-day		mg/kg-day	
				CHRYSENE	5E+00	ug/l	1E-05	mg/kg-day	1E-03	1/(mg/kg-day)	1E-08	8E-04	mg/kg-day		mg/kg-day	
				NAPHTHALENE	1E+02	ug/l	2E-05	mg/kg-day		1/(mg/kg-day)		1E-03	mg/kg-day	2E-02	mg/kg-day	7E-02
Ground Water	Shallow Ground Water	Exposure Unit 9	Dermal	PHENANTHRENE	7E+00	ug/l	4E-06	mg/kg-day		1/(mg/kg-day)		3E-04	mg/kg-day	3E-02	mg/kg-day	9E-03
				PYRENE	7E+00	ug/l		mg/kg-day		1/(mg/kg-day)			mg/kg-day	3E-02	mg/kg-day	
				1,4-DICHLOROBENZENE	3E-01	ug/l	5E-08	mg/kg-day	5E-03	1/(mg/kg-day)	3E-10	4E-06	mg/kg-day	7E-02	mg/kg-day	5E-05
				BENZENE	9E-01	ug/l	5E-08	mg/kg-day	6E-02	1/(mg/kg-day)	3E-09	3E-06	mg/kg-day	4E-03	mg/kg-day	9E-04

TABLE 7.4a RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -SYW-12
REASONABLE MAXIMUM EXPOSURE
HONEYWELL WASTEBED B/HARBOR BROOK SITE - GEDDES AND SYRACUSE, NEW YORK

Scenario Timeframe:	Future
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
			Exp. Route Total								3E-05					2E+00
		Exp. Point Total									3E-05					2E+00
	Exp. Medium Total										3E-05					2E+00
Medium Total											3E-05					2E+00
											Total of Receptor Risks Across All Media	3E-05		Total of Receptor Hazards Across All Media		2E+00

TABLE 7.10a RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS - SYW-12
REASONABLE MAXIMUM EXPOSURE
HONEYWELL WASTEBED B/HARBOR BROOK SITE - GEDDES AND SYRACUSE, NEW YORK

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational Visitor
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Exposure Unit 9	Dermal	2,3,7,8-TCDD Equivalent	3E-05	mg/kg	5E-12	mg/kg-day	2E+05	1/(mg/kg-day)	8E-07	6E-11	mg/kg-day	1E-09	mg/kg-day	6E-02
				ALUMINUM	5E+03	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	1E+00	mg/kg-day	
				ARSENIC	6E+00	mg/kg	1E-06	mg/kg-day	2E+00	1/(mg/kg-day)	2E-06	1E-05	mg/kg-day	3E-04	mg/kg-day	4E-02
				CADMIUM	2E+01	mg/kg	1E-07	mg/kg-day		1/(mg/kg-day)		1E-06	mg/kg-day	3E-05	mg/kg-day	4E-02
				CHROMIUM	1E+02	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	8E-05	mg/kg-day	
				COPPER	1E+02	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	4E-02	mg/kg-day	
				IRON	1E+04	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	7E-01	mg/kg-day	
				MANGANESE	3E+02	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	6E-03	mg/kg-day	
				MERCURY	2E+00	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	2E-05	mg/kg-day	
				VANADIUM	1E+01	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	2E-04	mg/kg-day	
				HIGHLY CHLORINATED PCBs	9E-01	mg/kg	7E-07	mg/kg-day	2E+00	1/(mg/kg-day)	1E-06	8E-06	mg/kg-day	2E-05	mg/kg-day	4E-01
				ACENAPHTHYLENE	2E+00	mg/kg	1E-06	mg/kg-day		1/(mg/kg-day)		2E-05	mg/kg-day	3E-02	mg/kg-day	6E-04
				BENZ(A)ANTHRACENE	9E+00	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	4E-06	7E-06	mg/kg-day		mg/kg-day	
				BENZO(A)PYRENE	7E+00	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	3E-05	5E-06	mg/kg-day	3E-04	mg/kg-day	2E-02
				BENZO(B)FLUORANTHENE	1E+01	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	4E-06	7E-06	mg/kg-day		mg/kg-day	
				BENZO(G,H,I)PERYLENE	2E+00	mg/kg	2E-06	mg/kg-day		1/(mg/kg-day)		2E-05	mg/kg-day	3E-02	mg/kg-day	7E-04
				BENZO(K)FLUORANTHENE	3E+00	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	2E-07	2E-06	mg/kg-day		mg/kg-day	
				CHRYSENE	1E+01	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	4E-08	7E-06	mg/kg-day		mg/kg-day	
				DIBENZ(A,H)ANTHRACENE	6E-01	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	3E-06	4E-07	mg/kg-day		mg/kg-day	
				DIBENZOFURAN	2E+00	mg/kg	9E-07	mg/kg-day		1/(mg/kg-day)		1E-05	mg/kg-day	1E-03	mg/kg-day	1E-02
				INDENO(1,2,3-CD)PYRENE	2E+00	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	8E-07	1E-06	mg/kg-day		mg/kg-day	
				PHENANTHRENE	1E+01	mg/kg	1E-05	mg/kg-day		1/(mg/kg-day)		1E-04	mg/kg-day	3E-02	mg/kg-day	4E-03
				BENZENE	1E-03	mg/kg		mg/kg-day	6E-02	1/(mg/kg-day)			mg/kg-day	4E-03	mg/kg-day	
			Exp. Route Total								**5E-05**					**6E-01**
			Ingestion	2,3,7,8-TCDD Equivalent	3E-05	mg/kg	4E-12	mg/kg-day	2E+05	1/(mg/kg-day)	6E-07	5E-11	mg/kg-day	1E-09	mg/kg-day	5E-02
				ALUMINUM	5E+03	mg/kg	7E-04	mg/kg-day		1/(mg/kg-day)		8E-03	mg/kg-day	1E+00	mg/kg-day	8E-03
				ARSENIC	6E+00	mg/kg	8E-07	mg/kg-day	2E+00	1/(mg/kg-day)	1E-06	1E-05	mg/kg-day	3E-04	mg/kg-day	3E-02
				CADMIUM	2E+01	mg/kg	2E-06	mg/kg-day		1/(mg/kg-day)		3E-05	mg/kg-day	1E-03	mg/kg-day	3E-02
				CHROMIUM	1E+02	mg/kg	2E-05	mg/kg-day		1/(mg/kg-day)		2E-04	mg/kg-day	3E-03	mg/kg-day	6E-02
				COPPER	1E+02	mg/kg	2E-05	mg/kg-day		1/(mg/kg-day)		2E-04	mg/kg-day	4E-02	mg/kg-day	5E-03
				IRON	1E+04	mg/kg	2E-03	mg/kg-day		1/(mg/kg-day)		2E-02	mg/kg-day	7E-01	mg/kg-day	3E-02
				MANGANESE	3E+02	mg/kg	4E-05	mg/kg-day		1/(mg/kg-day)		5E-04	mg/kg-day	1E-01	mg/kg-day	4E-03
				MERCURY	2E+00	mg/kg	2E-07	mg/kg-day		1/(mg/kg-day)		3E-06	mg/kg-day	3E-04	mg/kg-day	1E-02
				VANADIUM	1E+01	mg/kg	2E-06	mg/kg-day		1/(mg/kg-day)		2E-05	mg/kg-day	9E-03	mg/kg-day	2E-03
				HIGHLY CHLORINATED PCBs	9E-01	mg/kg	1E-07	mg/kg-day	2E+00	1/(mg/kg-day)	2E-07	1E-06	mg/kg-day	2E-05	mg/kg-day	7E-02
				ACENAPHTHYLENE	2E+00	mg/kg	3E-07	mg/kg-day		1/(mg/kg-day)		3E-06	mg/kg-day	3E-02	mg/kg-day	1E-04
				BENZ(A)ANTHRACENE	9E+00	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	8E-07	1E-06	mg/kg-day		mg/kg-day	
				BENZO(A)PYRENE	7E+00	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	6E-06	9E-07	mg/kg-day	3E-04	mg/kg-day	3E-03
				BENZO(B)FLUORANTHENE	1E+01	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	9E-07	1E-06	mg/kg-day		mg/kg-day	
				BENZO(G,H,I)PERYLENE	2E+00	mg/kg	3E-07	mg/kg-day		1/(mg/kg-day)		4E-06	mg/kg-day	3E-02	mg/kg-day	1E-04
				BENZO(K)FLUORANTHENE	3E+00	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	3E-08	4E-07	mg/kg-day		mg/kg-day	
				CHRYSENE	1E+01	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	9E-09	1E-06	mg/kg-day		mg/kg-day	
				DIBENZ(A,H)ANTHRACENE	6E-01	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	5E-07	8E-08	mg/kg-day		mg/kg-day	
				DIBENZOFURAN	2E+00	mg/kg	2E-07	mg/kg-day		1/(mg/kg-day)		3E-06	mg/kg-day	1E-03	mg/kg-day	3E-03
				INDENO(1,2,3-CD)PYRENE	2E+00	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	2E-07	2E-07	mg/kg-day		mg/kg-day	
				PHENANTHRENE	1E+01	mg/kg	2E-06	mg/kg-day		1/(mg/kg-day)		2E-05	mg/kg-day	3E-02	mg/kg-day	8E-04
				BENZENE	1E-03	mg/kg	1E-10	mg/kg-day	6E-02	1/(mg/kg-day)	7E-12	1E-09	mg/kg-day	4E-03	mg/kg-day	4E-07
			Exp. Route Total								**1E-05**					**3E-01**
		Exp. Point Total									**6E-05**					**9E-01**
	Exp. Medium Total										**6E-05**					**9E-01**
Medium Total											**6E-05**					**9E-01**

TABLE 7.10a RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS - SYW-12
REASONABLE MAXIMUM EXPOSURE
HONEYWELL WASTEBED B/HARBOR BROOK SITE - GEDDES AND SYRACUSE, NEW YORK

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational Visitor
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Outdoor Air	Exposure Unit 9	Inhalation	2,3,7,8-TCDD Equivalent	1E-08	mg/m3	5E-10	mg/m3		1/(mg/m3)		6E-09	mg/m3		mg/m3	
				ALUMINUM	2E-06	mg/m3	9E-08	mg/m3		1/(mg/m3)		1E-06	mg/m3	1E-03	mg/m3	7E-04
				ARSENIC	3E-09	mg/m3	1E-10	mg/m3	2E+01	1/(mg/m3)	2E-09	1E-09	mg/m3	1E-05	mg/m3	9E-05
				CADMIUM	8E-09	mg/m3	3E-10	mg/m3	6E+00	1/(mg/m3)	2E-09	3E-09	mg/m3		mg/m3	
				CHROMIUM	5E-08	mg/m3	2E-09	mg/m3	4E+01	1/(mg/m3)	9E-08	2E-08	mg/m3	3E-05	mg/m3	9E-04
				COPPER	5E-08	mg/m3	2E-09	mg/m3		1/(mg/m3)		2E-08	mg/m3		mg/m3	
				IRON	6E-06	mg/m3	2E-07	mg/m3		1/(mg/m3)		3E-06	mg/m3		mg/m3	
				MANGANESE	1E-07	mg/m3	6E-09	mg/m3		1/(mg/m3)		7E-08	mg/m3	1E-05	mg/m3	5E-03
				MERCURY	8E-10	mg/m3	3E-11	mg/m3		1/(mg/m3)		4E-10	mg/m3	9E-05	mg/m3	4E-06
				VANADIUM	6E-09	mg/m3	3E-10	mg/m3		1/(mg/m3)		3E-09	mg/m3		mg/m3	
				HIGHLY CHLORINATED PCBs	4E-10	mg/m3	2E-11	mg/m3	2E+00	1/(mg/m3)	3E-11	2E-10	mg/m3		mg/m3	
				ACENAPHTHYLENE	9E-10	mg/m3	3E-11	mg/m3		1/(mg/m3)		4E-10	mg/m3		mg/m3	
				BENZ(A)ANTHRACENE	4E-09	mg/m3	(a)	mg/m3		1/(mg/m3)	8E-10	2E-09	mg/m3		mg/m3	
				BENZO(A)PYRENE	3E-09	mg/m3	(a)	mg/m3		1/(mg/m3)	6E-09	1E-09	mg/m3	2E-06	mg/m3	7E-04
				BENZO(B)FLUORANTHENE	4E-09	mg/m3	(a)	mg/m3		1/(mg/m3)	8E-10	2E-09	mg/m3		mg/m3	
				BENZO(G,H,I)PERYLENE	1E-09	mg/m3	4E-11	mg/m3		1/(mg/m3)		5E-10	mg/m3		mg/m3	
				BENZO(K)FLUORANTHENE	1E-09	mg/m3	(a)	mg/m3		1/(mg/m3)	3E-11	6E-10	mg/m3		mg/m3	
				CHRYSENE	4E-09	mg/m3	(a)	mg/m3		1/(mg/m3)	8E-12	2E-09	mg/m3		mg/m3	
				DIBENZ(A,H)ANTHRACENE	3E-10	mg/m3	(a)	mg/m3		1/(mg/m3)	5E-10	1E-10	mg/m3		mg/m3	
				DIBENZOFURAN	7E-10	mg/m3	3E-11	mg/m3		1/(mg/m3)		3E-10	mg/m3		mg/m3	
				INDENO(1,2,3-CD)PYRENE	8E-10	mg/m3	(a)	mg/m3		1/(mg/m3)	2E-10	4E-10	mg/m3		mg/m3	
				PHENANTHRENE	6E-09	mg/m3	3E-10	mg/m3		1/(mg/m3)		3E-09	mg/m3		mg/m3	
				BENZENE	5E-07	mg/m3	2E-08	mg/m3	3E-02	1/(mg/m3)	6E-10	2E-07	mg/m3	9E-03	mg/m3	3E-05
			Exp. Route Total								**1E-07**					**7E-03**
		Exp. Point Total									**1E-07**					**7E-03**
	Exp. Medium Total										**1E-07**					**7E-03**
Medium Total											**1E-07**					**7E-03**
										Total of Receptor Risks Across All Media	**6E-05**			Total of Receptor Hazards Across All Media		**9E-01**

Notes:
(a) See Table 7.10a RME Supplement A for the intake and toxicity values for COPCs with an MMOA

TABLE 7.10a.RME Supplement A
CALCULATION OF CHEMICAL CANCER RISKS FOR COPC WITH MUTAGENIC MODE OF ACTION - SYW-12
REASONABLE MAXIMUM EXPOSURE
HONEYWELL WASTEBED B/HARBOR BROOK SITE - GEDDES AND SYRACUSE, NEW YORK

Scenario Timeframe:	Current/Future
Receptor Population:	Child Recreator
Receptor Age:	0 to < 6 years old

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations						
							Intake(1)			CSF/Unit Risk (2)			
							Value			Value			
					Value	Units	0-2 yrs	2-6 yrs	Units	0-2 yrs (ADAF=10)	2-6 yrs (ADAF=3)	Units	Cancer Risk
Soil	Surface Soil	EU-9	Ingestion	Benz(a)anthracene	9.3E+00	mg/kg	6.1E-07	7.6E-07	mg/kg/day	1.0E+00	3.0E-01	1/(mg/kg-day)	8.E-07
				Benzo(a)pyrene	6.6E+00	mg/kg	4.3E-07	5.4E-07	mg/kg/day	1.0E+01	3.0E+00	1/(mg/kg-day)	6.E-06
				Benzo(b)fluoranthene	9.6E+00	mg/kg	6.2E-07	7.8E-07	mg/kg/day	1.0E+00	3.0E-01	1/(mg/kg-day)	9.E-07
				Benzo(k)fluoranthene	3.3E+00	mg/kg	2.1E-07	2.7E-07	mg/kg/day	1.0E-01	3.0E-02	1/(mg/kg-day)	3.E-08
				Chrysene	9.5E+00	mg/kg	6.2E-07	7.8E-07	mg/kg/day	1.0E-02	3.0E-03	1/(mg/kg-day)	9.E-09
				Dibenz(a,h)anthracene	5.9E-01	mg/kg	3.8E-08	4.8E-08	mg/kg/day	1.0E+01	3.0E+00	1/(mg/kg-day)	5.E-07
				Indeno(1,2,3-cd)pyrene	1.8E+00	mg/kg	1.2E-07	1.5E-07	mg/kg/day	1.0E+00	3.0E-01	1/(mg/kg-day)	2.E-07
			Dermal	Benz(a)anthracene	9.3E+00	mg/kg	3.1E-06	4.3E-06	mg/kg/day	1.0E+00	3.0E-01	1/(mg/kg-day)	4.E-06
				Benzo(a)pyrene	6.6E+00	mg/kg	2.2E-06	3.1E-06	mg/kg/day	1.0E+01	3.0E+00	1/(mg/kg-day)	3.E-05
				Benzo(b)fluoranthene	9.6E+00	mg/kg	3.2E-06	4.4E-06	mg/kg/day	1.0E+00	3.0E-01	1/(mg/kg-day)	4.E-06
				Benzo(k)fluoranthene	3.3E+00	mg/kg	1.1E-06	1.5E-06	mg/kg/day	1.0E-01	3.0E-02	1/(mg/kg-day)	2.E-07
				Chrysene	9.5E+00	mg/kg	3.1E-06	4.4E-06	mg/kg/day	1.0E-02	3.0E-03	1/(mg/kg-day)	4.E-08
				Dibenz(a,h)anthracene	5.9E-01	mg/kg	1.9E-07	2.7E-07	mg/kg/day	1.0E+01	3.0E+00	1/(mg/kg-day)	3.E-06
				Indeno(1,2,3-cd)pyrene	1.8E+00	mg/kg	6.0E-07	8.3E-07	mg/kg/day	1.0E+00	3.0E-01	1/(mg/kg-day)	8.E-07
	Fugitive Dust	EU-9	Inhalation	Benz(a)anthracene	2.7E-08	mg/m^3	1.1E-09		mg/m^3	6.0E-01	1.8E-01	$(mg/m^3)^{-1}$	8.E-10
				Benzo(a)pyrene	1.9E-08	mg/m^3	7.5E-10		mg/m^3	6.0E+00	1.8E+00	$(mg/m^3)^{-1}$	6.E-09
				Benzo(b)fluoranthene	2.8E-08	mg/m^3	1.1E-09		mg/m^3	6.0E-01	1.8E-01	$(mg/m^3)^{-1}$	8.E-10
				Benzo(k)fluoranthene	9.4E-09	mg/m^3	3.7E-10		mg/m^3	6.0E-02	1.8E-02	$(mg/m^3)^{-1}$	3.E-11
				Chrysene	2.7E-08	mg/m^3	1.1E-09		mg/m^3	6.0E-03	1.8E-03	$(mg/m^3)^{-1}$	8.E-12
				Dibenz(a,h)anthracene	1.7E-09	mg/m^3	6.7E-11		mg/m^3	6.0E+00	1.8E+00	$(mg/m^3)^{-1}$	5.E-10
				Indeno(1,2,3-cd)pyrene	5.2E-09	mg/m^3	2.1E-10		mg/m^3	6.0E-01	1.8E-01	$(mg/m^3)^{-1}$	2.E-10

(1) - Intake equations derived from Table 4 series: Supplement A - Values Used for Daily Intake Calculations (mutagenic mode of action)
(2) - Cancer slope factor/unit risk (CSF/Unit Risk) derived from Table 6 series and adjusted using Age Dependent Adjustment Factors (ADAF) in accordance with the 2006 USEPA Memoradum.

Source: EPA Memorandum dated 14 June 2006: Implementation of the Cancer Guidelines and Accompanying Supplemental Guidance – Science Policy Council Cancer Guidelines Implementation Workgroup Communication II: Performing Risk Assessments that Include Carcinogens Described in the Supplemental Guidance as having a Mutagenic Mode of Action.

TABLE 7.11a. RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS - SYW-12
REASONABLE MAXIMUM EXPOSURE
HONEYWELL WASTEBED B/HARBOR BROOK SITE - GEDDES AND SYRACUSE, NEW YORK

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational Visitor
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Outdoor Air	Exposure Unit 9	Inhalation	2,3,7,8-TCDD Equivalent	1E-08	mg/m3	3E-09	mg/m3		1/(mg/m3)		6E-09	mg/m3		mg/m3	
				ALUMINUM	2E-06	mg/m3	5E-07	mg/m3		1/(mg/m3)		1E-06	mg/m3	1E-03	mg/m3	7E-04
				ARSENIC	3E-09	mg/m3	5E-10	mg/m3	2E+01	1/(mg/m3)	8E-09	1E-09	mg/m3	1E-05	mg/m3	9E-05
				CADMIUM	8E-09	mg/m3	1E-09	mg/m3	6E+00	1/(mg/m3)	9E-09	3E-09	mg/m3		mg/m3	
				CHROMIUM	5E-08	mg/m3	1E-08	mg/m3	4E+01	1/(mg/m3)	4E-07	2E-08	mg/m3	3E-05	mg/m3	9E-04
				COPPER	5E-08	mg/m3	1E-08	mg/m3		1/(mg/m3)		2E-08	mg/m3		mg/m3	
				IRON	6E-06	mg/m3	1E-06	mg/m3		1/(mg/m3)		3E-06	mg/m3		mg/m3	
				MANGANESE	1E-07	mg/m3	3E-08	mg/m3		1/(mg/m3)		7E-08	mg/m3	1E-05	mg/m3	5E-03
				MERCURY	8E-10	mg/m3	2E-10	mg/m3		1/(mg/m3)		4E-10	mg/m3	9E-05	mg/m3	4E-06
				VANADIUM	6E-09	mg/m3	1E-09	mg/m3		1/(mg/m3)		3E-09	mg/m3		mg/m3	
				HIGHLY CHLORINATED PCBs	4E-10	mg/m3	8E-11	mg/m3	2E+00	1/(mg/m3)	2E-10	2E-10	mg/m3		mg/m3	
				ACENAPHTHYLENE	9E-10	mg/m3	2E-10	mg/m3		1/(mg/m3)		4E-10	mg/m3		mg/m3	
				BENZ(A)ANTHRACENE	4E-09	mg/m3	8E-10	mg/m3	6E-02	1/(mg/m3)	5E-11	2E-09	mg/m3		mg/m3	
				BENZO(A)PYRENE	3E-09	mg/m3	6E-10	mg/m3	6E-01	1/(mg/m3)	3E-10	1E-09	mg/m3	2E-06	mg/m3	7E-04
				BENZO(B)FLUORANTHENE	4E-09	mg/m3	8E-10	mg/m3	6E-02	1/(mg/m3)	5E-11	2E-09	mg/m3		mg/m3	
				BENZO(G,H,I)PERYLENE	1E-09	mg/m3	2E-10	mg/m3		1/(mg/m3)		5E-10	mg/m3		mg/m3	
				BENZO(K)FLUORANTHENE	1E-09	mg/m3	3E-10	mg/m3	6E-03	1/(mg/m3)	2E-12	6E-10	mg/m3		mg/m3	
				CHRYSENE	4E-09	mg/m3	8E-10	mg/m3	6E-04	1/(mg/m3)	5E-13	2E-09	mg/m3		mg/m3	
				DIBENZ(A,H)ANTHRACENE	3E-10	mg/m3	5E-11	mg/m3	6E-01	1/(mg/m3)	3E-11	1E-10	mg/m3		mg/m3	
				DIBENZOFURAN	7E-10	mg/m3	1E-10	mg/m3		1/(mg/m3)		3E-10	mg/m3		mg/m3	
				INDENO(1,2,3-CD)PYRENE	8E-10	mg/m3	2E-10	mg/m3	6E-02	1/(mg/m3)	9E-12	4E-10	mg/m3		mg/m3	
				PHENANTHRENE	6E-09	mg/m3	1E-09	mg/m3		1/(mg/m3)		3E-09	mg/m3		mg/m3	
				BENZENE	5E-07	mg/m3	1E-07	mg/m3	3E-02	1/(mg/m3)	3E-09	2E-07	mg/m3	9E-03	mg/m3	3E-05
			Exp. Route Total								**5E-07**					**7E-03**
		Exp. Point Total									**5E-07**					**7E-03**
	Exp. Medium Total										**5E-07**					**7E-03**
Medium Total											**5E-07**					**7E-03**
Soil	Surface Soil	Exposure Unit 9	Dermal	2,3,7,8-TCDD Equivalent	3E-05	mg/kg	1E-12	mg/kg-day	2E+05	1/(mg/kg-day)	2E-07	3E-12	mg/kg-day	1E-09	mg/kg-day	3E-03
				ALUMINUM	5E+03	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	1E+00	mg/kg-day	
				ARSENIC	6E+00	mg/kg	2E-07	mg/kg-day	2E+00	1/(mg/kg-day)	3E-07	5E-07	mg/kg-day	3E-04	mg/kg-day	2E-03
				CADMIUM	2E+01	mg/kg	2E-08	mg/kg-day		1/(mg/kg-day)		5E-08	mg/kg-day	3E-05	mg/kg-day	2E-03
				CHROMIUM	1E+02	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	8E-05	mg/kg-day	
				COPPER	1E+02	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	4E-02	mg/kg-day	
				IRON	1E+04	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	7E-01	mg/kg-day	
				MANGANESE	3E+02	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	6E-03	mg/kg-day	
				MERCURY	2E+00	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	2E-05	mg/kg-day	
				VANADIUM	1E+01	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	2E-04	mg/kg-day	
				HIGHLY CHLORINATED PCBs	9E-01	mg/kg	2E-07	mg/kg-day	2E+00	1/(mg/kg-day)	3E-07	4E-07	mg/kg-day	2E-05	mg/kg-day	2E-02
				ACENAPHTHYLENE	2E+00	mg/kg	3E-07	mg/kg-day		1/(mg/kg-day)		7E-07	mg/kg-day	3E-02	mg/kg-day	2E-05
				BENZ(A)ANTHRACENE	9E+00	mg/kg	1E-06	mg/kg-day	1E-01	1/(mg/kg-day)	1E-07	3E-06	mg/kg-day		mg/kg-day	
				BENZO(A)PYRENE	7E+00	mg/kg	1E-06	mg/kg-day	1E+00	1/(mg/kg-day)	1E-06	2E-06	mg/kg-day	3E-04	mg/kg-day	8E-03
				BENZO(B)FLUORANTHENE	1E+01	mg/kg	1E-06	mg/kg-day	1E-01	1/(mg/kg-day)	1E-07	3E-06	mg/kg-day		mg/kg-day	
				BENZO(G,H,I)PERYLENE	2E+00	mg/kg	4E-07	mg/kg-day		1/(mg/kg-day)		9E-07	mg/kg-day	3E-02	mg/kg-day	3E-05
				BENZO(K)FLUORANTHENE	3E+00	mg/kg	5E-07	mg/kg-day	1E-02	1/(mg/kg-day)	5E-09	1E-06	mg/kg-day		mg/kg-day	
				CHRYSENE	1E+01	mg/kg	1E-06	mg/kg-day	1E-03	1/(mg/kg-day)	1E-09	3E-06	mg/kg-day		mg/kg-day	
				DIBENZ(A,H)ANTHRACENE	6E-01	mg/kg	9E-08	mg/kg-day	1E+00	1/(mg/kg-day)	9E-08	2E-07	mg/kg-day		mg/kg-day	
				DIBENZOFURAN	2E+00	mg/kg	2E-07	mg/kg-day		1/(mg/kg-day)		5E-07	mg/kg-day	1E-03	mg/kg-day	5E-04
				INDENO(1,2,3-CD)PYRENE	2E+00	mg/kg	3E-07	mg/kg-day	1E-01	1/(mg/kg-day)	3E-08	7E-07	mg/kg-day		mg/kg-day	
				PHENANTHRENE	1E+01	mg/kg	2E-06	mg/kg-day		1/(mg/kg-day)		5E-06	mg/kg-day	3E-02	mg/kg-day	2E-04
				BENZENE	1E-03	mg/kg		mg/kg-day	6E-02	1/(mg/kg-day)			mg/kg-day	4E-03	mg/kg-day	
			Exp. Route Total								**2E-06**					**3E-02**

TABLE 7.11a. RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS - SYW-12
REASONABLE MAXIMUM EXPOSURE
HONEYWELL WASTEBED B/HARBOR BROOK SITE - GEDDES AND SYRACUSE, NEW YORK

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational Visitor
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Exposure Unit 9	Ingestion	2,3,7,8-TCDD Equivalent	3E-05	mg/kg	1E-12	mg/kg-day	2E+05	1/(mg/kg-day)	2E-07	3E-12	mg/kg-day	1E-09	mg/kg-day	3E-03
				ALUMINUM	5E+03	mg/kg	2E-04	mg/kg-day		1/(mg/kg-day)		4E-04	mg/kg-day	1E+00	mg/kg-day	4E-04
				ARSENIC	6E+00	mg/kg	2E-07	mg/kg-day	2E+00	1/(mg/kg-day)	3E-07	5E-07	mg/kg-day	3E-04	mg/kg-day	2E-03
				CADMIUM	2E+01	mg/kg	6E-07	mg/kg-day		1/(mg/kg-day)		1E-06	mg/kg-day	1E-03	mg/kg-day	1E-03
				CHROMIUM	1E+02	mg/kg	4E-06	mg/kg-day		1/(mg/kg-day)		1E-05	mg/kg-day	3E-03	mg/kg-day	3E-03
				COPPER	1E+02	mg/kg	4E-06	mg/kg-day		1/(mg/kg-day)		1E-05	mg/kg-day	4E-02	mg/kg-day	2E-04
				IRON	1E+04	mg/kg	5E-04	mg/kg-day		1/(mg/kg-day)		1E-03	mg/kg-day	7E-01	mg/kg-day	2E-03
				MANGANESE	3E+02	mg/kg	1E-05	mg/kg-day		1/(mg/kg-day)		3E-05	mg/kg-day	1E-01	mg/kg-day	2E-04
				MERCURY	2E+00	mg/kg	7E-08	mg/kg-day		1/(mg/kg-day)		2E-07	mg/kg-day	3E-04	mg/kg-day	5E-04
				VANADIUM	1E+01	mg/kg	5E-07	mg/kg-day		1/(mg/kg-day)		1E-06	mg/kg-day	9E-03	mg/kg-day	1E-04
				HIGHLY CHLORINATED PCBs	9E-01	mg/kg	3E-08	mg/kg-day	2E+00	1/(mg/kg-day)	7E-08	8E-08	mg/kg-day	2E-05	mg/kg-day	4E-03
				ACENAPHTHYLENE	2E+00	mg/kg	7E-08	mg/kg-day		1/(mg/kg-day)		2E-07	mg/kg-day	3E-02	mg/kg-day	6E-06
				BENZ(A)ANTHRACENE	9E+00	mg/kg	3E-07	mg/kg-day	1E-01	1/(mg/kg-day)	3E-08	8E-07	mg/kg-day		mg/kg-day	
				BENZO(A)PYRENE	7E+00	mg/kg	2E-07	mg/kg-day	1E+00	1/(mg/kg-day)	2E-07	5E-07	mg/kg-day	3E-04	mg/kg-day	2E-03
				BENZO(B)FLUORANTHENE	1E+01	mg/kg	3E-07	mg/kg-day	1E-01	1/(mg/kg-day)	3E-08	8E-07	mg/kg-day		mg/kg-day	
				BENZO(G,H,I)PERYLENE	2E+00	mg/kg	8E-08	mg/kg-day		1/(mg/kg-day)		2E-07	mg/kg-day	3E-02	mg/kg-day	6E-06
				BENZO(K)FLUORANTHENE	3E+00	mg/kg	1E-07	mg/kg-day	1E-02	1/(mg/kg-day)	1E-09	3E-07	mg/kg-day		mg/kg-day	
				CHRYSENE	1E+01	mg/kg	3E-07	mg/kg-day	1E-03	1/(mg/kg-day)	3E-10	8E-07	mg/kg-day		mg/kg-day	
				DIBENZ(A,H)ANTHRACENE	6E-01	mg/kg	2E-08	mg/kg-day	1E+00	1/(mg/kg-day)	2E-08	5E-08	mg/kg-day		mg/kg-day	
				DIBENZOFURAN	2E+00	mg/kg	6E-08	mg/kg-day		1/(mg/kg-day)		1E-07	mg/kg-day	1E-03	mg/kg-day	1E-04
				INDENO(1,2,3-CD)PYRENE	2E+00	mg/kg	6E-08	mg/kg-day	1E-01	1/(mg/kg-day)	6E-09	1E-07	mg/kg-day		mg/kg-day	
				PHENANTHRENE	1E+01	mg/kg	5E-07	mg/kg-day		1/(mg/kg-day)		1E-06	mg/kg-day	3E-02	mg/kg-day	4E-05
				BENZENE	1E-03	mg/kg	3E-11	mg/kg-day	6E-02	1/(mg/kg-day)	2E-12	8E-11	mg/kg-day	4E-03	mg/kg-day	2E-08
			Exp. Route Total								**9E-07**					**2E-02**
		Exp. Point Total									**3E-06**					**5E-02**
	Exp. Medium Total										**3E-06**					**5E-02**
Medium Total											**3E-06**					**5E-02**
											Total of Receptor Risks Across All Media					
											4E-06	Total of Receptor Hazards Across All Media				**6E-02**

TABLE 7.12a RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS - SYW-12
REASONABLE MAXIMUM EXPOSURE
HONEYWELL WASTEBED B/HARBOR BROOK SITE - GEDDES AND SYRACUSE, NEW YORK

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Soil	Outdoor Air	Exposure Unit 9	Inhalation	2,3,7,8-TCDD Equivalent	1E-08	mg/m3	7E-10	mg/kg-day		1/(mg/kg-day)		3E-07	mg/kg-day		mg/kg-day	
				ALUMINUM	2E-06	mg/m3	1E-07	mg/kg-day		1/(mg/kg-day)		5E-05	mg/kg-day	1E-03	mg/kg-day	4E-02
				ARSENIC	3E-09	mg/m3	1E-10	mg/kg-day	2E+01	1/(mg/kg-day)	2E-09	6E-08	mg/kg-day	1E-05	mg/kg-day	4E-03
				CADMIUM	8E-09	mg/m3	4E-10	mg/kg-day	6E+00	1/(mg/kg-day)	3E-09	2E-07	mg/kg-day		mg/kg-day	
				CHROMIUM	5E-08	mg/m3	3E-09	mg/kg-day	4E+01	1/(mg/kg-day)	1E-07	1E-06	mg/kg-day	3E-05	mg/kg-day	4E-02
				COPPER	5E-08	mg/m3	3E-09	mg/kg-day		1/(mg/kg-day)		1E-06	mg/kg-day		mg/kg-day	
				IRON	6E-06	mg/m3	3E-07	mg/kg-day		1/(mg/kg-day)		1E-04	mg/kg-day		mg/kg-day	
				MANGANESE	1E-07	mg/m3	8E-09	mg/kg-day		1/(mg/kg-day)		3E-06	mg/kg-day	1E-05	mg/kg-day	2E-01
				MERCURY	8E-10	mg/m3	4E-11	mg/kg-day		1/(mg/kg-day)		2E-08	mg/kg-day	9E-05	mg/kg-day	2E-04
				VANADIUM	6E-09	mg/m3	4E-10	mg/kg-day		1/(mg/kg-day)		1E-07	mg/kg-day		mg/kg-day	
				HIGHLY CHLORINATED PCBs	4E-10	mg/m3	2E-11	mg/kg-day	2E+00	1/(mg/kg-day)	4E-11	9E-09	mg/kg-day		mg/kg-day	
				ACENAPHTHYLENE	9E-10	mg/m3	5E-11	mg/kg-day		1/(mg/kg-day)		2E-08	mg/kg-day		mg/kg-day	
				BENZ(A)ANTHRACENE	4E-09	mg/m3	(a)	mg/kg-day		1/(mg/kg-day)	8E-10	9E-08	mg/kg-day		mg/kg-day	
				BENZO(A)PYRENE	3E-09	mg/m3	(a)	mg/kg-day		1/(mg/kg-day)	6E-09	7E-08	mg/kg-day	2E-06	mg/kg-day	3E-02
				BENZO(B)FLUORANTHENE	4E-09	mg/m3	(a)	mg/kg-day		1/(mg/kg-day)	8E-10	1E-07	mg/kg-day		mg/kg-day	
				BENZO(G,H,I)PERYLENE	1E-09	mg/m3	6E-11	mg/kg-day		1/(mg/kg-day)		2E-08	mg/kg-day		mg/kg-day	
				BENZO(K)FLUORANTHENE	1E-09	mg/m3	(a)	mg/kg-day		1/(mg/kg-day)	3E-11	3E-08	mg/kg-day		mg/kg-day	
				CHRYSENE	4E-09	mg/m3	(a)	mg/kg-day		1/(mg/kg-day)	8E-12	9E-08	mg/kg-day		mg/kg-day	
				DIBENZ(A,H)ANTHRACENE	3E-10	mg/m3	(a)	mg/kg-day		1/(mg/kg-day)	5E-10	6E-09	mg/kg-day		mg/kg-day	
				DIBENZOFURAN	7E-10	mg/m3	4E-11	mg/kg-day		1/(mg/kg-day)		2E-08	mg/kg-day		mg/kg-day	
				INDENO(1,2,3-CD)PYRENE	8E-10	mg/m3	(a)	mg/kg-day		1/(mg/kg-day)	2E-10	2E-08	mg/kg-day		mg/kg-day	
				PHENANTHRENE	6E-09	mg/m3	4E-10	mg/kg-day		1/(mg/kg-day)		1E-07	mg/kg-day		mg/kg-day	
				BENZENE	5E-07	mg/m3	3E-08	mg/kg-day	3E-02	1/(mg/kg-day)	8E-10	1E-05	mg/kg-day	9E-03	mg/kg-day	1E-03
			Exp. Route Total								**1E-07**					**4E-01**
		Exp. Point Total									**1E-07**					**4E-01**
	Exp. Medium Total										**1E-07**					**4E-01**
Medium Total											**1E-07**					**4E-01**
Soil	Surface Soil	Exposure Unit 9	Dermal	2,3,7,8-TCDD Equivalent	3E-05	mg/kg	4E-11	mg/kg-day	2E+05	1/(mg/kg-day)	6E-06	5E-10	mg/kg-day	1E-09	mg/kg-day	5E-01
				ALUMINUM	5E+03	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	1E+00	mg/kg-day	
				ARSENIC	6E+00	mg/kg	9E-06	mg/kg-day	2E+00	1/(mg/kg-day)	1E-05	1E-04	mg/kg-day	3E-04	mg/kg-day	3E-01
				CADMIUM	2E+01	mg/kg	8E-07	mg/kg-day		1/(mg/kg-day)		9E-06	mg/kg-day	3E-05	mg/kg-day	4E-01
				CHROMIUM	1E+02	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	8E-05	mg/kg-day	
				COPPER	1E+02	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	4E-02	mg/kg-day	
				IRON	1E+04	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	7E-01	mg/kg-day	
				MANGANESE	3E+02	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	6E-03	mg/kg-day	
				MERCURY	2E+00	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	2E-05	mg/kg-day	
				VANADIUM	1E+01	mg/kg		mg/kg-day		1/(mg/kg-day)			mg/kg-day	2E-04	mg/kg-day	
				HIGHLY CHLORINATED PCBs	9E-01	mg/kg	6E-06	mg/kg-day	2E+00	1/(mg/kg-day)	1E-05	7E-05	mg/kg-day	2E-05	mg/kg-day	4E+00
				ACENAPHTHYLENE	2E+00	mg/kg	1E-05	mg/kg-day		1/(mg/kg-day)		1E-04	mg/kg-day	3E-02	mg/kg-day	5E-03
				BENZ(A)ANTHRACENE	9E+00	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	2E-06	1E-05	mg/kg-day		mg/kg-day	
				BENZO(A)PYRENE	7E+00	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	2E-05	4E-05	mg/kg-day	3E-04	mg/kg-day	1E-01
				BENZO(B)FLUORANTHENE	1E+01	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	2E-06	1E-05	mg/kg-day		mg/kg-day	
				BENZO(G,H,I)PERYLENE	2E+00	mg/kg	1E-05	mg/kg-day		1/(mg/kg-day)		2E-04	mg/kg-day	3E-02	mg/kg-day	5E-03
				BENZO(K)FLUORANTHENE	3E+00	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	8E-08	2E-05	mg/kg-day		mg/kg-day	
				CHRYSENE	1E+01	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	2E-08	6E-05	mg/kg-day		mg/kg-day	
				DIBENZ(A,H)ANTHRACENE	6E-01	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	2E-06	4E-06	mg/kg-day		mg/kg-day	
				DIBENZOFURAN	2E+00	mg/kg	8E-06	mg/kg-day		1/(mg/kg-day)		1E-05	mg/kg-day	1E-03	mg/kg-day	9E-02
				INDENO(1,2,3-CD)PYRENE	2E+00	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	5E-07	1E-05	mg/kg-day		mg/kg-day	
				PHENANTHRENE	1E+01	mg/kg	9E-05	mg/kg-day		1/(mg/kg-day)		1E-03	mg/kg-day	3E-02	mg/kg-day	3E-02
				BENZENE	1E-03	mg/kg		mg/kg-day	6E-02	1/(mg/kg-day)			mg/kg-day	4E-03	mg/kg-day	
			Exp. Route Total								**6E-05**					**5E+00**

TABLE 7.12a RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS - SYW-12
REASONABLE MAXIMUM EXPOSURE
HONEYWELL WASTEBED B/HARBOR BROOK SITE - GEDDES AND SYRACUSE, NEW YORK

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Exposure Unit 9	Ingestion	2,3,7,8-TCDD Equivalent	3E-05	mg/kg	3E-11	mg/kg-day	2E+05	1/(mg/kg-day)	5E-06	4E-10	mg/kg-day	1E-09	mg/kg-day	4E-01
				ALUMINUM	5E+03	mg/kg	6E-03	mg/kg-day		1/(mg/kg-day)		7E-02	mg/kg-day	1E+00	mg/kg-day	7E-02
				ARSENIC	6E+00	mg/kg	7E-06	mg/kg-day	2E+00	1/(mg/kg-day)	1E-05	8E-05	mg/kg-day	3E-04	mg/kg-day	3E-01
				CADMIUM	2E+01	mg/kg	2E-05	mg/kg-day		1/(mg/kg-day)		2E-04	mg/kg-day	1E-03	mg/kg-day	2E-01
				CHROMIUM	1E+02	mg/kg	1E-04	mg/kg-day		1/(mg/kg-day)		2E-03	mg/kg-day	3E-03	mg/kg-day	5E-01
				COPPER	1E+02	mg/kg	1E-04	mg/kg-day		1/(mg/kg-day)		2E-03	mg/kg-day	4E-02	mg/kg-day	4E-02
				IRON	1E+04	mg/kg	1E-02	mg/kg-day		1/(mg/kg-day)		2E-01	mg/kg-day	7E-01	mg/kg-day	2E-01
				MANGANESE	3E+02	mg/kg	4E-04	mg/kg-day		1/(mg/kg-day)		4E-03	mg/kg-day	1E-01	mg/kg-day	3E-02
				MERCURY	2E+00	mg/kg	2E-06	mg/kg-day		1/(mg/kg-day)		2E-05	mg/kg-day	3E-04	mg/kg-day	8E-02
				VANADIUM	1E+01	mg/kg	2E-05	mg/kg-day		1/(mg/kg-day)		2E-04	mg/kg-day	9E-03	mg/kg-day	2E-02
				HIGHLY CHLORINATED PCBs	9E-01	mg/kg	1E-06	mg/kg-day	2E+00	1/(mg/kg-day)	2E-06	1E-05	mg/kg-day	2E-05	mg/kg-day	6E-01
				ACENAPHTHYLENE	2E+00	mg/kg	2E-06	mg/kg-day		1/(mg/kg-day)		3E-05	mg/kg-day	3E-02	mg/kg-day	9E-04
				BENZ(A)ANTHRACENE	9E+00	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	7E-06	1E-05	mg/kg-day		mg/kg-day	
				BENZO(A)PYRENE	7E+00	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	5E-05	8E-06	mg/kg-day	3E-04	mg/kg-day	3E-02
				BENZO(B)FLUORANTHENE	1E+01	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	7E-06	1E-05	mg/kg-day		mg/kg-day	
				BENZO(G,H,I)PERYLENE	2E+00	mg/kg	3E-06	mg/kg-day		1/(mg/kg-day)		3E-05	mg/kg-day	3E-02	mg/kg-day	1E-03
				BENZO(K)FLUORANTHENE	3E+00	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	2E-07	4E-06	mg/kg-day		mg/kg-day	
				CHRYSENE	1E+01	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	7E-08	1E-05	mg/kg-day		mg/kg-day	
				DIBENZ(A,H)ANTHRACENE	6E-01	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	4E-06	7E-07	mg/kg-day		mg/kg-day	
				DIBENZOFURAN	2E+00	mg/kg	2E-06	mg/kg-day		1/(mg/kg-day)		2E-05	mg/kg-day	1E-03	mg/kg-day	2E-02
				INDENO(1,2,3-CD)PYRENE	2E+00	mg/kg	(a)	mg/kg-day	(a)	1/(mg/kg-day)	1E-06	2E-06	mg/kg-day		mg/kg-day	
				PHENANTHRENE	1E+01	mg/kg	2E-05	mg/kg-day		1/(mg/kg-day)		2E-04	mg/kg-day	3E-02	mg/kg-day	6E-03
				BENZENE	1E-03	mg/kg	1E-09	mg/kg-day	6E-02	1/(mg/kg-day)	6E-11	1E-08	mg/kg-day	4E-03	mg/kg-day	3E-06
			Exp. Route Total								**9E-05**					**3E+00**
		Exp. Point Total									**1E-04**					**8E+00**
	Exp. Medium Total										**1E-04**					**8E+00**
Medium Total											**1E-04**					**8E+00**
										Total of Receptor Risks Across All Media	**1E-04**			Total of Receptor Hazards Across All Media		**8E+00**

Notes:
(a) See Table 7.12a RME Supplement A for the intake and toxicity values for COPCs with an MMOA

TABLE 7.12a.RME Supplement A
CALCULATION OF CHEMICAL CANCER RISKS FOR COPC WITH MUTAGENIC MODE OF ACTION
REASONABLE MAXIMUM EXPOSURE
HONEYWELL WASTEBED B/HARBOR BROOK SITE - GEDDES AND SYRACUSE, NEW YORK

Scenario Timeframe:	Current/Future
Receptor Population:	Child Resident
Receptor Age:	0 to < 6 years old

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations						
							Intake(1)			CSF/Unit Risk (2)			
					Value	Units	Value		Units	Value		Units	Cancer Risk
							0-2 yrs	2-6 yrs		0-2 yrs (ADAF=10)	2-6 yrs (ADAF=3)		
Soil	Surface Soil	EU-9	Ingestion	Benz(a)anthracene	9.3E+00	mg/kg	5.1E-06	6.3E-06	mg/kg/day	1.0E+00	3.0E-01	1/(mg/kg-day)	7.E-06
				Benzo(a)pyrene	6.6E+00	mg/kg	3.6E-06	4.5E-06	mg/kg/day	1.0E+01	3.0E+00	1/(mg/kg-day)	5.E-05
				Benzo(b)fluoranthene	9.6E+00	mg/kg	5.2E-06	6.5E-06	mg/kg/day	1.0E+00	3.0E-01	1/(mg/kg-day)	7.E-06
				Benzo(k)fluoranthene	3.3E+00	mg/kg	1.8E-06	2.2E-06	mg/kg/day	1.0E-01	3.0E-02	1/(mg/kg-day)	2.E-07
				Chrysene	9.5E+00	mg/kg	5.2E-06	6.5E-06	mg/kg/day	1.0E-02	3.0E-03	1/(mg/kg-day)	7.E-08
				Dibenz(a,h)anthracene	5.9E-01	mg/kg	3.2E-07	4.0E-07	mg/kg/day	1.0E+01	3.0E+00	1/(mg/kg-day)	4.E-06
				Indeno(1,2,3-cd)pyrene	1.8E+00	mg/kg	9.8E-07	1.2E-06	mg/kg/day	1.0E+00	3.0E-01	1/(mg/kg-day)	1.E-06
			Dermal	Benz(a)anthracene	9.3E+00	mg/kg	1.7E-06	2.4E-06	mg/kg/day	1.0E+00	3.0E-01	1/(mg/kg-day)	2.E-06
				Benzo(a)pyrene	6.6E+00	mg/kg	1.2E-06	1.7E-06	mg/kg/day	1.0E+01	3.0E+00	1/(mg/kg-day)	2.E-05
				Benzo(b)fluoranthene	9.6E+00	mg/kg	1.8E-06	2.4E-06	mg/kg/day	1.0E+00	3.0E-01	1/(mg/kg-day)	2.E-06
				Benzo(k)fluoranthene	3.3E+00	mg/kg	6.0E-07	8.4E-07	mg/kg/day	1.0E-01	3.0E-02	1/(mg/kg-day)	8.E-08
				Chrysene	9.5E+00	mg/kg	1.7E-06	2.4E-06	mg/kg/day	1.0E-02	3.0E-03	1/(mg/kg-day)	2.E-08
				Dibenz(a,h)anthracene	5.9E-01	mg/kg	1.1E-07	1.5E-07	mg/kg/day	1.0E+01	3.0E+00	1/(mg/kg-day)	2.E-06
				Indeno(1,2,3-cd)pyrene	1.8E+00	mg/kg	3.3E-07	4.6E-07	mg/kg/day	1.0E+00	3.0E-01	1/(mg/kg-day)	5.E-07
	Fugitive Dust	EU-9	Inhalation	Benz(a)anthracene	2.7E-08	mg/m^3	1.1E-09		mg/m^3	6.0E-01	1.8E-01	$(mg/m^3)^{-1}$	8.E-10
				Benzo(a)pyrene	1.9E-08	mg/m^3	7.5E-10		mg/m^3	6.0E+00	1.8E+00	$(mg/m^3)^{-1}$	6.E-09
				Benzo(b)fluoranthene	2.8E-08	mg/m^3	1.1E-09		mg/m^3	6.0E-01	1.8E-01	$(mg/m^3)^{-1}$	8.E-10
				Benzo(k)fluoranthene	9.4E-09	mg/m^3	3.7E-10		mg/m^3	6.0E-02	1.8E-02	$(mg/m^3)^{-1}$	3.E-11
				Chrysene	2.7E-08	mg/m^3	1.1E-09		mg/m^3	6.0E-03	1.8E-03	$(mg/m^3)^{-1}$	8.E-12
				Dibenz(a,h)anthracene	1.7E-09	mg/m^3	6.7E-11		mg/m^3	6.0E+00	1.8E+00	$(mg/m^3)^{-1}$	5.E-10
				Indeno(1,2,3-cd)pyrene	5.2E-09	mg/m^3	2.1E-10		mg/m^3	6.0E-01	1.8E-01	$(mg/m^3)^{-1}$	2.E-10

(1) - Intake equations derived from Table 4 series: Supplement A - Values Used for Daily Intake Calculations (mutagenic mode of action)
(2) - Cancer slope factor/unit risk (CSF/Unit Risk) derived from Table 6 series and adjusted using Age Dependent Adjustment Factors (ADAF) in accordance with the 2006 USEPA Memoradum.

Source: EPA Memorandum dated 14 June 2006: Implementation of the Cancer Guidelines and Accompanying Supplemental Guidance – Science Policy Council Cancer Guidelines Implementation Workgroup Communication II: Performing Risk Assessments that Include Carcinogens Described in the Supplemental Guidance as having a Mutagenic Mode of Action.

APPENDIX 2
SUMMARY STATISTICS FOR DETECTED CONSTITUENTS AND ARARS EXCEEDANCES

Table 1
SYW-12 Site
Surface Soils (0-2 ft bgs)
Summary of Detected Concentrations and Part 375 SCO Exceedances

Parameter	Number of Samples	Number of Detects	Minimum Detected Conc.	Maximum Detected Conc.	NYSDEC Part 375 Unrestricted Use SCOS	Number of Unrestricted Use SCO Exceedances	NYSDEC Part 375 Restricted Use - Commercial SCOs	Number of Commercial SCO Exceedances	NYSDEC Part 375 Restricted Use - Ecological SCOs	Number of Ecological SCO Exceedances
Semivolatile Organic Compounds (µg/kg)										
BENZO(A)ANTHRACENE	63	63	140	7,300	1,000	48	5,600	6	NC	0
BENZO(A)PYRENE	63	63	130	9,100	1,000	49	1,000	49	2,600	20
BENZO(B)FLUORANTHENE	63	63	180	12,000	1,000	51	5,600	10	NC	0
BENZO(K)FLUORANTHENE	63	63	63	4,500	800	40	56,000	0	NC	0
CHRYSENE	63	63	140	9,200	1,000	49	56,000	0	NC	0
DIBENZO(A,H)ANTHRACENE	63	57	63	1,100	330	22	560	9	NC	0
INDENO(1,2,3-CD)PYRENE	63	62	52	2,800	500	35	5,600	0	NC	0
Pesticides (µg/kg)										
4,4'-DDD	63	9	6.5	73	3.3	9	92,000	0	3.3	9
4,4'-DDE	63	3	0.5	3.6	3.3	1	62,000	0	3.3	1
4,4'-DDT	63	21	2.5	100	3.3	20	47,000	0	3.3	20
DIELDRIN	63	10	4.9	30	5	9	1,400	0	6	9
ENDRIN	63	1	26	26	14	1	89,000	0	14	1
PCBs (µg/kg)										
AROCLOR-1254	63	58	31	2,110	NC	0	NC	0	NC	0
AROCLOR-1260	63	58	29.6	1,360	NC	0	NC	0	NC	0
Total PCBs	63	58	65.3	3,470	100	50	1,000	8	1,000	8
Metals (mg/kg)										
CADMIUM	63	63	1	52	2.5	55	9.3	34	4	53
CHROMIUM	63	63	7.3	410	30	55	1,500	0	41	49
COPPER	63	63	7.3	330	50	47	270	4	50	47
LEAD	63	63	9.1	390	63	51	1,000	0	63	51
MERCURY	63	63	0.07	8.6	0.18	60	2.8	13	0.18	60
NICKEL	63	63	3.4	87	30	28	310	0	30	28
SILVER	63	57	0.34	13	2	32	1,500	0	2	32
ZINC	63	63	37	780	109	56	10,000	0	109	56

NOTES
This table presents (1) RI Report and SCI data only, (2) the detected concentration data only and (3) only parameters that exceeded the Part 375 Unrestricted, Restricted-Commercial or Restricted-Protection of Ecological SCOs.
NC = No criteria available.
SCO = Soil Cleanup Objectives; NYSDEC = New York State Department of Environmental Conservation.

Table 2
SYW-12 Site
Subsurface Soils (>2 ft bgs)
Summary of Detected Concentrations and Part 375 SCO Exceedances

Parameter	Number of Samples	Number of Detects	Minimum Detected Conc.	Maximum Detected Conc.	NYSDEC Part 375 Unrestricted Use SCOS	Number of Unrestricted Use SCO Exceedances	NYSDEC Part 375 Restricted Use - Commercial SCOs	Number of Commercial SCO Exceedances	NYSDEC Part 375 Restricted Use - Ecological SCOs	Number of Ecological SCO Exceedances
Volatile Organic Compounds (µg/kg)										
2-BUTANONE	40	22	3.1	220	120	1	500,000	0	100,000	0
ACETONE	40	15	14.2	730	50	9	500,000	0	2,200	0
ETHYLBENZENE	40	22	1.2	11,200	1,000	9	390,000	0	NC	0
METHYLENE CHLORIDE	40	2	5.3	80	50	1	500,000	0	12,000	0
XYLENES, TOTAL	40	24	0.96	15,300	260	9	500,000	0	260	9
Semivolatile Organic Compounds (µg/kg)										
4-METHYLPHENOL	21	8	84	1,800	330	4	500,000	0	NC	0
ACENAPHTHENE	40	33	53	210,000	20,000	4	500,000	0	20,000	4
BENZO(A)ANTHRACENE	40	34	161	53,000	1,000	31	5,600	15	NC	0
BENZO(A)PYRENE	40	34	307	46,000	1,000	31	1,000	31	2,600	28
BENZO(B)FLUORANTHENE	40	34	236	45,000	1,000	32	5,600	12	NC	0
BENZO(K)FLUORANTHENE	40	34	97	9,500	800	28	56,000	0	NC	0
CHRYSENE	40	34	201	59,000	1,000	31	56,000	1	NC	0
DIBENZO(A,H)ANTHRACENE	40	32	66.9	4,220	330	27	560	20	NC	0
FLUORENE	40	33	48	86,000	30,000	3	500,000	0	30,000	3
INDENO(1,2,3-CD)PYRENE	40	34	160	8,350	500	31	5,600	5	NC	0
NAPHTHALENE	40	33	43.2	380,000	12,000	6	500,000	0	NC	0
PHENANTHRENE	40	34	65.1	280,000	100,000	3	500,000	0	NC	0
PYRENE	40	34	279	140,000	100,000	2	500,000	0	NC	0
Pesticides (µg/kg)										
4,4'-DDD	21	1	4.4	4.4	3.3	1	92,000	0	3.3	1
4,4'-DDT	21	3	4.9	31	3.3	3	47,000	0	3.3	3
PCBs (µg/kg)										
AROCLOR-1248	40	1	1,110	1,110	NC	1	NC	1	NC	1
AROCLOR-1254	40	6	7.88	1,530	NC	3	NC	2	NC	2
AROCLOR-1260	40	6	12.2	853	NC	2	NC	0	NC	0
Total PCBs	40	6	18.3	2640	100	3	1,000	2	1,000	2
Metals (mg/kg)										
ARSENIC	40	37	1.5	19.7	13	3	16	2	13	3
CADMIUM	40	31	0.31	100	2.5	13	9.3	2	4	4
CHROMIUM	40	40	3	470	30	13	1,500	0	41	8
COPPER	40	40	2.8	450	50	27	270	1	50	27
LEAD	40	40	1.5	437	63	29	1,000	0	63	29
MERCURY	40	40	0.0069	6	0.18	29	2.8	4	0.18	29
NICKEL	40	40	3.6	116	30	21	310	0	30	21
SILVER	40	28	0.23	13	2	18	1,500	0	2	18
ZINC	40	40	11	1,200	109	27	10,000	0	109	27

NOTES
This table presents (1) RI Report and SCI data only, (2) the detected concentration data only and (3) only parameters that exceeded the Part 375 Unrestricted, Restricted-Commercial or Restricted-Protection of Ecological SCOs.
NC = No criteria available.
SCO = Soil Cleanup Objectives; NYSDEC = New York State Department of Environmental Conservation.

Table 3
SYW-12 Site
Shallow and Intermediate Groundwater
Summary of Detected Concentrations and Class GA SGV and EPA MCL Exceedances

Parameter	Number of Samples	Number of Detects	Minimum Detected Conc.	Maximum Detected Conc.	NYSDEC Class GA SGVs	Number of Class GA Exceedances	EPA National Primary Drinking Water MCLs	Number of MCL Exceedances
Volatile Organic Compounds (µg/L)								
ETHYLBENZENE	26	3	0.48	14.8	5(S)	2	700	0
ISOPROPYLBENZENE	26	5	0.23	5.25	5(G)	1	NC	0
O-XYLENE	3	2	2.1	7.3	5(S)	1	NC	0
XYLENES, TOTAL	26	5	0.45	15.2	5(S)	2	10,000	0
Semivolatile Organic Compounds (µg/L)								
4-METHYLPHENOL	23	3	0.36	2	1(S)	1	NC	0
4-NITROPHENOL	26	1	1.1	1.1	1(S)	1	NC	0
ACENAPHTHENE	26	13	0.53	41	20(G)	1	NC	0
NAPHTHALENE	26	5	1.6	170	10(G)	4	NC	0
Pesticides (µg/L)								
Alpha-BHC	23	2	0.0087	0.027	0.01(S)	1	NC	0
Metals (mg/L)								
BARIUM	26	18	0.12	2	1(S)	6	2	2
CHROMIUM	26	4	0.0093	0.16	0.05(S)	1	0.1	1
IRON	26	25	0.34	62.3	0.3(S)	25	NC	0
LEAD	26	4	0.005	0.041	0.025(S)	1	0.015	2
MAGNESIUM	26	20	23	176	35(G)	15	NC	0
MANGANESE	26	26	0.086	2.1	0.3(S)	23	NC	0
SODIUM	26	26	250	3,400	20(S)	26	NC	0
Inorganics (mg/L)								
BROMIDE	17	11	1.6	16.6	2(G)	9	NC	0
CHLORIDE	26	26	380	9,940	250(S)	26	NC	0
NITROGEN, AMMONIA (AS N)	3	3	5.5	36	2(S)	3	NC	0
SULFIDE	14	4	2	17.6	0.05(G)	4	NC	0

NOTES
This table presents (1) RI Report and 2019 follow up data only, (2) the detected concentration data only and (3) only parameters that exceeded the NYSDEC Class GA SGVs or USEPA Drinking Water MCLs.
NC = No criteria available.
(S) = Standard; (G) = Guidance Value; MCL = Maximum Contaminant Level; EPA = Environmental Protection Agency; NYSDEC = New York State Department of Environmental Conservation.

APPENDIX 3
SURFACE SOIL ANALYTICAL RESULTS – FIGURES 1 THROUGH 6

I:\Honeywell.1163\65696.Syw-12-FsiDocs\DWG\MXD\DEVELOPMENT OF ALTERNATIVES\FS ALTERNATIVES JULY 2021

PROJECT: 1940065696 | DATED: 3/2/2022 | DESIGNER: MONETANT

NOTE:
COMMERCIAL SCO= 9.3 mg/kg
POGW SCO= 7.5 mg/kg
ECO SCO= 4.0 mg/kg
J = ESTIMATED VALUE

COMMERCIAL, PROTECTION OF ECOLOGICAL RESOURCES (ECO), AND PROTECTION OF GROUNDWATER (POGW) SOIL CLEANUP OBJECTIVES (SCOS) ARE BASED ON 6 NYCRR PART 375-6.8(B) RESTRICTED USE SCOS

HUMAN HEALTH RISK ASSESSMENT (HHRA) ESTIMATED ACCEPTABLE RISKS TO HUMAN RECEPTORS UNDER ANTICIPATED SITE USE.

LEGEND
- FORESTED UPLAND
- DELINEATED FORESTED WETLAND
- DELINEATED NON-FORESTED WETLAND
- SOIL SAMPLE

0 75 150 Feet

SOIL ANALYTICAL RESULTS
- < ECO SCO
- EXCEEDED ECO SCO
- EXCEEDED ECO AND POGW SCO
- EXCEEDED ECO, POGW AND COMMERCIAL SCO

DEPTH
- 0 - 6"
- 6" - 1'
- 1' - 2'

CADMIUM
RESULT IN SURFACE SOIL (MG/KG)

HONEYWELL INTERNATIONAL INC.
SYW-12 FEASIBILITY STUDY
SYRACUSE, NY

FIGURE 01

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

I:\Honeywell.116365696.Syw-12-FsiDocs\DWG\MXD\DEVELOPMENT OF ALTERNATIVES\FS ALTERNATIVES JULY 2021

PROJECT: 1940065696| DATED: 3/2/2022 | DESIGNER: MONETANT

LEGEND

- FORESTED UPLAND
- DELINEATED FORESTED WETLAND
- DELINEATED NON-FORESTED WETLAND
- ▲ SOIL SAMPLE

0 75 150 Feet

SOIL ANALYTICAL RESULTS

- < ECO SCO
- EXCEEDS ECO SCO
- EXCEEDS BOTH ECO AND COMMERCIAL SCO

DEPTH

- 0 - 6"
- 6" - 1'
- 1' - 2'

CHROMIUM
RESULTS IN SURFACE SOIL (MG/KG)

HONEYWELL INTERNATIONAL INC.
SYW-12 FEASIBILITY STUDY
SYRACUSE, NY

FIGURE 02

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

I:\Honeywell.116316\65696.Syw-12-FsiDocs\DWG\MXD\DEVELOPMENT OF ALTERNATIVES\FS ALTERNATIVES JULY 2021

PROJECT: 1940065696 | DATED: 3/2/2022 | DESIGNER: MONETANT

NOTE:
COMMERCIAL SCO= 2.8 mg/kg
POGW SCO= 0.73 mg/kg
ECO SCO= 0.18 mg/kg
J = ESTIMATED VALUE

COMMERCIAL, PROTECTION OF ECOLOGICAL RESOURCES (ECO), AND PROTECTION OF GROUNDWATER (POGW) SOIL CLEANUP OBJECTIVES (SCOS) ARE BASED ON 6 NYCRR PART 375-6.8(B) RESTRICTED USE SCOS .

HUMAN HEALTH RISK ASSESSMENT (HHRA) ESTIMATED ACCEPTABLE RISKS TO HUMAN RECEPTORS UNDER ANTICIPATED SITE USE.

LEGEND

- FORESTED UPLAND
- DELINEATED FORESTED WETLAND
- DELINEATED NON-FORESTED WETLAND
- ▲ SOIL SAMPLE

0 75 150 Feet

SOIL ANALYTICAL RESULTS

- < ECO SCO
- EXCEEDED ECO SCO
- EXCEEDED ECO AND POGW SCO
- EXCEEDED ECO, POGW AND COMMERCIAL SCO

DEPTH

- 0 - 6"
- 6" - 1'
- 1' - 2'

MERCURY
RESULTS IN SURFACE SOIL (MG/KG)

HONEYWELL INTERNATIONAL INC.
SYW-12 FEASIBILITY STUDY
SYRACUSE, NY

FIGURE 03

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

I:\Honeywell.116365696.Syw-12-FsiDocs\DWG\MXD\DEVELOPMENT OF ALTERNATIVES\FS ALTERNATIVES JULY 2021

PROJECT: 1940065696 | DATED: 3/2/2022 | DESIGNER: MONETANT

NOTE:
COMMERCIAL SCO= 1.0 mg/kg
ECO SCO= 2.6 mg/kg
POGW SCO= 22 mg/kg
J = ESTIMATED VALUE

COMMERCIAL, PROTECTION OF ECOLOGICAL RESOURCES (ECO), AND PROTECTION OF GROUNDWATER (POGW) SOIL CLEANUP OBJECTIVES (SCOS) ARE BASED ON 6 NYCRR PART 375-6.8(B) RESTRICTED USE SCOS

HUMAN HEALTH RISK ASSESSMENT (HHRA) ESTIMATED ACCEPTABLE RISKS TO HUMAN RECEPTORS UNDER ANTICIPATED SITE USE.

LEGEND
- FORESTED UPLAND
- DELINEATED FORESTED WETLAND
- DELINEATED NON-FORESTED WETLAND
- SOIL SAMPLE

0 75 150 Feet

SOIL ANALYTICAL RESULTS
- < COMMERCIAL SCO
- EXCEEDED COMMERCIAL SCO
- EXCEEDED ECO AND COMMERCIAL SCO
- EXCEEDED ECO, POGW AND COMMERCIAL SCO

DEPTH
- 0 - 6"
- 6" - 1'
- 1' - 2'

BENZO(A)PYRENE
RESULTS IN SURFACE SOIL (MG/KG)

HONEYWELL INTERNATIONAL INC.
SYW-12 FEASIBILITY STUDY
SYRACUSE, NY

FIGURE 04

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

NOTE:
COMMERCIAL SCO= 1.0 mg/kg
ECO SCO= 1.0 mg/kg
POGW SCO= 3.2 mg/kg
ND = NON-DETECT RESULT BELOW THE DETECTION LIMIT

COMMERCIAL, PROTECTION OF ECOLOGICAL RESOURCES (ECO), AND PROTECTION OF GROUNDWATER (POGW) SOIL CLEANUP OBJECTIVES (SCOS) ARE BASED ON 6 NYCRR PART 375-6.8(B) RESTRICTED USE SCOS .

HUMAN HEALTH RISK ASSESSMENT (HHRA) ESTIMATED ACCEPTABLE RISKS TO HUMAN RECEPTORS UNDER ANTICIPATED SITE USE.

LEGEND
- FORESTED UPLAND
- DELINEATED FORESTED WETLAND
- DELINEATED NON-FORESTED WETLAND
- ▲ SOIL SAMPLE

0 75 150 Feet

SOIL ANALYTICAL RESULTS
- < ECO SCO
- EXCEEDED ECO AND COMMERCIAL SCO
- EXCEEDED ECO, COMMERCIAL AND POGW SCO

DEPTH
- 0 - 6"
- 6" - 1'
- 1' - 2'

TOTAL PCB
RESULTS IN SURFACE SOIL (MG/KG)

HONEYWELL INTERNATIONAL INC.
SYW-12 FEASIBILITY STUDY
SYRACUSE, NY

FIGURE 05

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

PROJECT: 1163.65696 | DATED: 3/2/2022 | DESIGNER: MONETANT
I:\Honeywell.1163\65696.Syw-12-Fs\Docs\DWG\MXD\DEVELOPMENT OF ALTERNATIVES\FS ALTERNATIVES JULY 2021\Surface_Total_PCBs_03022022.mxd

NOTE:
ECO SCO= 0.0033 mg/kg
COMMERCIAL SCO= 47.0 mg/kg
POGW SCO= 136 mg/kg
ND = NON-DETECT RESULT BELOW THE DETECTION LIMIT
J = ESTIMATED VALUE
JN = ESTIMATED, UNCONFIRMED VALUE

COMMERCIAL, PROTECTION OF ECOLOGICAL RESOURCES (ECO), AND PROTECTION OF GROUNDWATER (POGW) SOIL CLEANUP OBJECTIVES (SCOS) ARE BASED ON 6 NYCRR PART 375-6.8(B) RESTRICTED USE SCOS

HUMAN HEALTH RISK ASSESSMENT (HHRA) ESTIMATED ACCEPTABLE RISKS TO HUMAN RECEPTORS UNDER ANTICIPATED SITE USE.

LEGEND
- FORESTED UPLAND
- DELINEATED FORESTED WETLAND
- DELINEATED NON-FORESTED WETLAND
- ▲ SOIL SAMPLE

0 75 150 Feet

SOIL ANALYTICAL RESULTS
- < ECO SCO
- EXCEEDED ECO SCO
- EXCEEDED ECO AND COMMERCIAL SCO
- EXCEEDED ECO, POGW AND COMMERCIAL SCO

DEPTH
- 0 - 6"
- 6" - 1'
- 1' - 2'

4-4-DDT
RESULTS IN SURFACE SOIL (MG/KG)

HONEYWELL INTERNATIONAL INC.
SYW-12 FEASIBILITY STUDY
SYRACUSE, NY

FIGURE 06

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

I:\Honeywell.116\165696.Syw-12-Fs\Docs\DWG\MXD\DEVELOPMENT OF ALTERNATIVES\FS ALTERNATIVES JULY 2021
PROJECT: 1940065696 | DATED: 3/2/2022 | DESIGNER: MONETANT

APPENDIX 4
TEST TRENCH PTFE SHEEN NET SAMPLES – SIM FORENSIC PAHS AND PETROLEUM BIOMARKERS

Table 29
Honeywell
SYW-12 Sources of Contamination Investigation
Test Trench PTFE Sheen Net Samples
Method D5739-06/8270M SIM Forensic PAHs and Petroleum Biomarkers

Parameter Name	Field Sample ID Location Sample Date Sample Depth Sample Purpose Units	HB-0053-01 HB-TP-54A-85 6/4/2010 7 FT Regular sample	HB-0059-03 HB-TP-55-356 6/6/2012 10.5 FT Regular sample	HB-0062-05 HB-TP-55AN-152 6/7/2012 9.5 FT Regular sample	HB-0062-08 HB-TP-55AN-72PAN 6/7/2012 8 FT Regular sample	HB-0075-05 HB-TP-55-(50)PAN 6/12/2012 10 ft Regular sample	HB-0075-11 HB-TP-55-(50) 6/12/2012 10 FT Regular sample	HB-0081-10 HB-SB-256PAN 6/13/2012 14-16 FT Regular sample
Naphthalene	µg/kg	7310 J	162000	63100	569000	7500	7500	20400
2-Methylnaphthalene	µg/kg	6100 J	105000	55100	1400000	51100	154000	32600
1-Methylnaphthalene	µg/kg	4300 J	6010000	220000	1040000	402000	498000	29400
C1-Naphthalenes	µg/kg	6510 J	3730000	169000	1520000	282000	405000	38700
C2-Naphthalenes	µg/kg	13200 J	9920000	630000	2880000	6440000	7280000	73400
C3-Naphthalenes	µg/kg	14200 J	6260000	883000	2340000	11000000	12100000	70500
C4-Naphthalenes	µg/kg	10600 J	2200000	510000	948000	7190000	7870000	38500
Acenaphthylene	µg/kg	69600 J	1370000	450000	804000	84700	166000	94000
Acenaphthene	µg/kg	3760 J	5160000	316000	1390000	151000	238000	46800
Dibenzofuran	µg/kg	4740 J	373000	35600	107000	138000	149000	4170
Fluorene	µg/kg	3930 J	2690000	261000	1030000	455000	527000	38100
C1-Fluorenes	µg/kg	13100 J	3070000	569000	1470000	1610000	1780000	73200
C2-Fluorenes	µg/kg	17200 J	2410000	582000	1160000	1980000	2300000	69600
C3-Fluorenes	µg/kg	15400 J	850000	277000	498000	1130000	1300000	35100
Dibenzothiophene	µg/kg	2850 J	952000	168000	469000	115000	139000	24000
C1-Dibenzothiophenes	µg/kg	5310 J	1540000	373000	829000	351000	414000	54500
C2-Dibenzothiophenes	µg/kg	12200 J	1280000	364000	701000	268000	316000	52000
C3-Dibenzothiophenes	µg/kg	10100 J	619000	207000	355000	109000	134000	29400
C4-Dibenzothiophenes	µg/kg	5090 J	230000	86900	137000	37400	45100	11800
Phenanthrene	µg/kg	37000 J	8800000	1940000	5120000	839000	1050000	240000
Anthracene	µg/kg	45500 J	3470000	831000	1690000	323000	399000	111000
C1-Phenanthrenes/Anthracenes	µg/kg	57900 J	8770000	2220000	4440000	1820000	2140000	300000
C2-Phenanthrenes/Anthracenes	µg/kg	53000 J	4310000	1340000	2320000	1210000	1440000	179000
C3-Phenanthrenes/Anthracenes	µg/kg	23600 J	1400000	478000	744000	404000	469000	64900
C4-Phenanthrenes/Anthracenes	µg/kg	11000 J	430000	171000	258000	128000	152000	21600
Fluoranthene	µg/kg	56800 J	3190000	1330000	1650000	108000	224000	115000
Pyrene	µg/kg	70100 J	4080000	1620000	2340000	302000	447000	207000
C1-Fluoranthenes/Pyrenes	µg/kg	88200 J	4760000	1730000	2800000	346000	520000	260000
C2-Fluoranthenes/Pyrenes	µg/kg	56200 J	2050000	759000	1170000	192000	272000	125000
C3-Fluoranthenes/Pyrenes	µg/kg	30400 J	909000	357000	501000	91800	124000	53800
Benzo(b)fluorene	µg/kg	7250 J	434000	176000	260000	13500	24800	20500
Benzo(c)fluorene	µg/kg	2900 J	217000	84000	131000	8640	18700	10200
2-Methylpyrene	µg/kg	11200 J	570000	214000	338000	74000	94400	34400
4-Methylpyrene	µg/kg	15500 J	584000	204000	335000	84900	109000	42600
1-Methylpyrene	µg/kg	10200 J	690000	211000	366000	71300	93100	36500
Benzo(a)anthracene	µg/kg	54900 J	1970000	838000	1010000	44400	108000	90400
Chrysene	µg/kg	60100 J	1900000	783000	1060000	54600	121000	101000
C1-Benzo(a)anthracenes/Chrysenes	µg/kg	69800 J	2110000	819000	1230000	60500	138000	124000

NOTES:

U - analyte was below the detection limit; J - estimated value

Table 29
Honeywell
SYW-12 Sources of Contamination Investigation
Test Trench PTFE Sheen Net Samples
Method D5739-06/8270M SIM Forensic PAHs and Petroleum Biomarkers

Parameter Name	Field Sample ID Location Sample Date Sample Depth Sample Purpose Units	HB-0053-01 HB-TP-54A-85 6/4/2010 7 FT Regular sample	HB-0059-03 HB-TP-55-356 6/6/2012 10.5 FT Regular sample	HB-0062-05 HB-TP-55AN-152 6/7/2012 9.5 FT Regular sample	HB-0062-08 HB-TP-55AN-72PAN 6/7/2012 8 FT Regular sample	HB-0075-05 HB-TP-55-(50)PAN 6/12/2012 10 ft Regular sample	HB-0075-11 HB-TP-55-(50) 6/12/2012 10 FT Regular sample	HB-0081-10 HB-SB-256PAN 6/13/2012 14-16 FT Regular sample
C2-Benzo(a)anthracenes/Chrysenes	µg/kg	44400 J	1060000	393000	621000	44200	92700	69700
C3-Benzo(a)anthracenes/Chrysenes	µg/kg	20800 J	460000	184000	246000	27200	46900	30500
C4-Benzo(a)anthracenes/Chrysenes	µg/kg	11500 J	177000	75400	103000	14500	23400	12800
Benzo(b)fluoranthene	µg/kg	42900 J	711000	361000	335000	33100	65300	46800
Benzo(k)fluoranthene	µg/kg	45500 J	832000	398000	394000	28500	64400	49100
Benzo(e)pyrene	µg/kg	46100 J	647000	326000	334000	40600	74200	53900
Benzo(a)pyrene	µg/kg	72900 J	1350000	608000	654000	51100	105000	98100
Perylene	µg/kg	13900 J	167000	92900	77800	7290	13800	13100
Indeno(1,2,3-cd)pyrene	µg/kg	35800 J	407000	197000	192000	21300	39000	32800
Dibenzo(a,h)anthracene	µg/kg	13100 J	178000	82600	92200	7810	15400	4180
Benzo(g,h,i)perylene	µg/kg	42700 J	413000	202000	198000	24000	42700	35000
C23 Tricyclic Terpane	µg/kg	1800 UJ	23900	15300	12600	2350	4820	1530
C24 Tricyclic Terpane	µg/kg	1800 UJ	21200	12800	10600	2280	4230	1240
C25 Tricyclic Terpane-22S	µg/kg	1800 UJ	10500	7530	6180	1220 J	2390 J	683 J
C25 Tricyclic Terpane-22R	µg/kg	1800 UJ	7700	6040	4870	1900 U	1810 J	627 J
C24 Tetracyclic Terpane	µg/kg	1800 UJ	10600	6490	4860	1900 U	2530	592 J
C26 Tricyclic Terpane-22S	µg/kg	1800 UJ	9200	5650	4720	1020 J	2130 J	583 J
C26 Tricyclic Terpane-22R	µg/kg	1800 UJ	8280	5250	4000	1220 J	2530	605 J
C28 Tricyclic Terpane-22S	µg/kg	1800 UJ	11700	7410	5980	1170 J	2510	985
C28 Tricyclic Terpane-22R	µg/kg	1800 UJ	11800	7470	6080	998 J	2550	873 J
C29 Tricyclic Terpane-22S	µg/kg	1800 UJ	8980	4910	3930	935 J	2200 J	532 J
C29 Tricyclic Terpane-22R	µg/kg	1800 UJ	10100	6250	5250	976 J	2430	641 J
18a-22,29,30-Trisnorneohopane-TS	µg/kg	1600 J	16900	15900	11800	2750	6620	1750
C30 Tricyclic Terpane-22S	µg/kg	1800 UJ	4850	1220	834	1900 U	1250 J	910 U
C30 Tricyclic Terpane-22R	µg/kg	1800 UJ	4720	3560	2920	1900 U	1400 J	910 U
17a(H)-22,29,30-Trisnorhopane-TM	µg/kg	1430 J	21100	13800	9900	3080	6530	1680
30-Norhopane	µg/kg	4240 J	41500	26900	22600	6920	14600	3540
18a(H)-30-Norneohopane-C29Ts	µg/kg	1270 J	15300	10600	8080	2690	5120	1160
17a(H)-Diahopane	µg/kg	1800 UJ	4030 J	2320	1970	1900 U	1460 J	910 U
30-Normoretane	µg/kg	1070 J	9190	6230	4400	1640 J	3560	844 J
18a(H)&18b(H)-Oleananes	µg/kg	1800 UJ	5520	3840	2450	1030 J	1880 J	490 J
Hopane	µg/kg	6890 J	71700	49400	33900	10400	23700	5500
Moretane	µg/kg	1660 J	16500	12000	8080	2300	5390	1380
30-Homohopane-22S	µg/kg	2650 J	22600	15100	9890	3370	8360	1800
30-Homohopane-22R	µg/kg	1330 J	12100	8290	5390	2550	4000	1030
Gammacerane	µg/kg	1800 UJ	4400 U	670 U	770 U	1900 U	2400 U	910 U
30,31-Bishomohopane-22S	µg/kg	2410 J	9310	8270	5260	2330	4130	1480
30,31-Bishomohopane-22R	µg/kg	1800 UJ	12200	5500	3870	1390 J	3230	758 J

NOTES:

U - analyte was below the detection limit; J - estimated value

Table 29
Honeywell
SYW-12 Sources of Contamination Investigation
Test Trench PTFE Sheen Net Samples
Method D5739-06/8270M SIM Forensic PAHs and Petroleum Biomarkers

Parameter Name	Field Sample ID Location Sample Date Sample Depth Sample Purpose Units	HB-0053-01 HB-TP-54A-85 6/4/2010 7 FT Regular sample	HB-0059-03 HB-TP-55-356 6/6/2012 10.5 FT Regular sample	HB-0062-05 HB-TP-55AN-152 6/7/2012 9.5 FT Regular sample	HB-0062-08 HB-TP-55AN-72PAN 6/7/2012 8 FT Regular sample	HB-0075-05 HB-TP-55-(50)PAN 6/12/2012 10 ft Regular sample	HB-0075-11 HB-TP-55-(50) 6/12/2012 10 FT Regular sample	HB-0081-10 HB-SB-256PAN 6/13/2012 14-16 FT Regular sample
30,31-Trishomohopane-22S	µg/kg	1800 UJ	8530	4220	3170	989 J	2200 J	610 J
30,31-Trishomohopane-22R	µg/kg	1800 UJ	5970	4290	2740	1900 U	1430 J	910 U
Tetrakishomohopane-22S	µg/kg	1800 UJ	2540 J	2120	1600	1900 U	1350 J	910 U
Tetrakishomohopane-22R	µg/kg	1800 UJ	4400 U	1270	805	1900 U	2400 U	910 U
Pentakishomohopane-22S	µg/kg	1800 UJ	4400 U	1510	724 J	1900 U	2400 U	910 U
Pentakishomohopane-22R	µg/kg	1800 UJ	4400 U	1050	790	1900 U	2400 U	910 U
13b(H),17a(H)-20S-Diacholestane	µg/kg	1190 J	36700	24700	20900	3100	9240	2020
13b(H),17a(H)-20R-Diacholestane	µg/kg	1800 UJ	21200	14900	11000	1930	5740	1170
13b,17a-20S-Methyldiacholestane	µg/kg	2820 J	13300	27000	9950	2090	4300	1250
14a(H),17a(H)-20S-Cholestane	µg/kg	3100 J	61000	38700	33100	7180	16500	4370
14b(H),17b(H)-20R-Cholestane	µg/kg	1140 J	31100	19700	14900	2530	7030	1720
14b(H),17b(H)-20S-Cholestane	µg/kg	1390 J	27400	17900	14200	2500	7340	1660
14a(H),17a(H)-20R-Cholestane	µg/kg	4370 J	64900	42900	38100	8840	21100	5590
13b,17a-20R-Ethyldiacholestane	µg/kg	1020 J	13300	8230	6780	2070	3940	1030
13a,17b-20S-Ethyldiacholestane	µg/kg	1800 UJ	4400 U	1750	2150	1900 U	1520 J	910 U
14a,17a-20S-Methylcholestane	µg/kg	1520 J	22400	15100	10800	2830	7630	1610
14b,17b-20R-Methylcholestane	µg/kg	1370 J	24300	16700	11900	3110	7700	1460
14b,17b-20S-Methylcholestane	µg/kg	1650 J	31900	23800	16800	4570	11200	2400
14a,17a-20R-Methylcholestane	µg/kg	1370 J	29700	18000	15200	3580	7910	2100
14a(H),17a(H)-20S-Ethylcholestane	µg/kg	1910 J	30700	21200	15000	4390	11600	2430
14b(H),17b(H)-20R-Ethylcholestane	µg/kg	2360 J	43200	28800	19600	5300	11900	3240
14b(H),17b(H)-20S-Ethylcholestane	µg/kg	2000 J	25000	16000	14300	4890	10600	2220
14a(H),17a(H)-20R-Ethylcholestane	µg/kg	2060 J	25400	16900	14300	3000	8320	1970

NOTES:

U - analyte was below the detection limit; J - estimated value

Table 30
Honeywell
SYW-12 Sources of Contamination Investigation
Test Trench PTFE Sheen Net Samples
Method ASTM D3328-06 Total Petroleum Hydrocarbons

	Field Sample ID	HB-0053-01	HB-0059-03	HB-0062-05	HB-0062-08	HB-0075-05	HB-0075-11	HB-0081-10
	Location	HB-TP-54A-85	HB-TP-55-356	HB-TP-55AN-152	HB-TP-55AN-72PAN	HB-TP-55-(50)PAN	HB-TP-55-(50)	HB-SB-256PAN
	Sample Date	6/4/2010	6/6/2012	6/7/2012	6/7/2012	6/12/2012	6/12/2012	6/13/2012
	Sample Depth	7 FT	10.5 FT	9.5 FT	8 FT	10 ft	10 FT	14-16 FT
	Sample Purpose	Regular sample	Regular sample	Regular sample	Regular sample	Regular sample	Regular sample	Regular sample
Parameter Name	Units							
C-8	mg/kg	180 UJ	44 UJ	67 UJ	77 UJ	37 UJ	48 UJ	91 UJ
C-9	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-10	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-11	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-12	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-13	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
2,6,10-trimethyldodecane (1380)	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-14	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
2,6,10-trimethyltridecane (1470)	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-15	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-16	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
2,6,10-trimethylpentadecane (1650)	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-17	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
Pristane	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-18	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
Phytane	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-19	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-20	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-21	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-22	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-23	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-24	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-25	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-26	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-27	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-28	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-29	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-30	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-31	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-32	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-33	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-34	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-35	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-36	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-37	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-38	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-39	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
C-40	mg/kg	180 UJ	44 U	67 U	77 U	37 U	48 U	91 U
TPH (C8-C40)	mg/kg	71200 UJ	326000 JN	334000 JN	375000 JN	472000 JN	563000 JN	53900 U

NOTES:

U - analyte was below the detection limit; J - estimated value; N - unconfirmed value

APPENDIX 5
PROTECTION OF GROUNDWATER SCO EXCEEDANCE – NAPHTHALENE IN SUBSURFACE SOIL

I:\Honeywell.1163\65696.Syw-12-Fs\Docs\DWG\MXD\Exceedances\SubSurface_ProtofWater_030222022.mxd

PROJECT: 169000XXXX | DATED: 4/5/2022 | DESIGNER: MONETANT

HB-MW-29

HB-SB-259
9.5-10 FT.

HB-SB-51
12-14 FT.

HB-SB-254
10-12 FT.

HB-SB-53
10-12 FT.

HB-SB-253
11.5-12 FT.

HB-SB-256
14-16 FT.

NOTE:
NAPHTHALENE WAS THE ONLY ORGANIC CONSTITUENT THAT EXCEEDED BOTH THE PART 375 SCO FOR THE PROTECTION OF GROUNDWATER IN SUBSURFACE SOIL AND THE NEW YORK STATE CLASS GA GUIDANCE VALUE IN GROUNDWATER. GROUNDWATER SAMPLING IN 2019 INDICATED THAT NAPHTHALENE WAS THE ONLY ORGANIC CONSTITUENT THAT EXCEEDED THE NEW YORK STATE CLASS GA GUIDANCE VALUE (10 UG/L) IN ONE WELL (HB-MW-29)

Service Layer Credits: NYS ITS GIS Program Office, Westchester County GIS

- SOIL BORING / GROUNDWATER SCREENING LOCATION
- MONITORING WELL
- SOIL BORING
- TEST PIT
- PROTECTION OF GROUNDWATER SCO EXCEEDANCE FOR NAPHTHALENE
- SYW-12 BOUNDARY
- FORESTED UPLAND
- DELINEATED FORESTED WETLAND
- DELINEATED NON-FORESTED WETLAND

0 75 150 Feet

PROTECTION OF GROUNDWATER SCO EXCEEDANCE NAPHTHALENE IN SUBSURFACE SOIL

SYW-12 Feasibility Study
Syracuse,NY

FIGURE 01

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

APPENDIX 6
RATIONALE AND IDENTIFICATION OF SURFACE SOIL CONSTITUENTS OF CONCERN

Honeywell
SYW-12 FS
Surface Soils (0 to 2 ft)
Rationale and Identification of Surface Soil Constituents of Concern

Chemical	Units	No. of Samples	Detection Frequency	Mean Detect	Maximum Detect	95% UCL	NYSDEC Part 375.6 Comm Use SCOs[1]	EPC Comm Exceedance Factor (EF) (EPC/Comm SCO)	NYSDEC Part 375.6 Eco SCOs[1]	EPC Eco EF (EPC/Eco SCO)	HHRA Risk Driver (Recreational Use)	BERA Risk Driver[2]	Representative FS COC (Yes/No)?	Rationale	USFWS Targeted Constituent[3]	PBT Constituent[4]	FS COC of Focus (Yes/No)?	Representative FS Risk and Remedy Driver Rationale
Volatile Organic Compounds																		
1,4-DICHLOROBENZENE	ug/kg	63	49.2%	2.18	8.70	2.67	130000	NA	20000	NA			No	EPC does not exceed Commercial or Ecological SCO				
XYLENES, TOTAL	ug/kg	63	31.7%	2.17	7.30	3.19	500000	NA	260	NA			No	EPC does not exceed Commercial or Ecological SCO				
TOLUENE	ug/kg	63	39.7%	1.44	3.80	1.54	500000	NA	36000	NA			No	EPC does not exceed Commercial or Ecological SCO				
CHLOROBENZENE	ug/kg	63	36.5%	2.26	5.80	2.09	500000	NA	40000	NA			No	EPC does not exceed Commercial or Ecological SCO				
1,2-DICHLOROBENZENE	ug/kg	63	11.1%	1.54	2.30	1.91	500000	NA	NC	-			No	EPC does not exceed Commercial SCO, no Ecological SCO				
ETHYLBENZENE	ug/kg	63	9.5%	0.89	1.00	0.97	390000	NA	NC	-			No	EPC does not exceed Commercial SCO, no Ecological SCO				
2-BUTANONE	ug/kg	63	1.6%	2.10	2.10	NA	500000	NA	100000	NA			No	EPC does not exceed Commercial or Ecological SCO				
BENZENE	ug/kg	63	4.8%	1.96	4.30	1.01	44000	NA	70000	NA			No	EPC does not exceed Commercial or Ecological SCO				
TETRACHLOROETHENE	ug/kg	63	3.2%	2.35	4.10	1.10	150000	NA	2000	NA			No	EPC does not exceed Commercial or Ecological SCO				
1,3-DICHLOROBENZENE	ug/kg	63	1.6%	1.10	1.10	NA	280000	NA	NC	-			No	EPC does not exceed Commercial SCO, no Ecological SCO				
ACETONE	ug/kg	63	1.6%	14.0	14.0	NA	500000	NA	2200	NA			No	EPC does not exceed Commercial or Ecological SCO				
CIS-1,2-DICHLOROETHENE	ug/kg	63	1.6%	1.40	1.40	NA	500000	NA	NC	-			No	EPC does not exceed Commercial SCO, no Ecological SCO				
METHYLENE CHLORIDE	ug/kg	63	1.6%	9.90	9.90	NA	500000	NA	12000	NA			No	EPC does not exceed Commercial or Ecological SCO				
TRICHLOROETHENE	ug/kg	63	1.6%	4.30	4.30	NA	200000	NA	2000	NA			No	EPC does not exceed Commercial or Ecological SCO				
CARBON DISULFIDE	ug/kg	63	6.3%	1.06	1.30	1.27	NC	-	NC	-			No	No Commercial or Ecological SCO				
Semivolatile Organic Compounds																		
BENZO(B)FLUORANTHENE	ug/kg	63	100%	3545	12000	4255	5600	NA	NC	-			No	EPC does not exceed Commercial SCO, no Ecological SCO				
CHRYSENE	ug/kg	63	100%	2536	9200	3058	56000	NA	NC	-			No	EPC does not exceed Commercial SCO, no Ecological SCO				
BENZO(A)PYRENE	ug/kg	63	100%	2552	9100	3072	1000	3.1	2600	1.2			Yes	EPC exceeds Commercial and Ecological SCO	Yes		Yes	EPC significantly elevated above Commercial SCO, USFWS Targeted Constituent
BENZO(A)ANTHRACENE	ug/kg	63	100%	2178	7300	2613	5600	NA	NC	-			No	EPC does not exceed Commercial SCO, no Ecological SCO				
BENZO(K)FLUORANTHENE	ug/kg	63	100%	1195	4500	1442	56000	NA	NC	-			No	EPC does not exceed Commercial SCO, no Ecological SCO				
INDENO(1,2,3-CD)PYRENE	ug/kg	63	98.4%	753	2800	906	5600	NA	NC	-			No	EPC does not exceed Commercial SCO no Ecological SCO				
DIBENZO(A,H)ANTHRACENE	ug/kg	63	90.5%	353	1100	399	560	NA	NC	-			No	EPC does not exceed Commercial SCO, no Ecological SCO				
DIBENZOFURAN	ug/kg	63	81.0%	204	790	281	350000	NA	NC	-			No	EPC does not exceed Commercial SCO, no Ecological SCO				
FLUORANTHENE	ug/kg	63	100%	3523	13000	4241	500000	NA	NC	-			No	EPC does not exceed Commercial SCO, no Ecological SCO				
PYRENE	ug/kg	63	100%	4195	14000	5060	500000	NA	NC	-		Yes	Yes	BERA risk driver				
PHENANTHRENE	ug/kg	63	100%	2448	9600	3694	500000	NA	NC	-			No	EPC does not exceed Commercial SCO, no Ecological SCO				
FLUORENE	ug/kg	63	90.5%	335	1200	393	500000	NA	30000	NA			No	EPC does not exceed Commercial or Ecological SCO				
ACENAPHTHENE	ug/kg	63	84.1%	246	850	336	500000	NA	20000	NA			No	EPC does not exceed Commercial or Ecological SCO				
4-METHYLPHENOL	ug/kg	63	30.2%	99	230	119	500000	NA	NC	-			No	Does not exceed Commercial SCO, no Ecological SCO				
BENZO(G,H,I)PERYLENE	ug/kg	63	98.4%	1203	4200	1424	500000	NA	NC	-			No	Does not exceed Commercial SCO, no Ecological SCO		Yes		
ANTHRACENE	ug/kg	63	98.4%	794	2700	939	500000	NA	NC	-			No	Does not exceed Commercial SCO, no Ecological SCO				
ACENAPHTHYLENE	ug/kg	63	93.7%	898	3100	1030	500000	NA	NC	-			No	Does not exceed Commercial SCO, no Ecological SCO				
NAPHTHALENE	ug/kg	63	93.7%	929	4200	1103	500000	NA	NC	-			No	Does not exceed Commercial SCO, no Ecological SCO				
HEXACHLOROBENZENE	ug/kg	63	27.0%	118	240	142	6000	NA	NC	-		Yes	Yes	BERA risk driver		Yes		
PHENOL	ug/kg	63	6.3%	59.3	71	69.6	500000	NA	30000	NA			No	EPC does not exceed Commercial or Ecological SCO				
2-METHYLNAPHTHALENE	ug/kg	63	90.5%	586	2800	682	NC	-	NC	-			No	No Commercial or Ecological SCO				
CARBAZOLE	ug/kg	63	85.7%	279	990	388	NC	-	NC	-			No	No Commercial or Ecological SCO				
1-PHENYL-1-(2,4-DIMETHYLPHENYL) ETHANE	ug/kg	63	93.7%	1586	8000	1900	NC	-	NC	-			No	No Commercial or Ecological SCO				
1-PHENYL-1-(4-METHYLPHENYL) ETHANE	ug/kg	63	85.7%	1004	5300	1159	NC	-	NC	-			No	No Commercial or Ecological SCO				
ACETOPHENONE	ug/kg	63	68.3%	175	760	194	NC	-	NC	-			No	No Commercial or Ecological SCO				
1,1'-BIPHENYL	ug/kg	63	60.3%	142	490	157	NC	-	NC	-			No	No Commercial or Ecological SCO				
BENZALDEHYDE	ug/kg	63	54.0%	224	1700	259	NC	-	NC	-			No	No Commercial or Ecological SCO				
BIS(2-ETHYLHEXYL)PHTHALATE	ug/kg	63	39.7%	560	2200	474	NC	-	NC	-		Yes	Yes	BERA risk driver				
BUTYLBENZYL PHTHALATE	ug/kg	63	11.1%	87.6	180	116	NC	-	NC	-		Yes	Yes	BERA risk driver				
4-CHLOROANILINE	ug/kg	63	4.8%	110	200	185	NC	-	NC	-			No	No Commercial or Ecological SCO				
CAPROLACTAM	ug/kg	63	4.8%	73.7	93.0	91.2	NC	-	NC	-			No	No Commercial or Ecological SCO				
DI-N-BUTYL PHTHALATE	ug/kg	63	1.6%	150	150	NA	NC	-	NC	-			No	No Commercial or Ecological SCO				
TOTAL PAHs	-	-	-	-	-	-	-	-	-	-			No	No Commercial or Ecological SCO	Yes			
Pesticides																		
4,4'-DDT	ug/kg	63	33.3%	26.2	100	18.7	47000	NA	3.3	5.7			Yes	EPC exceeds Ecological SCO			Yes	EPC significantly elevated above Ecological SCO
4,4'-DDD	ug/kg	63	14.3%	39.5	73.0	14.1	92000	NA	3.3	4.3			Yes	EPC exceeds Ecological SCO				
DIELDRIN	ug/kg	63	15.9%	12.9	30.0	8.79	1400	NA	6	1.5		Yes	Yes	EPC exceeds Ecological SCO, BERA risk driver				
4,4'-DDE	ug/kg	63	4.8%	2.10	3.60	3.60	62000	NA	3.3	1.1			Yes	EPC exceeds Ecological SCO				
ENDRIN	ug/kg	63	1.6%	26.0	26.0	NA	89000	NA	14	1.9			Yes	EPC exceeds Ecological SCO				
ALPHA-CHLORDANE	ug/kg	63	41.3%	23.3	63.0	16.8	24000	NA	NC	-			No	EPC does not exceed Commercial SCO, no Ecological SCO				
ENDOSULFAN II	ug/kg	63	11.1%	21.2	50.0	9.82	200000	NA	NC	-			No	EPC does not exceed Commercial SCO, no Ecological SCO				
ENDOSULFAN I	ug/kg	63	1.6%	2.50	2.50	NA	200000	NA	NC	-			No	EPC does not exceed Commercial SCO, no Ecological SCO				
ALPHA-BHC	ug/kg	63	3.2%	0.47	0.49	0.50	3400	NA	40	NA			No	EPC does not exceed Commercial or Ecological SCO				
GAMMA-BHC (LINDANE)	ug/kg	63	1.6%	2.80	2.80	NA	9200	NA	6000	NA			No	EPC does not exceed Commercial or Ecological SCO				
ENDRIN KETONE	ug/kg	63	6.3%	7.18	9.30	4.99	NC	-	NC	-			No	No Commercial or Ecological SCO				
HEPTACHLOR EPOXIDE	ug/kg	63	0%	-	-	NA	NC	-	NC	-			No	No Commercial or Ecological SCO				

Honeywell
SYW-12 FS
Surface Soils (0 to 2 ft)
Rationale and Identification of Surface Soil Constituents of Concern

Chemical	Units	No. of Samples	Detection Frequency	Mean Detect	Maximum Detect	95% UCL	NYSDEC Part 375.6 Comm Use SCOs[1]	EPC Comm Exceedance Factor (EF) (EPC/Comm SCO)	NYSDEC Part 375.6 Eco SCOs[1]	EPC Eco EF (EPC/Eco SCO)	HHRA Risk Driver (Recreational Use)	BERA Risk Driver[2]	Representative FS COC (Yes/No)?	Rationale	USFWS Targeted Constituent[3]	PBT Constituent[4]	FS COC of Focus (Yes/No)?	Representative FS Risk and Remedy Driver Rationale
Dioxans/Furans																		
1,2,3,4,6,7,8-HPCDD	ng/kg	24	100%	391	2653	620	NC	-	NC	-			No	No Commercial or Ecological SCO				
1,2,3,4,6,7,8-HPCDF	ng/kg	24	100%	84.8	469	132	NC	-	NC	-			No	No Commercial or Ecological SCO				
1,2,3,4,7,8-HXCDF	ng/kg	24	100%	15.2	79.0	23.6	NC	-	NC	-			No	No Commercial or Ecological SCO				
1,2,3,6,7,8-HXCDD	ng/kg	24	100%	28.4	196	45.8	NC	-	NC	-			No	No Commercial or Ecological SCO				
OCDD	ng/kg	24	100%	2810	15854	4416	NC	-	NC	-			No	No Commercial or Ecological SCO				
OCDF	ng/kg	24	100%	202	1313	323	NC	-	NC	-			No	No Commercial or Ecological SCO				
1,2,3,6,7,8-HXCDF	ng/kg	24	91.7%	4.82	24.4	7.27	NC	-	NC	-			No	No Commercial or Ecological SCO				
1,2,3,7,8,9-HXCDD	ng/kg	24	91.7%	16.2	83.1	25.6	NC	-	NC	-			No	No Commercial or Ecological SCO				
1,2,3,7,8-PECDF	ng/kg	24	95.8%	9.78	49.6	16.3	NC	-	NC	-			No	No Commercial or Ecological SCO				
2,3,4,7,8-PECDF	ng/kg	24	95.8%	18.0	97.1	31.9	NC	-	NC	-			No	No Commercial or Ecological SCO				
1,2,3,7,8-PECDD	ng/kg	24	91.7%	9.44	58.2	15.8	NC	-	NC	-			No	No Commercial or Ecological SCO				
2,3,7,8-TCDF	ng/kg	24	95.8%	14.7	64.7	23.3	NC	-	NC	-			No	No Commercial or Ecological SCO				
1,2,3,4,7,8,9-HPCDF	ng/kg	24	87.5%	7.05	37.9	10.8	NC	-	NC	-			No	No Commercial or Ecological SCO				
1,2,3,4,7,8-HXCDD	ng/kg	24	83.3%	4.64	28.8	7.59	NC	-	NC	-			No	No Commercial or Ecological SCO				
2,3,4,6,7,8-HXCDF	ng/kg	24	83.3%	3.17	13.8	4.46	NC	-	NC	-			No	No Commercial or Ecological SCO				
2,3,7,8-TCDD	ng/kg	24	66.7%	3.51	18.1	4.88	NC	-	NC	-			No	No Commercial or Ecological SCO				
1,2,3,7,8,9-HXCDF	ng/kg	24	54.2%	0.91	2.97	1.35	NC	-	NC	-			No	No Commercial or Ecological SCO				
PCBs																		
AROCLOR-1254	ug/kg	63	92.1%	523	2110	660	NC	-	NC	-			No	No Commercial or Ecological SCO				
AROCLOR-1260	ug/kg	63	92.1%	390	1360	487	NC	-	NC	-			No	No Commercial or Ecological SCO				
TOTAL PCBs	ug/kg	63	92.1%	753	3470	660	1000	NA	1000	NA		Yes	Yes	BERA risk driver	Yes	Yes	Yes	BERA risk driver, USFWS Targeted Constituent, PBT Constituent
Inorganic Compounds																		
CALCIUM	mg/kg	63	100%	167190	370000	183394	NC	-	NC	-			No	No Commercial or Ecological SCO				
MAGNESIUM	mg/kg	63	100%	8892	17000	9629	NC	-	NC	-			No	No Commercial or Ecological SCO				
POTASSIUM	mg/kg	63	96.8%	889	2300	1003	NC	-	NC	-			No	No Commercial or Ecological SCO				
MERCURY	mg/kg	63	100%	2.0	8.6	2.4	2.8	NA	0.18	13.4		Yes	Yes	EPC exceeds Ecological SCO, BERA risk driver	Yes	Yes	Yes	EPC significantly elevated above Ecological SCO, USFWS Targeted Constituent, PBT Constituent, BERA risk driver
ZINC	mg/kg	63	100%	276	780	318	10000	NA	109	2.9		Yes	Yes	EPC exceeds Ecological SCO, BERA risk driver				
LEAD	mg/kg	63	100%	155	390	181	1000	NA	63	2.9		Yes	Yes	EPC exceeds Ecological SCO, BERA risk driver		Yes		
CHROMIUM	mg/kg	63	100%	132	410	160	1500	NA	41	3.9		Yes	Yes	EPC exceeds Ecological SCO, BERA risk driver			Yes	EPC significantly elevated above Ecological SCO, BERA risk driver
CADMIUM	mg/kg	63	100%	15.3	52.0	18.6	9.3	2.0	4	4.6		Yes	Yes	EPC exceeds Commercial and Ecological SCO, BERA risk driver			Yes	EPC significantly elevated above Ecological SCO, BERA risk driver
COPPER	mg/kg	63	100%	117	330	138	270	NA	50	2.8		Yes	Yes	EPC exceeds Ecological SCO, BERA risk driver				
SILVER	mg/kg	63	90%	3.89	13.0	4.42	1500	NA	2	2.2		Yes	Yes	EPC exceeds Ecological SCO, BERA risk driver				
NICKEL	mg/kg	63	100%	34.1	87.0	39.6	310	NA	30	1.3		Yes	Yes	EPC exceeds Ecological SCO, BERA risk Driver				
ANTIMONY	mg/kg	63	34.9%	0.39	0.87	0.46	NC	-	NC	-			No	No Commercial or Ecological SCO				
SODIUM	mg/kg	63	66.7%	265	400	236	NC	-	NC	-			No	No Commercial or Ecological SCO				
ARSENIC	mg/kg	63	96.8%	4.97	12.0	5.53	16	NA	13	NA			No	EPC does not exceed Commercial or Ecological SCO				
CYANIDE	mg/kg	63	19.0%	1.50	2.30	0.84	27	NA	NC	-			No	EPC does not exceed Commercial SCO, no Ecological SCO				
BARIUM	mg/kg	63	100%	173	320	190	400	NA	433	NA		Yes	Yes	BERA risk driver				
BERYLLIUM	mg/kg	63	100%	0.34	0.77	0.38	590	NA	10	NA			No	EPC does not exceed Commercial or Ecological SCO				
MANGANESE	mg/kg	63	100%	291	450	304	10000	NA	1600	NA			No	EPC does not exceed Commercial or Ecological SCO				
SELENIUM	mg/kg	63	100%	1.02	2.00	1.12	1500	NA	3.9	NA			No	EPC does not exceed Commercial or Ecological SCO				
ALUMINUM	mg/kg	63	100%	4848	14000	5544	NC	-	NC	-			No	No Commercial or Ecological SCO				
COBALT	mg/kg	63	100%	5.24	13.0	5.83	NC	-	NC	-			No	No Commercial or Ecological SCO				
IRON	mg/kg	63	100%	12022	31000	13325	NC	-	NC	-			No	No Commercial or Ecological SCO				
VANADIUM	mg/kg	63	100%	11.8	32.0	13.5	NC	-	NC	-		Yes	Yes	BERA risk driver				
METHYL MERCURY	mg/kg	63	79.4%	0.004	0.014	0.007	NC	-	NC	-			No	No Commercial or Ecological SCO	Yes			
Other Parameters																		
LUBRICATING OIL	mg/kg	63	61.9%	497	2000	523	NC	-	NC	-			No	No Commercial or Ecological SCO				
PETROLEUM HYDROCARBONS (#6 FUEL OIL)	mg/kg	63	1.6%	230	230	NA	NC	-	NC	-			No	No Commercial or Ecological SCO				
AVIAN DIOXIN EQUIVALENT	mg/kg	-	-	-	-	-	-	-	-	-			No	No Commercial or Ecological SCO		Yes		
MAMMALIAN DIOXIN EQUIVALENT	mg/kg	-	-	-	-	-	-	-	-	-		Yes	Yes	BERA risk driver		Yes		

Notes:
1. New York State Department of Environmental Conservation (NYSDEC) Part 375-6.8 Soil Cleanup Objectives (SCOs) for Commercial Use (Comm) and the Protection of Ecological Resources (Eco) (2006).
2. Constituents producing unacceptable hazards for avian and mammalian receptor populations evaluated in the BERA based on lowest effect level doses
3. Constituents of concern identified in March 23, 2018 letter from United States Fish and Wildlife Service (USFWS) to O'Brien & Gere.
4. Based on United States Environmental Protection Agency (USEPA) Persistent Bioaccumulative Toxic (PBT) Chemicals (40 CFR Part 372) October 29, 1999.

Acronyms:
COC - constituent of concern
EF - exceedance factor
EPC - exposure point concentration, the lower of the 95% upper confidence limit (UCL) (where available) or maximum concentration was applied
FS - Feasibility Study
NA - 95% UCL not calculated due to low detection (< 2 detections) or UCL less than Commercial or Ecological SCOs
NC - no applicable criteria/SCO
UCL - upper confidence limit of the mean concentration
mg/kg - milligrams per kilogram
ng/kg - nanograms per kilogram
ug/kg - micrograms per kilogram

APPENDIX 7
WASTEBEDS 1 THROUGH 8 MITIGATION WETLANDS AND UPLAND RESTORATION BASIS OF DESIGN

APPENDIX H

Mitigation Wetlands and Upland Restoration Basis of Design

Honeywell

October 2012
Revised January 2013

O'BRIEN & GERE

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1 INTRODUCTION

This Appendix presents the 100% level basis of design for the compensatory mitigation wetlands and restoration of adjacent uplands developed as part of the Integrated Interim Remedial Measure (Integrated IRM) for the Wastebeds 1-8 Site (WB 1-8, Site) located in the Town of Geddes, New York. Forthcoming documents will detail Operations, Maintenance, and Monitoring (OM&M) and the Construction Work Plan as they relate to the mitigation wetlands and restoration of adjacent upland areas. This appendix was prepared with input from Ryan Davis (AnchorQEA), Joseph McMullen (Terrestrial Environmental Specialists), Peter Ducey (SUNY Cortland, Herpetology), and Donald Leopold (SUNY ESF, Plant Ecology).

The wetlands described herein create and restore a minimum of 9.53-acres of wetland and aquatic habitat (minimum 2.30-acres of Connected Wetlands and 7.23-acres of Inland Wetlands) in order to mitigate impacts associated with the Willis Avenue/Semet Tar Beds Sites IRM, Wastebed B/Harbor Brook Site IRM, and Wastebeds 1-8 Integrated IRM. The design and execution of the Connected Wetland dredging and earthwork will be included as part of the Onondaga Lake Bottom Project (*i.e.*, Onondaga Lake Capping, Dredging, Habitat and Profundal Zone Sediment Management Unit 8 Final Design, herein referred to as 'Lake Final Design'; Parsons and Anchor QEA 2012). Details concerning these items will be presented in documents associated with that project. Because vegetation installation in the Connected Wetland will be coordinated with that of the Inland Wetlands and associated uplands, vegetation details are presented as part of the Integrated IRM Design for WB 1-8.

Prior to this design submittal, a preliminary design for the Connected Wetland was submitted to NYSDEC on November 21, 2008 (Honeywell 2008). The NYSDEC letter of June 4, 2009 provided comments on the preliminary design. The revised interim design for the Connected and Inland Wetland complex was submitted to NYSDEC on October 1, 2009 (Honeywell 2009). Comments on the revised interim design were received from NYSDEC on December 21, 2009, followed by Honeywell's response letter of February 12, 2010. The NYDSDEC provided additional comments in its July 2, 2010 letter (Hesler 2010), responses to which were incorporated into the Integrated IRM 50% Design submitted by Honeywell to NYSDEC on May 20, 2011 (O'Brien & Gere 2011). Comments on the 50% Design were received by Honeywell from NYSDEC on August 24, 2011. Responses to comments on the 50% Design were provided in a Wetland Interim Submittal (Honeywell 2011) on which NYSDEC commented on December 20, 2011 (Smith 2011). Honeywell provided responses to NYSDEC comments on the Wetland Interim Submittal on February 10, 2012 (Honeywell 2012), and NYSDEC commented on these responses in an email from Mr. Tracy Smith to Honeywell on March 7, 2012. Comments were incorporated into the Integrated IRM 95% Design submitted by Honeywell to NYSDEC on April 24, 2012. Comments on the 95% design were received by Honeywell from NYSDEC on June 29, 2012. Responses to comments on the 95% Design were provided in a response to comment letter of August 29, 2012 and incorporated into this submittal. Additional comment responses presented to NYSDEC via email (from Brad Kubiak to Tracy Smith) on October 16 have also been incorporated herein, as appropriate.

A summary of the NYSDEC Comments on the 50% Design and Wetland Interim Submittal that had yet to be fully addressed prior to submittal of the 95% Design and the respective responses are included with this Appendix as Attachment 1. These comments were previously listed in Section 1 of the 95% Report Appendix H, but have been moved to the attachment for this report.

2 WETLAND DESCRIPTIONS

The proposed wetland mitigation areas are located on the low-lying eastern shoreline of the Wastebeds 1-8 Site (**Sheet C-2**). The mitigation wetland complex will consist of three Inland Wetlands (*i.e.,* Inland Wetlands A, B, and C) and one wetland connected to Onondaga Lake (*i.e.,* Connected Wetland). Inland Wetland construction will include installation of a low-permeability liner system (see **Sheet C-80**), placement of a habitat layer (see Section 3.10 of this Appendix), and seeding and planting of target plant species (Section 3 of this Appendix). Connected Wetland construction will include dredging and placement of an isolation cap and habitat layer (details provided in the Lake Final Design), and installation of target plant species (discussed in Section 3 of this Appendix).

The spatial organization of mitigation wetlands, vegetative cover and necessary engineered facilities has been optimized to meet interim remedial objectives while providing a viable complex of upland and wetland communities that tie together across the Site (Honeywell 2011).

Microtopography will be provided in wetlands by using a ripper to facilitate 2" plug installation. Furrows will be ripped to a depth of approximately 4 to 6 inches, providing small scale elevation variability across which species of varied growth requirements may sort. Elevation variability will also be provided in wetlands by creation of Habitat Islands (**Sheets C-45** to **C-46, C-49** to **C-50**) and by installation of habitat structure (discussed in Section 2.1). Over time, biotic processes (*e.g.*, tussock formation by grasses and sedges, animal activities) and physical processes such as freezing and thawing will provide additional microtopographic variation.

2.1 HABITAT OBJECTIVES

The primary habitat objective associated with the design of the mitigation wetlands is to produce viable and sustaining wetland and aquatic habitat. The varied plant communities (further described in Section 3), topographic variability, shallow grade, and location of wetlands in a complex of upland and nearby lacustrine habitats will provide robust landscape-level diversity able to support a variety of fauna.

The shallow emergent and wet meadow conditions of Inland Wetlands A, B and C will allow for a diverse community of hydrophytes and provide a broad range of niches, further facilitating plant diversity, wildlife utilization and aesthetic value. The deep emergent portion of Inland Wetland A and the Connected Wetland will provide open water for utilization by waterfowl, wading birds, amphibians and reptiles. Various species of benthic macroinvertebrates, especially dragonflies (*Odonata*), will utilize shallow emergent areas. In addition, shallow emergent marshes provide optimal habitat for red-winged blackbirds (*Agelaius phoeniceus*) and support muskrat (*Ondatra zibethicus*). Wet meadow communities are likely to be utilized by mallards (*Anas platyrhynchos*), great blue herons (*Ardea herodias*), belted kingfisher (*Megaceryle alcyon*), green herons (*Butorides virescens*), black-crowned night-heron (*Nycticorax nycticorax*) and both native and migratory shorebirds, such as the spotted sandpiper (*Actitis macularia*). Mammal species that may utilize the wet meadow communities as transition to adjacent upland and lake habitats include otter (*Lontra canadensis*), beaver (*Castor canadensis*), and mink (*Mustela vison*).

Amphibian and reptile species targeted for the wetland complex share the ability to utilize both temporary and semi-permanent wetlands that are surrounded by terrestrial habitats lacking extensive mature forests (*i.e.,* conditions similar to those in upland areas adjacent to the mitigation wetlands). These species include green frog (*Lithobates clamitans*), leopard frog (*Lithobates pipiens*), spring peeper (*Pseudacris crucifer*), American toad (*Anaxyrus americanus*), painted turtle (*Chrysemys picta*), snapping turtle (*Chelydra serpentina),* and northern water snake (*Nerodia sipedon*). These species can utilize, and in most cases, prefer mixtures of field and scrub habitat with patches of less dense forest. In addition, targeted species are expected to utilize both the terrestrial and aquatic habitats provided, and some will move freely into Onondaga Lake.

The Connected Wetland will serve as a corridor for the movement of wildlife between the Lake and the adjacent wetland and upland habitats proposed at the Wastebeds 1-8 Site; the shallow design grades will facilitate animal movements as well as the transition from wetland to upland conditions by providing an area across which plant species may sort out according to water levels. In addition to the above listed species, the Connected Wetland may also harbor mudpuppy (*Necturus maculosus*) and musk turtle (*Sternotherus odoratus*) as both of these

species may prefer the habitat structure provided by the design and slow currents and forage (*e.g.,* small fish) provided by the connection to the lake.

The springtime effective height of wetland berms (during peak amphibian dispersal times) will be minimized due to the wetlands likely being full (*i.e.,* water level at weir elevation) or near full at this time. The upland vegetation communities (Sections 3.4 to 3.8 of this Appendix) will also provide functional corridors between the mitigation wetlands. Access pathway design has been modified to minimize impact on animal movements, specifically, the reach of pathway northwest of Wetland A has been removed (**Sheet C-50**) and the pathway between Wetland B and the Connected Wetland has been shifted inland to provide increased connectivity between these wetlands and between the Vegetative Cover and Onondaga Lake (**Sheet C-47**). Animal movements between the Connected and Inland Wetlands will be facilitated by a swale running between Wetland A and the Connected Wetland (**Sheet C-9**) and a vegetated corridor running between Wetland B and the Connected Wetland (**Sheet C-47**). Turtle nesting zones (described in 3.10; **Sheets C-44** to **C-50**) will facilitate nesting activities adjacent to mitigation wetlands. A stormwater swale running along the length of the eastern shoreline (**Sheets C-43** through **C-50**) will also provide a corridor through the wetland complex.

Habitat structure (designed with significant input from Dr. Peter Ducey, SUNY Cortland) will be provided by the placement of brush and rock piles and coarse woody debris as follows:

- Coarse woody debris (logs with 8-inch minimum diameter at breast height; root ball and braches attached to the extent possible)
  - Fifteen logs will be placed per acre in Inland Wetlands with a minimum of five logs that extend from the shallowest to deepest wetland zones in each wetland
  - On-site debris will be preferentially used, but off site sources may be required to achieve desired density and physical character of logs
- Brush piles (approximately 7 feet by 10 feet wide, approximately 2 feet tall)
  - Base consisting of two layers perpendicularly stacked logs (4 to 6 inches in diameter; 7 to 10 feet long)
  - Brush consisting of hardwood limbs, 2 inch maximum diameter
  - Two piles will be placed per acre in wet meadow and successional forest zones of Inland Wetlands (described in Section 3)
- Rock piles (25 square feet in size)
  - Base consisting of 4 to 10 inch angular rock stacked to a height of 12 inches (except in the Shallow Emergent zone where rocks will be stacked to a finished height of 24 inches)
    - 4 to 6 inches of void space between base layer rocks to facilitate animal entry and exit
  - Large flat rocks (approximately 2 square feet) will be placed randomly over the base layer and covering approximately 90% of the base
  - Five rock piles will be placed per acre in the wet meadow and shallow emergent zones of Inland Wetlands, and successional forest zones
    - One rock pile will be placed on the south side of each Habitat Island in Wetlands A and B

2.2 INLAND WETLANDS

Sufficient wetland hydrology will be maintained by berms, variable water depth control structures (**Sheet C-82**), and a low-permeability liner system (see **Sheet C-80**). Variable water level control structures (**Sheet C-82**) will be used in the Inland Wetlands to allow for modifications facilitating optimal hydroperiod. Bottom slopes within the Inland Wetlands are gradual, (*i.e.*, less than 5%), allowing for plant species to naturally sort out along gradients of soil moisture and flooding duration (Mitsch and Gosselink 2000). Though 7.23 acres of Inland Wetlands is required to compensate for prior wetland impacts, the current design indicates 7.6 acres of wetland

creation. This additional area is provided as a factor of safety given uncertainty in hydrologic modeling and on-the-ground processes of wetland development.

Inland Wetland hydroperiod has been extensively modeled and documented in the 50% design, 95% design, and Wetland Interim Submittal (O'Brien & Gere 2011, Honeywell 2011); however, an additional set of three models is presented in this document to show expected water levels in each zone of Inland Wetland A over a 30-year span from 1978 to 2008 (**Figures H-1, H-2 and H-3** and associated supporting data). Because similar water level patterns were observed across Inland Wetlands (O'Brien & Gere 2011, Honeywell 2011), Inland Wetland A was considered to be representative (and conservative because it is the deepest Inland Wetland). This 30-year model was created by compiling annual budgets created using the methods presented in O'Brien & Gere (2011). A conservative scenario was assumed with no runoff and no initial surface water (water depth 0-inches). The model suggests that the inland wetland naturally fills over the course of five years and desired hydrology within each of the three wetland zones is maintained thereafter (**Figures H-1, H-2 and H-3**). In order to reduce the duration of the natural filling period and provide for optimal plant community establishment, Inland Wetlands will be initially pumped full using water from Onondaga Lake (if natural precipitation is insufficient) (Section 3.11).

Inland wetland water turnover (renewal) rate for the average precipitation year (1991; O'Brien & Gere 2011) was estimated using standard methods (Mitsch and Gosselink 2000) (**Table H-1**). This conservative analysis (*i.e.,* it does not include potential flushing associated with springtime snow melt events) shows that the wetlands will likely flush multiple times on an average year. Consideration of these estimated water turnover rates, in combination with the likely scenario that each of the wetlands will be full during spring (**Figures H-1, H-2 and H-3**) (Honeywell 2011), suggests that the Inland Wetlands will provide viable springtime amphibian breeding habitat. Variability in the number of turnovers per year appears to be related primarily to the average wetland depth (deeper wetlands turn over more slowly) and secondarily to the ratio between watershed area and wetland area (wetlands with a relatively low ratio turn over more slowly).

Wetland A

Wetland A is designed to be 2.9 acres in size and provide a maximum water depth of 3 feet (see **Sheets C-49** and **C-50**). This wetland is the northernmost of the mitigation wetlands. Three habitat zones are proposed in this wetland: deep emergent (Habitat Modules 3A and 4A, per Parsons 2009), shallow emergent (Habitat Modules 5A and 6A) and wet meadow (Habitat Module 9A).

Following NYSDEC review of the 50% design, Wetland A was expanded by 0.3 acres to the current acreage. This expansion was to the northwest, into an area that was previously allocated to Vegetative Cover. Additionally, a portion of the access pathway that was proposed in the 50% design to encircle Wetland A has been removed to further enhance the function and value of this wetland.

Wetland B

Wetland B is designed to be 3.9 acres in size with a maximum water depth of 18 inches (see **Sheets C-45** through **C-47**). This wetland is located southeast of Wetland A. Shallow emergent (Habitat Modules 5A and 6A) and wet meadow community types (Habitat Module 9A) are planned for this area.

Wetland C

Wetland C is designed to be 0.8 acres in size with a maximum water depth of 18 inches (see **Sheet C-44**). This wetland is located south of Wetland B. The plant communities within this wetland will be wet meadow (Habitat Module 9A) and shallow emergent (Habitat Modules 5A and 6A).

2.3 CONNECTED WETLAND

The Connected Wetland is designed to be a freshwater marsh of a minimum size of 2.3 acres (**Sheets C-10** and **C-11**) with varied habitat characteristics ranging from deep emergent to wet meadow (details in Section 3). The proposed design specifies a main pool that will typically contain 3 feet of surface water and will be protected from Onondaga Lake wave energy by a spit that contains breeches to maintain an open connection facilitating free interchange of water with the Lake.

2.4 SUCCESS CRITERIA

Success criteria have been modified from prior submittals to establish consistency where possible between the Wastebeds 1-8 site and Onondaga Lake remedial programs. In this document, success criteria are presented for the Inland Wetlands and upland vegetation zones. Success criteria are tailored as needed to specific areas (*e.g.*, vegetation zones) on site in order to account for varying design objectives. In general, the success criteria are intended to guide evaluating success of the mitigation wetlands and associated upland restoration efforts. The success criteria will be applied in two stages. In Stage 1, data will be collected to verify that each vegetation zone has been constructed as designed. The Stage 1 criteria are focused on the physical parameters of each zone such as elevation, substrate and area. Following the successful construction of each zone, additional success criteria (Stage 2) will be used to evaluate vegetation establishment and use of the habitats by fauna. The Stage 2 criteria include parameters such as plant species structure and composition, and wildlife observations. The data that will be collected for Stage 1 and Stage 2 are listed in **Tables H-2** and **H-3**, respectively. Data collected from mitigation and restoration areas will be evaluated within an adaptive management framework to be presented in a forthcoming OM&M plan.

In addition to the data that will be collected for Stage 1 and Stage 2, **Tables H-2** and **H-3** indicate the types of information (*e.g.,* contract drawings, thresholds) to which those data will be compared and the duration of the monitoring/comparisons. In some instances, the comparison may indicate that a response action should be considered (*i.e.*, when the collected data consistently fall below the comparison metric). Response actions that may include additional plantings or the removal of invasive plant species are listed in **Tables H-2** and **H-3**.

3 TARGET VEGETATION ZONES FOR WETLAND AND UPLAND AREAS

Vegetation zones planned for each of the mitigation wetlands and adjacent uplands are described below, shown on **Sheets C-43** through **C-56**, and summarized in **Table H-4**. Nine vegetation zones have been established for this design. The Topsoil and Seeding technical specification (see **Appendix B**) itemizes plant species proposed for installation in each of the zones. The wetland zones, described below, are generally consistent with the Habitat Modules described in the *Draft Onondaga Lake Remedial Design Elements for Habitat Restoration* (Parsons 2009); however, due to their refined water depths, different nomenclature is used.

3.1 DEEP EMERGENT

The deep emergent community type is planned in areas where the average growing season (May 1 to October 31; Parsons (2009)) water depth does not drop below 24 inches, with a maximum depth of 36 inches. This community is planned in Wetland A and the Connected Wetland (**Sheets C-48** through **C-50**). The deep emergent community comprises nine proposed herbaceous species, though this species list, as well as those for other community types, may vary slightly depending on commercial availability of species at the time of planting. Species will be introduced to this zone by planting.

3.2 SHALLOW EMERGENT

The shallow emergent community type is planned in areas where the average growing season water depth ranges from 6 to 24 inches during a year with normal precipitation; however, this community may dry out during dry years (Edinger *et al.* 2002). This periodic drying is important to limit the ability of hybrid cattail (*Typha* x *glauca*) to become dominant in this zone and to encourage new cohorts of emergent species to germinate from the seed bank (van der Valk and Davis 1978, 1980; Boers and Zedler 2008). This community type currently comprises a diverse assemblage of grasses, sedges and forbs, and it will be included in Wetland A, Wetland B , Wetland C and the Connected Wetland as shown on **Sheets C-44** through **C-50.** In the shallow emergent community, as well as the wet meadow community described below, desired species will be introduced by a combination of seeding and planting. The seeding component will facilitate rapid ground coverage through the inclusion of a cover crop and fast-establishing species; by broadcasting seed of many species across the topographic range of the wet meadow and shallow emergent zones, seeding will also facilitate optimal matching of species with appropriate conditions for germination and establishment following the self-design concept (Mitsch and Gosselink 2000). The installation of plants (*i.e.*, 2 inch plugs) in addition to the seeding will provide for rapid creation of habitat structure and will facilitate placing individuals where they are expected to perform best in the wetland. It is recognized that the shallow emergent (and wet meadow) species have varied flooding tolerances/requirements. Hence planting of species within shallow emergent and wet meadow zones will consider particular species needs (*e.g.,* species such as water smartweed (*Polygonum amphibium*) and pickerel-weed (*Pontederia cordata*) would be planted in areas with more persistent inundation).

3.3 WET MEADOW

The wet meadow community type is planned in areas where the average growing season water depth ranges from 6 inches above to 6 inches below the habitat layer surface. The extent of the wet meadow community type is depicted on **Sheets C-44** through **C-50** and consists of a mix of seeding, plugs, and live stakes. A highly diverse assemblage of herbaceous species is currently targeted for this community, including species such as Canada wild rye (*Elymus canadensis*), Virginia wild rye (*E. virginicus*), and showy tick trefoil (*Desmodium canadense*), which will function as a cover crop as relatively slow-growing species establish. A modest component of woody species is also targeted for this community type, including live stakes of buttonbush (*Cephalanthus occidentalis*), red osier dogwood (*Cornus sericea*), and elderberry (*Sambucus canadensis*), among others. This woody species list is limited to species of relatively smaller growth in order to avoid the potential for large individuals tipping over and damaging engineered structures. The woody structure will complement the otherwise prevalent herbaceous cover in the mitigation wetlands. Tree tip-ups are an important habitat feature in wetlands, and will

be simulated via the placement of coarse woody debris, and piles of bush and rocks throughout wetland and upland zones (Section 2.1).

The roots of woody species selected will not penetrate the low permeability liner system currently proposed for the bottom, and portions of the berms, of the Inland Wetlands. It is likely that soil anoxia will limit rooting depth and those roots that do reach the liner will grow along and parallel to the liner rather than penetrate the 40 mil LLDPE material. Prior studies, such as Robinson and Handel (1995), Handel *et al.* (1997), Hutchings *et al.* (2001), and Mooney *et al.* (2007), show that woody species rarely penetrate soil liners and problems are limited to situations where woody roots exploit inconsistencies in clay liners.

3.4 SUCCESSIONAL OLD FIELD

Successional old field (similar to Module 8A) is targeted for access pathway and wetland berms (**Sheets C-43** through **C-56**), seep aprons (**Sheets C-46** to **C-50** and **C-54** to **C-55**) upper portions of the revetment (**Sheet C-79**), and potentially-erosive areas adjacent to the project (*i.e.*, "spot application" areas shown on **Sheets C-54** through **C-55).** This plant community will be introduced by applying a seed mix as part of a hydromulch or EcoBlanket® application.

The successional old field seed mix will also be applied as part of combined seeding/planting efforts in the following locations: shoreline stabilization interface (*i.e.,* shoreline meadow, **Sheets C-43** through **C-50B** and **C-51** through **C-53**), lower Ditch A restoration (*i.e.,* successional shrubland, **Sheet C-43**), and Vegetative Cover (*i.e.,* successional forest, **Sheets 43** through **C-45**, **C-47** through **C-48, C-50A** through **C-50B**).

In the *Wetland Interim Submittal* (Honeywell 2011) the successional old field seed mix (based on mix Ernst Conservation Seeds ERNX-181-1) varied slightly for application in different zones, however for logistical simplicity, these slightly different mixes were combined into one mix containing a variety of species tolerating a broad range of environmental conditions. Additionally, the list was slightly modified to include a greater proportion of species native to Central New York (as opposed to native to somewhere in the Eastern United States). In general, the species list comprises species that establish quickly facilitating soil stability and that have wide-ranging tolerances facilitating flexibility of application. Because this mix is targeted for berms adjacent to wetlands, facultative wetland species are included in the mix to facilitate the transition from upland to wetland conditions.

3.5 SHORELINE MEADOW

The shoreline meadow (similar to Module 8A) consists of a mix of seeding, plugs, and live stakes and is intended to restore a species (*i.e.*, *Spartina pectinata*) that was once abundant along the shore of Onondaga Lake (Pursh 1869, Faust and Roberts 1983) but is now restricted to small patches along the southern shore of the lake. This species will be planted as plugs over 40% of the shoreline meadow zone and is one of the few representatives of Onondaga Lake's inland salt marshes that also has the competitive ability to persist in non-saline systems and tolerate seasonally dry conditions (Bush 2002). Hence, this species is an ideal target species for the area intended to interface with the Onondaga Lake shoreline stabilization (**Sheets C-43** through **C-50B**, **C-51** through **C-53**, **C-86**) because of the fluctuating water levels in this area. The strong rhizomatous growth of this species (and others in the mix such as *Eupatorium* spp.) is expected to extend into the shoreline stabilization treatment and link the Wastebeds 1-8 restoration and Onondaga Lake shoreline stabilization efforts. The woody species component in this species mix is intended to provide additional habitat structure and cover for small animals traveling along the shoreline (*e.g.*, between Inland and Connected Wetlands).

3.6 SUCCESSIONAL FOREST

The successional forest (similar to Module 8B) plant list contains a mix of woody and old field species in seeding, pots, and live stakes that will allow areas subject to this planting (*i.e.,* Vegetative Cover, **Sheets C-43** through **C-45**, **C-47** through **C-48, C-50A** through **C-50B**) to succeed to a forested community similar to red maple-hardwood swamps typical of Central New York. Approximately 30% of the planting (as live stakes and potted shrubs on an area basis) will comprise shrubs to encourage development of complex canopy structure as the trees develop and to facilitate establishment of a propagule bank to support gap dynamics once the successional

forest matures. The species mix will tolerate wide ranging soil moisture conditions associated with the landscape position and Vegetative Cover soil treatment of the successional forest.

3.7 SUCCESSIONAL SHRUBLAND

The successional shrubland (similar to Module 8B; **Sheets C-43**, **C-83**, **C-84**) is intended to introduce a suite of species via seeding, pots, and live stakes to facilitate establishment of scrub shrub conditions along Ditch A complementing the wetland and successional forest areas to the north at Wetland C. The shrub community, consisting of live stakes over 90% of the successional shrubland zone, is intended to provide shade for lower Ditch A while limiting the size of woody species in order to limit the likelihood of large woody species that could tip over and impede ditch flows.

3.8 SWALE

A vegetated stormwater swale (**Sheet C-83**) is designed to extend over much of the eastern shoreline (**Sheets C-43** through **C-50**). This swale will likely contain standing surface water; therefore, emergent and wet meadow species were specified for planting, which consists entirely of seeding. Quick-establishing species capable of tolerating dry conditions with periodic flooding were also specified to stabilize swale banks. In order to not restrict swale flows, woody species were not included in the planting list for this area.

3.9 REVETMENT PLANTINGS

The revetment will be vegetated via seeding and the installation of live stakes as follows: 3-feet tall live stakes will be inserted through the stone face into the filter layer that will provide a rooting medium. Insertion of the stakes will be facilitated by creating pilot holes with a stinger or similar. Live stake species (listed in Topsoil and Seeding technical specification) were selected based on the capability of growing from this stock type, mature size (shrubs were selected in lieu of trees in order to avoid physical damage to the revetment), and tolerance of stressful growing conditions and include silky dogwood (*Cornus amomum*), pussy willow (*Salix discolor*), and elderberry (*Sambucus canadensis*), among others. Species will be inserted into the revetment in a stratified random (elevation strata for each species shown in the specifications) fashion in order to avoid monocultures while limiting species to elevations where they will likely perform best. Live stakes will not be planted below an elevation of 364 ft due to likely ice scour. From the top of the revetment stone face (372 ft) to the top of bank (variable elevation), 4 inches of topsoil will be placed (to enhance the seedbed), seeded with the successional old field seed mix (described above) and protected with a biodegradable erosion control blanket (**Sheet C-79**).

3.10 SOILS

Habitat Layer

The habitat layer of the Inland Wetlands and Vegetative Cover will consist of 12 inches of habitat subgrade (organic concentration 0.5% to 6%, pH from 5.5 to 7.5)) and 12 inches of topsoil (texture ranging from silt loam to sandy loam). Topsoil organic concentration will be a minimum of 3% in uplands and 5% in wetlands; soil pH will range from 5.5 to 7.5.

Wetland topsoil application is limited to a depth of 12 inches because application of deep, rich topsoils will favor aggressive (*e.g.*, invasive) species, thus limiting the potential to establish a diverse community of native species (Grime 1974, 1977, Keddy 2005). The proposed soil depths are considered to provide adequate rooting volumes for establishment and growth of desired vegetation and formation of hydric indicators in the upper part of wetland soils while minimizing risks associated with excessive topsoil use.

Soil organic matter percentages as low as 2% are adequate to establish native vegetation (Hauser 2009), and development of soils with organic matter concentrations typical of marshes of the Great Lakes region (9 to 31%) (Mitsch and Gosselink 2000) will likely occur over time as wetland vegetation develops and senesces on an annual basis. Hence, soil organic matter concentrations of 5% are considered to be rich enough to initiate wetland biogeochemical processes.

Turtle Nesting Zones

Turtle Nesting Zone locations were selected by Dr. Peter Ducey, following the general concept that turtles are expected to preferentially nest in areas with south facing slopes that are close to the mitigation wetlands. In these areas, the relatively coarse Habitat Subgrade (Type H in Select Fill technical specification) will be mixed with sand (40% by volume) and used in lieu of topsoil in order to facilitate nest building behavior. These soils will likely establish vegetation less readily than the topsoil used elsewhere on site (although sparse vegetation is favorable for turtle nesting); therefore, Turtle Nesting Zones will be subject to modified success criteria (**Table H-3**).

3.11 PLANT ESTABLISHMENT STRATEGY

Following placement and rough grading of topsoil, a two to three week waiting period will take place to the extent possible to allow for undesirable plant species to germinate. These initial germinants will be eliminated via herbicide applied by a licensed applicator. Herbicide will be selected and applied so as not to impede desired species from establishing within the wetlands. Tilling is not a preferred option for eliminating these germinants because turning the soil will likely introduce a new crop of seeds to the soil surface that could compete with desirable plant species introduced to the site via seeding and planting. If site soils require stabilization at times when seeding is not practicable, they shall be temporarily mulched using two tons per acre of straw.

In wet meadow and higher elevations of the shallow emergent zone inundation will be discouraged during the growing season of planting and seeding in order to facilitate plant establishment; however, water will be applied, as necessary, to achieve satisfactory establishment and growth. Following the initial growing season, Inland Wetlands will be allowed to fill with direct precipitation. If necessary, water will be pumped from Onondaga Lake in early April to fill each Inland Wetland prior to the first full growing season after planting. Water quality testing of Onondaga Lake water in the vicinity of the pump intake is not considered to be necessary because Onondaga Lake water is suggested to be a satisfactory source of water for the Connected Wetland and others included in the Lake Final Design. Runoff from adjacent portions of the site will be used once the final site remedy is completed or testing of storm water suggests that its use in the Inland Wetlands will not negatively affect wetland water quality.

Closely managing water levels during the growing season of plant/seed installation will facilitate optimal vegetation stand establishment not only by limiting anoxia stress but also by facilitating rapid installation of plants by mechanized processes when 'working in the dry.' Additionally, seed may float away or accumulate at the drift line if the site is flooded prior to germination or incorporation into the soil.

In most of the vegetation zones (shallow emergent, wet meadow, successional forest, successional shrubland, and shoreline meadow) vegetation will be established by installing plants and seeding in between the plants. In zones where the installed plants are woody (*i.e.*, successional forest and successional shrubland) seed may be installed by hydroseeding or similar mechanized means (see Topsoil, Seeding and Planting specification); however, in other zones where plantings are largely herbaceous, seed will be hand broadcast in between plants to limit plant damage associated with hydroseeding. Rates of seed application and plant installation as described in the Topsoil and Seeding specifications are consistent with industry norms (*e.g.*, Hammer 1997).

If necessary, temporary chain link fencing (10 foot tall panels) or similar will be installed around Successional Forest plantings to limit damage due to browse and rubbing by white-tailed deer (*Odocoileus virginianus*). If used, temporary fencing will remain in place until growth of the tree species canopy above the browse line is observed. Fencing or other methods may also be employed to limit herbivory by geese.

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Table H-1
Honeywell Wastebeds 1-8
Mitigation Wetlands and Upland Restoration Basis of Design
Estimated Minimum Number of Surface Water Turnovers During an Average Precipitation Year (1991)—
Inland Wetlands[1]

Wetland	Wetland area (acres)	Watershed area (acres)	Watershed area: wetland area ratio	Average wetland depth (feet)	Minimum annual inflow (gallons)	Average volume (gallons)	Estimated minimum number of turnovers per year
A	2.9	11.2	3.9	1.9	2,585,642	1,376,443	2
B	3.9	24.0	6.2	0.4	3,925,318	335,474	12
C	0.8	6.0	7.5	0.9	651,781	163,965	4

[1]Turnover is rate calculated as the quotient of wetland inflow (precipitation and runoff) and volume per Mitsch and Gosselink (2000). Inflow does not include snowmelt runoff events and are based on the precipitation and runoff data presented in Honeywell (2011) and O'Brien & Gere (2011).

Table H-2
Honeywell Wastebeds 1-8
Mitigation Wetlands and Upland Restoration Basis of Design
Stage 1 Success Criteria

Criteria	Means of evaluation	Timing of sampling/meeting threshold and Threshold Standard	Response action if threshold is not being met	Notes
Acreage	As-built survey	During and immediately following construction (*i.e.*, year 1) Compliance with contract drawings and specifications	Contract requirements must be met.	Acreage initially based on 'designed wetland boundary' shown on contract drawings. Verification of acreage in the Connected Wetland will occur as part of the Onondaga Lake Bottom CQAPP.
Elevation	As-built survey			Verification of elevations in the Connected Wetland will occur as part of the Onondaga Lake Bottom CQAPP.
Habitat layer thickness	Random spot check (10 per acre)			Verification of soil thicknesses in the Connected Wetland will occur as part of the Onondaga Lake Bottom CQAPP.
Topsoil and habitat subgrade grain size	Sample per CQAPP			Verification of grain size distribution in the Connected Wetland will occur as part of the Onondaga Lake Bottom CQAPP.
Topsoil and habitat subgrade organic matter concentration and pH	Sample per CQAPP			Verification of soil organic matter in the Connected Wetland will occur as part of the Onondaga Lake Bottom CQAPP.
Topsoil and habitat subgrade analytical chemistry per Subpart C of 40 CFR 261.20 and NYSDEC DER-10 Appendix 5	Sample per CQAPP			Verification of topsoil and habitat subgrade analytical chemistry in the Connected Wetland will occur as part of the Onondaga Lake Bottom CQAPP.

Table H-2
Honeywell Wastebeds 1-8
Mitigation Wetlands and Upland Restoration Basis of Design
Stage 1 Success Criteria

Criteria	Means of evaluation	Timing of sampling/meeting threshold and Threshold Standard	Response action if threshold is not being met	Notes
Plant spacing	Random spot check (10 per acre)			
Plant species composition	Random spot check (10 per acre) Review of seed mix labels Review of bills of lading for plant shipments			
Structure placement	Census of structures			Biologist will be present on site to direct structure placement.
Geomembrane	Evaluate per Section 3.2 of CQAPP	During construction		

Note: Additional monitoring efforts (such as water level monitoring, photographic log, qualitative wildlife observations, amphibian abundance and community composition, reporting) will be discussed in the OM&M plan.

Table H-3
Honeywell Wastebeds 1-8
Mitigation Wetlands and Upland Restoration Basis of Design
Stage 2 Success Criteria

Criteria	Means of evaluation	Timing of sampling	Threshold (or standard as applicable)	Timing of meeting threshold	Response action if threshold is not being met	Notes
Percent cover of vegetation	Quadrat sampling	Annual beginning in the year of construction (*i.e.*, year 1) and running until end of year 5	80% absolute cover	By end of second growing season (*i.e.*, year 2)	Re-seed or replant as necessary to achieve threshold coverage. Implement herbivory controls if needed. Sample soil from persistent areas of sparse growth and analyze for pH and organic matter concentration.	Due to accessibility and safety concerns (*e.g.,* steep, rocky terrain), revetment coverage will not be measured, but will be qualitatively evaluated remotely (*e.g.*, from a boat or the lakeshore) for adherence to the threshold. If significant replanting or re-seeding is necessary, the clock for the threshold of two consecutive years will re-start for only the repaired area Turtle nesting zones are subject to a success criterion of 20% cover of vegetation.
			85% absolute cover	By end of fourth growing season (*i.e.*, year 4) and maintained for two consecutive years		
Invasive species	Site inventory	Semi-annual in growing season of years 1 through 4	Invasive species are not present	Years 1 through 4	Remove observed invasive species.	Invasive species monitoring may be reduced to bi-annual or annual if conditions allow. If significant invasive control is required, the clock for the threshold of two consecutive years will re-start for the respective control areas only Due to accessibility and safety concerns (*e.g.,* steep, rocky terrain), the revetment will not be measured, but will be qualitatively evaluated remotely (*e.g.*, from a boat or the lakeshore) for adherence to the threshold. Access pathways are not subject to invasive species criterion though periodic traffic and maintenance will likely deter dominance of invasive species on this facility. Successional old field areas on the seep apron, northern shore and Nine Mile Creek portion of the site are not subject to invasive species criteria. Invasive species include purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), common reed (*Phragmites australis* – non-native genotype), blue cattail (*Typha* x *glauca*), Eurasian watermilfoil (*Myriophyllum spicatum*), water chestnut (*Trapa natans*), and yellow iris (*Iris pseudacorus*).
	Quadrat sampling	Year 5	Less than or equal to 5%	Year 5 (end of growing season) and maintained for two consecutive years	Remove observed invasive species to achieve maximum of 5% coverage.	

Table H-3
Honeywell Wastebeds 1-8
Mitigation Wetlands and Upland Restoration Basis of Design
Stage 2 Success Criteria

Criteria	Means of evaluation	Timing of sampling	Threshold (or standard as applicable)	Timing of meeting standard and / or threshold	Response action if threshold is not being met	Notes
Wetland acreage	Delineation per USACOE methods	Years 3 and 5	Minimum of 7.23 acres of Inland Wetland	Year 5	Increase weir height up to 6" above design elevation to retain additional water. Planting of additional facultative wetland species.	Methods inherently include the following wetland success criteria: • Minimum percent cover of facultative (FAC) wetland indicator species or wetter: 51% • Presence of hydric soil indicators • Inundation or the presence of the water table at less than or equal to a depth of 12-inches from the soil surface for at least 5% (consecutive days) of the growing season (USACOE 2009)
Wetland surface water quality (pH, conductivity, dissolved oxygen, turbidity, and temperature)	Multi-parameter probe sample of wetland surface water	Annual during years 1 through 5	New York State Ambient Water Quality criteria	Maintained below threshold from years 1 through 5	Evaluate potential sources of exceedances. Potentially temporarily modify weir elevation to encourage greater rate of water turnover.	
Wetland chloride concentration in surface water	Grab sample of wetland surface water or probe	Annual during years 1 through 5	230 ppm[1]	Maintained below threshold from years 1 through 5	Evaluate potential sources of elevated chloride. Potentially temporarily modify weir elevation to encourage greater rate of water turnover.	Chlorides measured at levels in excess of criteria will trigger evaluation of the biological community of the wetland if there is an unexplained absence of fauna in the inland wetlands following the second annual monitoring event. This biological evaluation could include benthic macroinvertebrate community assessment, wildlife population evaluation, soil/sediment and/or surface water toxicity testing, and/or biota tissue analysis.
Successful reproduction of amphibians	Methods differ depending on life-stage. Evaluation to confirm presence of all life stages (eggs, larvae / tadpoles, juveniles / metamorphs, and adults) for at least one species of frog. 1. Spring call surveys 2. Visual observations 3. Summer dip netting or minnow trapping	Annual – with periodic events throughout growing season until all life stages are confirmed	Each to be met: 1. Calling of one or more species of frog 2. Presence of eggs or egg masses of at least one species 3. Presence of tadpoles or metamorphosing tadpoles 4. Capture of recent metamorphs/juveniles	By end of year 3	Biological and chemical evaluation to identify potential factors inhibiting amphibian reproduction. Corrective actions to repair or modify identified factors inhibiting amphibian reproduction.	This biological and chemical evaluation will include review of data regarding amphibian reproductive success from annual surveys, assessment of habitat condition, evaluation of water quality parameters, and any other potential factors inhibiting amphibian reproduction. If the evaluation is unable to provide a basis for inhibition of amphibian reproduction, laboratory or in-situ studies will be performed to evaluate the suitability of the inland wetland surface water for amphibian reproduction. The scope of the study, to be discussed with the NYSDEC prior to performance, may include a modified FETAX (standard amphibian toxicity test) study performed by a local laboratory, or an in-situ study where egg masses or larvae are placed within enclosures in the wetlands and control sites. Sediment toxicity testing may be performed following the surface water testing to assist in the interpretation of the collected data.

	4. Visual surveys or pitfall trapping					

Note: Additional monitoring efforts (such as water level monitoring, photographic log, qualitative wildlife observations, amphibian abundance and community composition, reporting) will be discussed in the OM&M plan. Additional monitoring in the successional forest beyond five years will be performed if the five-year monitoring data suggest that stand development is not moving on a favorable trajectory. Similar to the Geddes Brook Restoration, at the end of 5 years, the collected data for the successional forest will be evaluated for comparison against success criteria to determine if additional monitoring and maintenance is necessary. In areas where planting is not complete by the end of June, Stage 2 criteria will be applied beginning in the first full growing season after planting, otherwise Stage 2 criteria will be initiated during the same year as planting. In this table, year 1 refers to the first success criteria monitoring event.

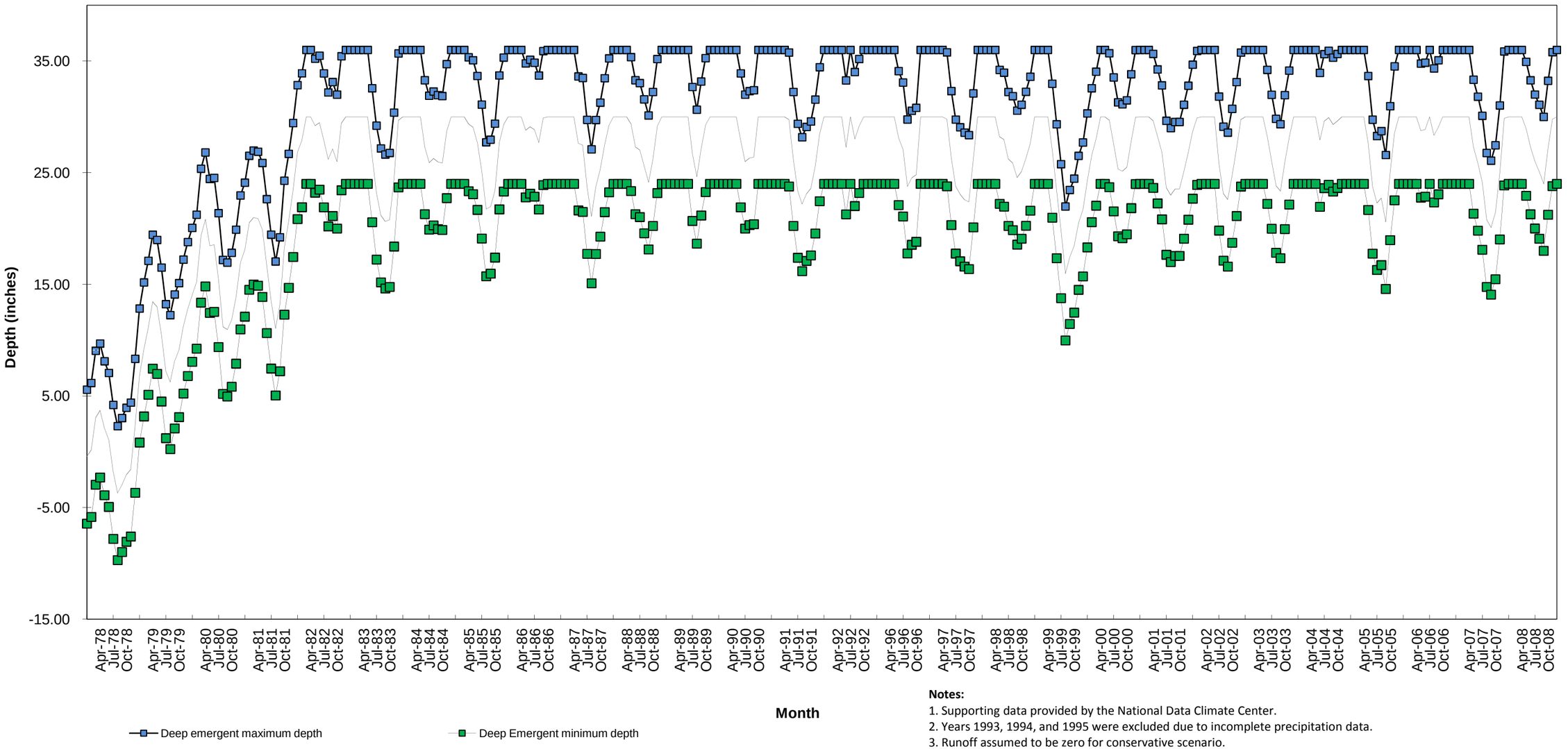
[1]United States Environmental Protection Agency (USEPA). 2009. *National Recommended Ambient Water Quality Criteria*. Office of Water. Office of Science and Technology.

Table H-4
Honeywell Wastebeds 1-8
Mitigation Wetlands and Upland Restoration Basis of Design
Vegetation Zone Summary

Vegetation zone		Habitat module[2]		Representative biota		
Name	Water depth range (inches)[1]	Number	Water depth range (inches)[1]	Flora[3]	Fauna	Target areas (elevations refer to finished grades)
Deep emergent wetland	24 to 36	4A	12 to 36	Table 4		368.5' to 369.5' in Wetland A 359.5' to 360.5' in the Connected Wetland
Shallow emergent wetland	6 to 24	5A, 6A	6 to 24, 12 to -12	Tables 1 and 5	Consistent with Table 4.8 in Parsons (2009), except presence of fish in inland wetlands	369.5' to 371' in Wetland A 367.5' to 368.5' in Wetland B 368.5' to 369.5' in Wetland C 360.5' to 362' in Connected Wetland
Wet meadow	6 to -6	9A	12 to -12	Tables 1 and 6		371' to 372' in Wetland A 368.5' to 369.5' in Wetland B 369.5' to 370.5' in Wetland C 362' to 364' in Connected Wetland[4]
Successional forest		8A, 8B		Tables 2 and 7		Vegetative Cover.
Successional shrubland		8A, 8B		Tables 2 and 11		From top of river stone installation in Lower Ditch A to edge of nearby Vegetative Cover.
Successional old-field	NA	8A	NA	Table 2	Consistent with Table 4.8 in Parsons (2009), green frog, spring peeper, American toad, painted turtle, snapping turtle, and northern water snake may also seasonally use these areas	Banks associated with access pathways, wetlands; seep aprons; immediately above revetment stone face to top of wastebed berm; incidental disturbed areas not part of a particular vegetation zone.
Swale		8A		Table 3		Bottom of drainage swales
Shoreline meadow		8A		Table 2 and 10		366.5' to lake-side edge of access pathway
Revetment - joint plantings	NA	8B	NA	Table 12	Belted kingfisher, green heron, songbirds, small mammals	364' to 372'on revetment

[1]Negative numbers indicate water levels below the soil surface.
[2]Inland wetland zones may also be listed as Habitat Module 9A.
[3]Tables are presented in Topsoil, Seeding and Planting specifications.
[4]For consistency with the design of wetlands directly connected with Onondaga Lake, the wet meadow zone is extended up to 364'.

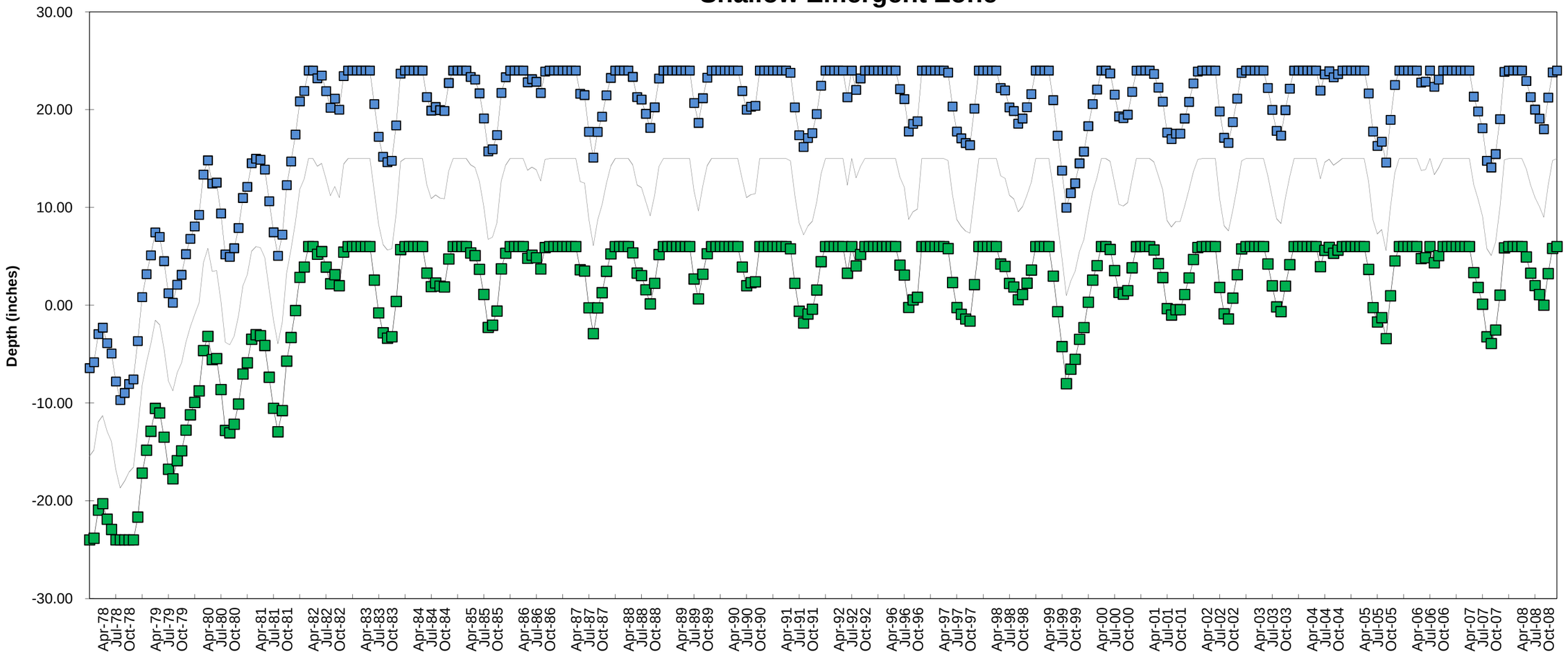
Figure H-1
Honeywell Wastebeds 1-8
Mitigation Wetlands and Upland Restoration Basis of Design
Wetland A Monthly Hydrograph - Wetland Starting Empty
1978 to 2008
Deep Emergent Zone



Notes:

1. Supporting data provided by the National Data Climate Center.
2. Years 1993, 1994, and 1995 were excluded due to incomplete precipitation data.
3. Runoff assumed to be zero for conservative scenario.
4. Gray lines indicate water depths at midpoint elevations between zones.
5. Depths are limited at -24 inches due to the presence of an impermeable LLDPE liner at that depth.

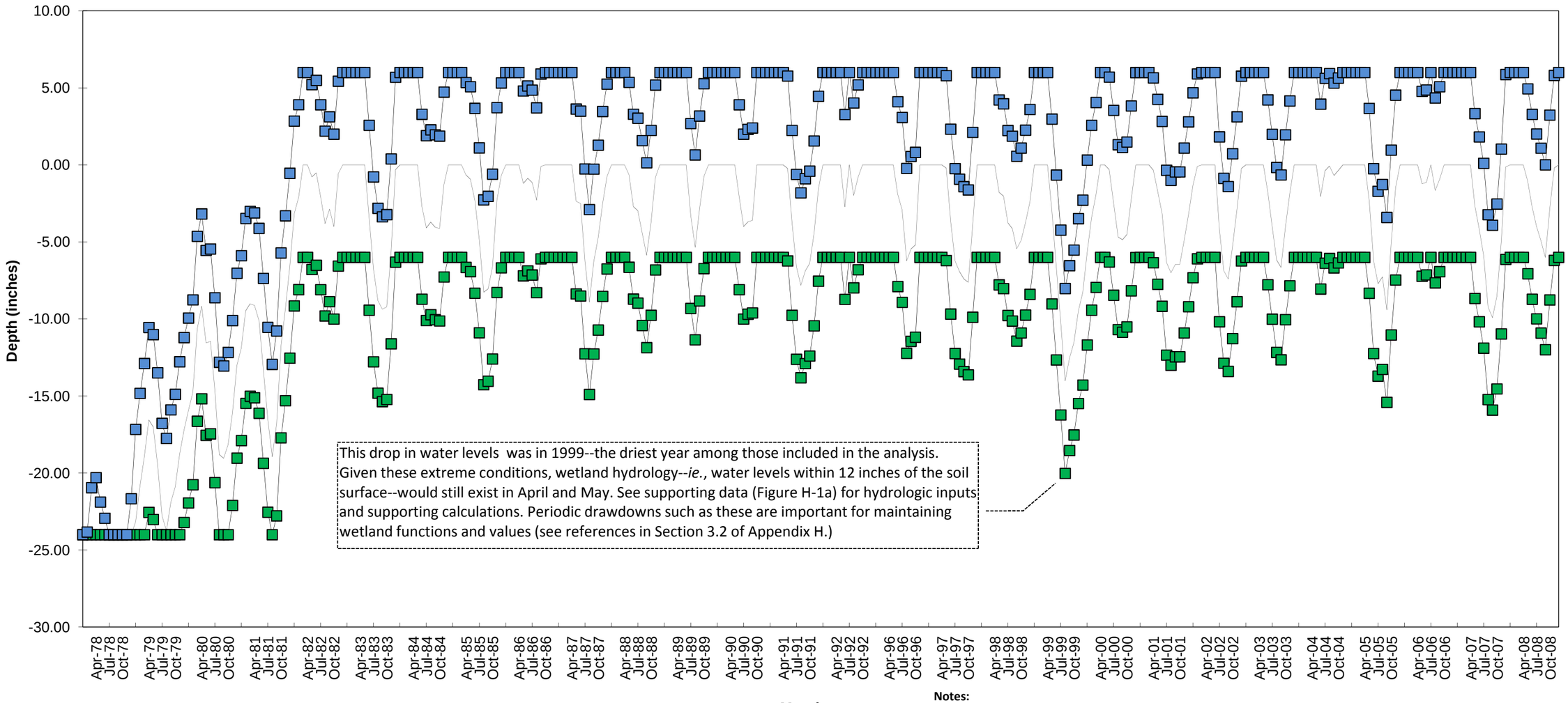
Figure H-2
Honeywell Wastebeds 1-8
Mitigation Wetlands and Upland Restoration Basis of Design
Wetland A Monthly Hydrograph - Wetland Starting Empty
1978 to 2008
Shallow Emergent Zone



Notes:

1. Supporting data provided by the National Data Climate Center.
2. Years 1993, 1994, and 1995 were excluded due to incomplete precipitation data.
3. Runoff assumed to be zero for conservative scenario.
4. Gray lines indicate water depths at midpoint elevations between zones.
5. Depths are limited at -24 inches due to the presence of an impermeable LLDPE liner at that depth.

Figure H-3
Honeywell Wastebeds 1-8
Mitigation Wetlands and Upland Restoration Basis of Design
Wetland A Monthly Hydrograph - Wetland Starting Empty
1978 to 2008
Wet Meadow Zone



Notes:

1. Supporting data provided by the National Data Climate Center.
2. Years 1993, 1994, and 1995 were excluded due to incomplete precipitation data.
3. Runoff assumed to be zero for conservative scenario.
4. Gray lines indicate water depths at midpoint elevations between zones.
5. Depths are limited at -24 inches due to the presence of an impermeable LLDPE liner at that depth.

WASTEBEDS 1-8 INTEGRATED IRM, MITIGATION WETLAND, AND REMEDIATION AREA A HYDRAULIC CONTROL SYSTEM – RESPONSE TO COMMENT SUMMARY AS PER NYSDEC COMMENT 59 ON 95% DESIGN REPORT

Comment 59. *Pages 2-3, Paragraph 4, Section 1, bullets. A formal response to comments summary should be submitted to supplement the list of bullets in this appendix. The list does not provide the comment along with the response and some references refer to the place in the report where the topic is discussed, but do not respond to the concerns of the comment. Also, it is believed some of the previously submitted responses would need to be updated/revised. Responses to comments can be presented as an attachment to this appendix.*

Response: This Attachment lists the original comments and updated (where needed) responses on the 50% Design and Wetland Interim Submittal. Comments/responses are limited to those that were listed in Section 1 of the 95% Design Appendix H and intended to be addressed in that design or the Operations, Maintenance and Monitoring Plan. Where applicable, this attachment also provides locations where these comments/responses are incorporated into the 100% Design.

50% DESIGN REPORT COMMENTS

Comment 2.8. *Page 13, Paragraph 2, Section 2.5.1. As discussed in NYSDEC's October 27, 2008 comments on the draft Wastebeds 1 through 8 RI, surface water samples were collected in Onondaga Lake in Sediment Management Unit (SMU) 3 during PDI Phase I for the purpose of assessing transport of contaminants from Wastebeds 1 through 8 to the lake (Parsons, 2005). The data show that seeps, groundwater, and/or runoff from the Wastebeds 1 through 8 site are contributing to detectable levels of BTEX, naphthalene, and phenol within the surface waters of the lake near this site. This data set from 2005 has stations (e.g., OL-STA-30010-SW through 30013) near shore adjacent to the wetland areas and should be used to supplement the data collected in 1999 at W52 as part of the lake RI.*

Updated Response: Water quality testing of Onondaga Lake water in the vicinity of an intake to be placed to draw surface water is not considered to be necessary because Onondaga Lake water is suggested to be a satisfactory source of water for the Connected Wetland and others included in the Lake Final Design. Runoff from adjacent portions of the Site will be used once the final Site remedy is completed or testing of stormwater suggests that its use in the Inland Wetlands will not negatively affect wetland water quality.

Comment 2.9. *Page 13, Paragraph 3, Section 2.5.1. The water quality samples listed here are over 10 years old. More recent water quality sampling should be used to establish baseline conditions which may be useful in determining suitability of the connected wetlands for amphibians. In addition, the water quality parameters listed here do not include all parameters that could potentially affect amphibians (see Section 2.5.2). Therefore, additional sampling inclusive of amphibian-specific parameters should be performed.*

Response (original): Water quality sampling within the Connected Wetland will be performed following construction. Water quality testing of Onondaga Lake water in the vicinity of an intake to be placed to draw surface water is not considered to be necessary because Onondaga Lake water is suggested to be a satisfactory source of water for the Connected Wetland and others included in the Lake Final Design. Additional monitoring efforts (such as water level monitoring, photographic log, qualitative wildlife observations, amphibian abundance and community composition, reporting) will be discussed in the OM&M plan.

Updated Response: Location of Incorporation: Water quality sampling is addressed in Table H-3 and within the forthcoming OM&M Plan.

Comment 2.10. *Page 13, Paragraph 4, Section 2.5.2. Although there are few water quality criteria specifically developed for amphibians, general state and federal water quality criteria should be used to screen potential risks to amphibians, along with the specific parameters identified in this paragraph. General information of water quality parameters, such as pH, dissolved oxygen, and nitrogen, and references to some amphibian toxicity studies are provided in Odum and Zippel (2011).*

Updated Response: Location of Incorporation: Table H-3. Chlorides measured at levels in excess of criteria will trigger evaluation of the biological community of the wetland if there is an unexplained absence of fauna in the Inland Wetlands following the second annual monitoring event. This biological evaluation could include benthic macroinvertebrate community assessment, wildlife population evaluation, soil/sediment and/or surface water toxicity testing, and/or biota tissue analysis.

Comment 2.12. *Page 13, Paragraphs 6 and 7, Section 2.5.3. Approval of the "inland wetland" concept for mitigation wetlands was contingent on the ability of the created wetlands to support amphibian breeding. Assessment of the water quality and quantity within the wetland to meet this function will be a requirement of the Operation, Maintenance, and Monitoring Plan and a determinative factor to evaluate success of the mitigation wetlands. Future evaluations will also have to include restoration success monitoring and management.*

Water quality monitoring should commence immediately after the IRM to enable corrective actions to be implemented, if necessary, to support amphibian breeding and other uses. Toxicity tests should also need to be performed, as requested in Specific Comment 12 of NYSDEC's December 21, 2009 comments on the October 1, 2009 Wetland Mitigation Design (Interim Submittal) and reiterated in NYSDEC's July 2, 2010 letter to Honeywell. Measureable water quality targets, including both general and amphibian-specific ones (see Specific Comment 6 of NYSDEC's December 21, 2009 comments), must be established for both connected and inland wetlands to ensure that the wetland design and target species are appropriate.

Response (original): Comment noted; additional details are provided in the Wetlands Interim Submittal.

Updated Response: See response to Comment 2.10. Location of Incorporation: Table H-3.

Comment 3.17. *Page 18, Paragraph 8 (continued onto next page), Section 3.8. More detail of the microtopography and deep pools should be provided in the next design submittal. Also, it is stated here that the inland wetland areas will have up to 3 feet of water above the low permeability liner. With this much head on the liner, what is the potential for leakage to occur? How would any leaks be detected and repaired? Please discuss. The sheets associated with inland wetlands should be listed as C-6 to C-9 and C-11 to C-12. In the last sentence, a proposed liner system is shown on Sheet C-32, rather than Sheet C-33. Please revise.*

Updated Response: Section 2 of Appendix H, Sheet C-90 of Appendix A. Microtopography will be provided in wetlands by using a ripper to facilitate 2-inch plug installation. Furrows will be ripped to a depth of approximately 4 to 6 inches, providing small scale elevation variability across which species of varied growth requirements may sort. Elevation variability will also be provided in wetlands by creation of Habitat Islands (Sheets C-45 to C-46, C-49 to C-50) and by installation of habitat structure (discussed in Section 2.1 of Appendix H). Over time, biotic processes (*e.g.*, tussock formation by grasses and sedges, animal activities) and physical processes such as freezing and thawing will provide additional microtopographic variation.

As per updates to Table H-2, CQAPP QA/QC conditions must be met to facilitate proper liner installation and function.

Comment 3.20. *Page 19, Paragraph 5, Section 3.9.1. The segment of Ditch A from where it discharges to approximately 50 feet upstream has been characterized as an embayment with lacustrine and littoral features. Since this segment of the ditch will be disturbed as a result of remediation, the embayment should be returned to its current status post remediation. However, it is not clear if this restoration has been incorporated into the IRM design. Please discuss.*

Updated Response: Ditch A restoration is addressed in Section 3.7 of Appendix H; Sheets C-43 and C-90; Topsoil, Seeding and Planting Specifications. This portion of Ditch A is anticipated to be returned to existing geometry and grade after excavation of substrate and placement of the habitat layer, and a successional shrubland community will be planted along the banks.

Comment C.2. *Sheets C-5 to C-12. The proposed vegetative cover is not shown between the eastern shoreline collection system and the lake shoreline (edge of water line). The extent of the shoreline stabilization and/or*

vegetative cover in this area (including proposed elevations/contours) should be shown on these grading plans.

Updated Response:. The extent of shoreline stabilization and/or vegetative cover has been shown on the associated drawings, Sheets C-43 to C-50B, in accordance with the comment.

Comment C.3. *Sheets C-6 to C-12. The boundaries of the inland wetland cells and connected wetlands should be clearly delineated on the design sheets to show the limits for the acreages listed (e.g., is the Inland Wetland A area of 2.6 acres based on the 371 ft contour line?).*

Updated Response: The anticipated boundaries of the Inland and Connected Wetland cells have been depicted on revised Sheets C-44 to C-50 in Appendix A.

Comment C.4. *Sheets C-7 and C-8 and Sheets C-26 and C-27. Sheets C-7 and C-8 show three local topographic highs in Wetland B. However, these are not evident on sheets C-26 and C-27. Please revise as appropriate.*

Updated Response: The habitat islands (topographic highs) are now called out on Sheets C-43 to C-50B.

Comment C.7. *Sheet C-12. Proposed spot elevations within the vegetative cover areas should be shown on this sheet and other sheets to ensure that the design shows a 2-ft-thick cover. The vegetative cover shown on this sheet does not appear to be 2 ft thick (existing contours of 365 to 367 ft with proposed contour of 366 ft at the base of the path).*

Updated Response: Design topographic details have been included on Sheets C-43 to C-50B in accordance with the comment.

Comment C.14. *Drawing C-28. The drawing indicates "Limits of grading and restoration to be coordinated with Onondaga Lake Bottom Restoration Project." The indicated areas are generally 30+ feet from the "edge of water" and so appear outside the scope of the elevations provided in the capping and dredging design for the lake. Specific details for these areas need to be provided in the next design document. Additionally, the details for the treatment of the "upland" areas need to be provided.*

Original Response: The distance of the connected wetland to the edge of water will be revised to shift the connected wetland, as depicted on Figure D-4 of the Draft Onondaga Lake Capping, Dredging, Habitat and Profundal Zone (Sediment Management Unit 8) Draft Final Design (Parsons and Anchor QEA 2011) and will be provided as part of the 95% Design. Additional details of the "upland" areas are provided in the wetlands interim submittal.

Comment C.16. *Drawings C 30 and 31. Cross sections should indicate the lake water surface or "edge of water" as depicted on the planar drawings as well as access paths and groundwater system details. The cross-sections do not appear to accurately represent the 15 – 20 ft of proposed access path between the lake and the wetland cells. Please revise the cross sections accordingly.*

Updated Response. Wetland cross sections presented on Sheet C-77 have been revised in accordance with the comment.

J.1-8: *Page 2, Paragraph 2, Description of Design. The 50% and/or 95% designs should also present the integration of the wetland mitigation with the shoreline stabilization work as well as the dredging/capping/restoration in adjacent lake areas. They should also include detailed discussions of the operation, maintenance, and monitoring of the isolation cap and wetland systems.*

Updated Response: The shoreline meadow (similar to Module 8A) is intended to restore a species (*i.e.*, *Spartina pectinata*) that was once abundant along the shore of Onondaga Lake (Pursh 1869, Faust and Roberts 1983). The strong rhizomatous growth of this species (and others in the mix such as *Eupatorium* spp.) is expected to extend into the shoreline stabilization treatment and link the Wastebeds 1-8

restoration and Onondaga Lake shoreline stabilization efforts. See Section 3 of Appendix H and forthcoming OM&M Plan.

J.1-13*: Page 3, Water Quality. It is proposed that runoff from the Wastebeds 1-8 site supplemented with water pumped from the lake, if needed, would provide the water source for the proposed 5.4-acre inland wetland areas. Since both surface water and groundwater outflow are assumed to be negligible, evapotranspiration was assumed to be the only water loss mechanism in the water budget analysis. This approach could potentially result in stagnant conditions with associated poor water quality. Measures to increase the flushing of the system and maintain acceptable water quality throughout the year should be included in the design. Water quality modeling and monitoring should be included in the design and operation, respectively, to ensure that water quality does not fall below acceptable levels.*

Updated Response: Section 2.2 and Table H-1 of Appendix H have been revised in response to the comment. Inland wetland water turnover (renewal) rate for the average precipitation year (1991; O'Brien & Gere 2011) was estimated using standard methods (Mitsch and Gosselink 2000) (Table H-1). This conservative analysis (*i.e.,* it does not include potential flushing associated with springtime snow melt events) shows that the wetlands will likely flush multiple times on an average year.

J.1-28*: Attachment A, Drawing G-4. The sections should show the groundwater collection trench on the left side of Cross Sections A and B and the seep collection trench and groundwater collection trench on the left and right sides of Cross Section C, respectively. Each section should also show a depiction of the groundwater surface. In addition, for Cross Section C, an isolation layer and habitat layer should also be shown from the top of the berm down to the lake shoreline to ensure that contamination in this area is controlled by the collection system and does not migrate to the lake or impact any plantings or wildlife along the shoreline.*

Updated Response:. Seep and groundwater collection systems have been included on the cross-section of Sheet C-77.

Comment J.2. *Page 2, Paragraph 1, Section 2. Management of the wetland mitigation areas should include adherence to pre-established success criteria specifying target levels of plant cover, diversity, and other factors at various times. In the third sentence, Sheet C-32, rather than C-33, should be referenced.*

Updated Response: Section 2.4 of Appendix H; Tables H-2 and H-3 have been revised in response to the comment. Success criteria are tailored as needed to specific areas (*e.g.*, vegetation zones) on site to account for varying design objectives. The success criteria will be applied in two stages. In addition to the data that will be collected for Stage 1 and Stage 2 (*e.g.,* percent cover of vegetation, plant species composition, and invasive species cover), Tables H-2 and H-3 indicate the types of information (*e.g.,* contract drawings, thresholds) to which those data will be compared and the duration of the monitoring/comparisons. These tables are adapted from Appendix K of the *Onondaga Lake Draft Final Design (DFD)*.

Comment J.4. *Page 3, Paragraph 1, Section 2.2. Sheet C-32, rather than C-33, should be referenced. Also, it is stated that variable water level control structures will be used in the inland wetlands to facilitate optimal hydrology. Although the Appendix C drawings show outlet (discharge) pipes for each of the three inland wetlands, variable water level control structures are not shown. These features should be added to the drawings and include the range of water elevations for each wetland.*

Updated Response: Variable water level control structures have been included on the drawings as requested, as well as a table including outlet structure dimensions and elevations (Sheet C-82).

Comment J.5. *Page 3, Paragraphs 3 and 4, Section 2.2. The Draft Onondaga Lake Remedial Design Elements for Habitat Restoration (Parsons, 2009) lists Module 6A as having water depths between 1 ft above and 1 ft below the water. The depths of this module for Wetlands B and C are given as a maximum water depth of 18 inches. In instances where module descriptions differ between reports, notes should be added or referenced (e.g., reference Section 3.0 here).*

Updated Response: Table H-4 of Appendix H. Wetland zones are generally consistent with the Habitat Modules described in the *Draft Onondaga Lake Remedial Design Elements for Habitat Restoration* (Parsons 2009); however, due to their refined water depths, different nomenclature is used.

Comment J.7. *Page 4, Paragraph 4, Section 3.3. The role of structure should be incorporated into the tree tip-up discussion along with an estimate of the amount of structure (trees) that will be placed in and around the mitigation wetlands.*

Updated Response: Section 2.1 of Appendix H, Sheet C-90 have been revised in response to the comment. Tree tip-ups are an important habitat feature in wetlands, and will be simulated via the placement of coarse woody debris, and piles of bush and rocks throughout wetland and upland zones. The role of structure in providing robust landscape-level diversity able to support a variety of fauna is further described in Section 2.1 of Appendix H.

Comment J.8. *Page 5, Paragraph 2, Section 3.4. Honeywell should ensure that the final material selected for the habitat layer is compatible with wetland soil requirements.*

Updated Response: Section 3.10 of Appendix H, Topsoil, Seeding and Planting Specifications have been revised in accordance with the comment.

Comment J.10. *Page 6, Section 4.2. As discussed in NYSDEC's December 21, 2009 Comment 13, since both surface water and groundwater inflow and outflow are predicted to be negligible in dry and average precipitation years, evapotranspiration was predicted to be the only water loss mechanism in the water budget analysis. This approach could potentially result in stagnant conditions with associated poor water quality. Measures to increase the flushing of the system and maintain acceptable water quality throughout the year should be included in the design. Water quality modeling and monitoring should be included in the design and operation, respectively, to ensure that water quality does not fall below acceptable levels. Honeywell's February 12, 2010 response stated that this evaluation of water cycling within the inland wetlands would be performed as part of the 50% and 95% design submittals. It does not appear that this evaluation was included in this 50% design submittal*

Updated Response/Location of Incorporation: See response to 50% comment J.1-13.

Comment J.13. *Page 7, Paragraph 5, Section 4.3. Potential water quality criteria (limiting factors) are not presented here or in Section 2.5 of this 50% design report. Given past water quality issues and target wetland functions, water quality data should be part of baseline measurements. See comments on Section 2.5.*

Updated Response: Wetland surface water quality parameters (*i.e.,* pH, conductivity, dissolved oxygen, turbidity, temperature and chlorides) will be evaluated in comparison to federal and New York State Ambient Water Quality criteria and guidance values. Table H-3 has been, and the forthcoming OM&M Plan will be, revised in accordance with the comment.

Comment J.14. *Page 8, Section 5. The second bullet includes assessment of substrate suitability and placement. Additional details should be provided regarding what factors will be considered to determine whether the substrate material is suitable (e.g., vegetative growth, use of the habitat by fauna, sampling to confirm that COCs are not present). The last sentence in this Appendix indicates that the forthcoming 95% design submittal will include monitoring of the low permeability liner system associated with the Inland Wetlands, and therefore these concerns regarding substrate suitability should also be addressed in the next design submittal.*

Updated Response:. The Topsoil, Seeding and Planting Specifications dictate that clean fill and topsoil will be used. Methods of post-construction substrate quality monitoring are addressed in Tables H-2 (liner installation) and H-3 (surface water sampling and biological surveys) and will be further detailed in the forthcoming OM&M Plan.

Comment J.15. *Page 8, Paragraph 2, Section 5. Comparison to baseline conditions is not an appropriate method to determine the success of wetland mitigation, as baseline conditions are not comparable to created wetlands. The criteria that would be used to establish threshold values and reference conditions will need to be included.*

In addition, the difference between habitat creation, restoration, and enhancement should be clearly set out in this appendix.

Updated Response: Section 2.4 and Tables H-2 and H-3 of Appendix H address the threshold values used to determine wetland success (see also response to Comment J.2 above).

The text of the Wetlands Interim Submittal defines the terms listed in the comment.

Comment J.17. *Page 8, Paragraph 5, Section 5. Proposed success criteria should be presented prior to the 95% Design, as final design details are unlikely to affect overall wetland mitigation objectives. In accordance with US Army Corps of Engineer guidance (USACE, 2011), they must be SMART (specific, measurable, attainable, reasonable and trackable) and include both structural and functional components. As noted in NYSDEC's July 2, 2010 letter to Honeywell (Response to Specific Comment 20), design of the monitoring plan, which includes the measurements used to assess success criteria, should begin in the 50% design submittal and be finalized in the 95% design submittal.*

Updated Response: Section 2.4 and Tables H-2 and H-3of Appendix H present the success criteria

Comment J.16. *Page 8, Paragraph 4, Bullets, Section 5. As the liner and cover system are components of the remedy to address underlying contamination in soils and groundwater, sediment/soil and water quality sampling will also need to be included in the plan.*

Updated Response: Tables H-2 and H-3 present the approach for sampling within the Inland Wetlands to evaluate the potential for migration of underlying contamination along with additional evaluations that could be triggered based on the results of the sampling.

Comment J.21. *Table J-4. The site-specific monitoring program will need to consider the inclusion of the sampling/analysis of macroinvertebrates or other organisms.*

Updated Response: As shown on Table H-3, chlorides measured in surface water at levels in excess of criteria will trigger evaluation of the biological community of the wetland if there is an unexplained absence of fauna in the Inland Wetlands following the second annual monitoring event. This biological evaluation may include benthic macroinvertebrate community assessment, wildlife population evaluation, sediment/soil and/or surface water toxicity testing, and/or biota tissue analysis.

Comment J.22. *Table J-4. An additional column should be added after "Year 5" entitled "After Year 5[3]." The associated footnote (3) should read that monitoring may extend beyond Year 5, if needed. The following changes should also be made:*

a. Under the Plant Monitoring, adaptive management should be a component of all years.

b. Under the Water Monitoring, water quality sampling should be performed in Years 1 to 5 with toxicity testing performed as needed. As noted in the comments on Sections 3.6 and 3.7, monitoring of the groundwater collection systems should be included in the OM&M plans.

c. Under Faunal Monitoring, "Browsing Impacts on Plant Species" should be replaced with "Herbivory Impacts."

d. Under Invasive Species Management, hand pulling should be implemented in Years 0 and 1 and clear criteria should be established for hand pulling in subsequent years.

e. Under Annual Report Deliverables, the evaluation of success should be both qualitative and quantitative.

Updated Response: Information pertaining to this comment is addressed in Table H-3 and will be further detailed in the forthcoming OM&M Plan.

WETLAND INTERIM SUBMITTAL COMMENTS

Comment 1. *Page 1, Paragraph 5, Section 1. Comment J.7 of my August 24, 2011 comment letter on the 50% Design is not addressed in Section 4 or the other sections ("The role of structure should be incorporated into the tree tip-up discussion along with an estimate of the amount of structure (trees) that will be placed in and around the mitigation wetlands"). Information on structure should be included in the next submittal. It appears that Comment J.20 was erroneously associated with Section 4 (Hydrologic Budget) rather than Section 5 (Target Vegetation).*

Updated Response: Section 2.1 of Appendix H and Sheet C-90 present the information relevant to structure. See also Updated Response to comment J.7, above.

Comment 2. *Pages 2-4, Section 2. Figures will need to be provided to illustrate the points discussed in this section (e.g., alternate configuration as discussed under the second bullet) and changes agreed to as discussed in our conference call on November 18, 2011.*

Updated Response: Section 2.1 of Appendix H and Sheets C-9, C-47, and C-50 incorporate changes discussed during the conference call.

Comment 3. *Page 5, Paragraphs 3 and 4, Sections 3.1.1 and 3.1.2. Although the lake-connected wetland is addressed under the Onondaga Lake design and the inland wetlands are addressed under this IRM, the development and presentation of success criteria for the entire wetland complex should be similar. Tables adapted from those provided in Appendix K of the Onondaga Lake Draft Final Design (DFD) (Parsons/AnchorQEA, 2011) should be provided for Stage 1 success criteria, Stage 2 success criteria and threshold targets.*

Updated Response: Tables H-2 and H-3 reflect the updated success criteria. See also the Updated Response to comment J.2, above.

Comment 4. *Page 5, Section 3.1.1. It is suggested that an additional criterion be included that addresses wetland acreage creation. Some suggested language is: "Established wetland acreage matches wetland creation design acreage, as determined by wetland delineation."*

Updated Response: Table H-2, Stage 2 criteria now include a wetland acreage criterion.

Comment 5. *Page 5, Paragraph 3, Section 3.1.1. Stage 1 success criteria should also include acreage, total organic carbon (TOC), pre-placement grain size and analytical chemistry, plant spacing, and plant composition, as presented in Table K-7 of the Onondaga Lake DFD.*

Updated Response: The parameters defined above are as addressed by the Stage 1 success criteria (Table H-2) and Topsoil, Seeding and Planting specification.

Comment 6. *Page 5, Paragraph 3, Bullets 3 and 4, Section 3.1.1. Random samples alone should not be the only check of Stage 1 criteria. In addition to the random samples, additional samples should be taken in areas that appear to have high mortality. Within the first full growing season following planting, at least 90% (instead of 80% or 70%) of the planted species and units should be present. Further, please provide a time frame for monitoring any replacement plants which are planted following the death of the original planting(s).*

Original Response/Location of Incorporation: Table H-2. In addition to the random samples, additional sampling will be performed in areas that appear to have high mortality, if present. Eighty percent survivorship will be included as a Stage 1 criterion (as included in the *Onondaga Lake DFD*). Planting densities are high enough to absorb 20% plant (*i.e.*, plug) mortality because seed application (which will co-occur with plantings) is expected to provide corresponding growth of native vegetation. In addition to the random sampling performed in Stage 1, additional sampling will be performed in areas that appear to have high mortality, if present. Following planting, survivorship will be evaluated for at least 80% survivorship (not 90%). If 80% survivorship is not met, replacement plants will be installed to achieve the 80% rate. Monitoring of replaced plantings will occur subsequently within monitoring periods via the percent cover assessment (Stage 2).

Comment 7. *Pages 5 to 7, Paragraph 4 on, Section 3.1.2. Separate tables listing Stage 2 success criteria and annual threshold targets adapted from Tables K-8 and K-9 of the Onondaga Lake DFD should be provided. Success criteria should include plant cover by year, fish (lake-connected wetland), macroinvertebrate, and wildlife parameters in addition to the vegetative, water quality, and sediment parameters listed.*

Updated Response: Table H-3 has been revised in accordance with the comment. See Updated Response to 50% comment J.2.

Comment 8. *Page 5, Paragraph 4, Section 3.1.2. Wetland delineations should also be performed after the third year to ensure that conditions are appropriate for wetland development and allow time to implement adaptive management measures, if required.*

Updated Response: Wetland delineations will be performed after Years 3 and 5 as outlined in Stage 2 success criteria (Table H-3).

Comment 9. *Page 5, Paragraph 4, Bullet 1, Section 3.1.2. All invasive species observed within the first year should be removed, regardless of whether or not they comprise less than 10% of the plant cover. The threshold for percent cover of invasive species should be set to ≤ 5% for the second and third years following planting, consistent with the target thresholds for Onondaga Lake.*

Updated Response: Table H-3. Invasive species will be removed as observed during the annual monitoring periods. The threshold for invasives is no more than 5% after the five-year monitoring phase.

Comment 10. *Page 5, Paragraph 4, Bullet 2, Section 3.1.2. This bullet should be revised to state "minimum percent cover of facultative (FAC) wetland indicator species or wetter: 51% (USACOE 2009)".*

Updated Response: Table H-3, Stage 2 success criterion for wetland acreage/delineation has been modified in accordance with the comment.

Comment 11. *Page 5, Paragraph 4, Bullet 4, Section 3.1.2. The success criteria should be met for at least two consecutive growing seasons. If this is not achieved by the end of the five-year monitoring period, the monitoring period will need to be extended until the success criteria are achieved for two consecutive years. Also, long-term monitoring will need to continue beyond year 5 for assessing remedy (e.g., cap) effectiveness. Please revise accordingly.*

Updated Response: Tables H-2 and H-3 have been revised in accordance with the comment. The success criteria for vegetation should be met for two consecutive years. If this is not achieved by the end of the five-year monitoring period, the monitoring period for vegetation will be extended until the success criteria are achieved or annual threshold targets are achieved.

Comment 12. *Page 5, Paragraph 4, Bullet 4, Section 3.1.2. As module 8b (scrub-shrub or forested) is included within the remediation areas (see Table 2, Summary of Vegetation Zones and Related Habitat Modules), the monitoring period and subsequent determination of success for the forested 8b areas should be ten years, instead of 5 years, with success criteria evaluated in years 1-4, 7, and 10.*

Updated Response: Table H-3 has been revised to note that additional monitoring in the successional forest beyond five years will be performed if the five-year monitoring data suggest that stand development is not moving on a favorable trajectory.

Comment 13. *Page 5, Paragraph 4, Bullet 6, #2 (on page 6), Section 3.1.2. The evaluation of the biological community of the wetland area should also include sediment toxicity testing, in addition to soil and surface water toxicity testing.*

Updated Response: Table H-3 has been revised in accordance with the comment. See also Updated response to 50% comment J.16.

Comment 14. *Page 6, #1, Section 3.1.2. This section should include lab testing to assess the potential toxicity of the water to amphibian eggs and larva. Testing should occur at initial establishment and periodically during monitoring.*

Updated Response: Table H-3has been revised in accordance with the comment. See also Updated Response to 50% comment J.16.

Comment 15. *Page 6, #2, Section 3.1.2. Evaluation of the biological community of the wetland should include growth and survival of amphibians.*

Updated Response: Table H-3 has been revised to include amphibian presence as a success criterion.

Comment 16. *Page 6, Paragraph 2, Section 3.1.2. The finer-grained soil with a higher organic carbon content proposed for the top 6 inches of wetland substrate should be used for at least the top 12 inches. Use of finer-grained soils only to a depth of 6 inches would not cover the major portion of the root zone, which is usually within 12 inches of the surface (USACE, 1987).*

Updated Response: Section 3.10 of Appendix H and the Topsoil, Seeding and Planting specification have been revised in accordance with the comment. The habitat layer will include 12 inches of topsoil.

Comment 17. *Page 7, Second bullet from top of page, Section 3.1.2. It is stated that the bottom 18 inches of habitat fill will have a maximum particle size of 8 inches with 80 to 100 percent passing a 4-inch sieve. This corresponds to gravels and cobbles which are not an appropriate wetland substrate. See related comments on the Onondaga Lake DFD.*

Updated Response: The Select Fill specification gradation now calls for 100% of fill materials passing the 4-inch sieve.

Comment 18. *Page 7, Paragraph 1, Section 3.1.2. Please note whether appropriate electrical conductivity ranges for the soil should be recommended, similar to pH ranges and soil organic matter concentrations.*

Original Response/Location of Incorporation: Table H-3. Because chloride is proposed for monitoring, electrical conductivity ranges are not needed for inclusion.

Comment 19. *Page 8, Paragraph 1, Section 4. The descriptions for the Inland Wetlands A, B, and C and the Connected Wetland were not presented, as stated within the sentence. These descriptions will need to be included in the 95% Design.*

Updated Response: Descriptions of the mitigation wetlands are presented in Section 2 of Appendix H.

Comment 21. *Page 11, Paragraph 2, Section 5. A figure will need to be included in the 95% Design that identifies the "vegetation zones" described here.*

Updated Response: Vegetation zones are detailed on the restoration Sheets C-43 to C-56.

Comment 22. *Table 4. Shallow Emergent Zone – Plant and Seed Mix. Wild rice should be shown at an installation rate of 50 pounds per acre, consistent with other areas of Onondaga Lake, unless seeding into a prepared seed bed, in which case the proposed installation rate of 30 pounds/acre is acceptable. Wild rice seeding should be conducted once a year for three consecutive years unless a stand is established earlier.*

Updated Response: As presented in the Topsoil, Seeding and Planting Specifications, wild rice will be applied at a rate of 30 pounds per acre into a prepared seed bed. Seeding will be repeated the following year if a stand has yet to establish.

NYSDEC COMMENTS ON HONEYWELL'S WETLAND INTERIM SUBMITTAL RESPONSE TO COMMENTS

C.1 - Comment 6. *It is suggested that the habitat success criteria for the Wastebeds 1 through 8 IRM be reviewed/discussed with the success criteria for the lake which also includes the lake-connected wetland on the*

Wastebeds 1 through 8 site (per response to Comments K.59 and K.61 on Appendix K of the Onondaga Lake Draft Final Design). Note that the success criteria tables and discussion have been removed from the final design for the lake and will be presented in a forthcoming Onondaga Lake Maintenance and Monitoring Scoping (OLMMS) document following discussion of the responses to related comments on the Draft Final Design.

Updated Response: Section 2.4 of Appendix H and Tables H-2 and H-3 have been revised in accordance with the comment . See also Updated Response to 50% comment J.2.

C.2 - Comment 12. *The successional forested module should be monitored at the 10-year point, as requested here and in Comment K.58 on Appendix K of the Draft Final Design.*

Updated Response: Table H-3 has been revised in accordance with the comment. See also Updated Response to Wetland Interim Submittal comment 12.

C.3 - Comments 16 and 17. *For consistency with the final lake design, the minimum 2-ft-thick habitat layer in the wetlands should consist of a minimum of 19.5 inches of fine-grained substrate (topsoil) with appropriate organic matter (5 to 20%, average of about 7.5% as per Appendix L of the final design) and a minimum of 4.5 inches of habitat subgrade fill as per page 7 of the Wastebeds 1 through 8 Interim Submittal.*

Updated Response: See Section 3.10 of Appendix H. In the inland wetlands where the slope is greater than 10%, a finer grained material than the current version of Type "H" will be used as the lower 12 inches of substrate. The applicable design drawings and Select Fill Technical Specification have been incorporated into the 100% Design.

C.4 - Comment 27. *The figures show wetland water depths at maximum values. An evaluation should be included in the 95% design with lower wetland starting depths to show the worse case scenario.*

Updated Response: Section 2.2 and Figures H-1, H-2 and H-3 of Appendix H have been revised in accordance with the comment. The figures show mid-point depths in each wetland zone. The model starts with 0-inches of water to show a worst case scenario.

Hydrograph preparation as described in - Gary J. Pierce. 1993. Planning Hydrology for Constructed Wetlands Wetland Training Institute, Inc. Poolseville, MD. WTI 93-2. 49pp.

Attachment H-2
Honeywell Wastebeds 1-8
Mitigation Wetlands and Upland Restoration Basis of Design
Wetland A Monthly Hydrograph Supporting Data - Wetland Starting Empty
1978 to 2008

Water Budget Graphing Calculations

Month	Avg. Temp. (Degrees F)	Avg. Temp. (Degrees C)	Heat Index (I)	Evapotranspiration (ET)	Evapotranspiration Correction Factor	Corrected ET (Inches)	Infiltration (Inches)	Precipitation (Inches)	Groundwater (Inches)	Runoff (Inches)	Total depth change	Deep Emergent Max Depth (Inches)	Deep Emergent Midpoint Depth (Inches)	Shallow Emergent Max Depth (Inches)	Shallow Emergent Midpoint Depth (Inches)	Wet Meadow Max Depth (Inches)	Wet Meadow Midpoint Depth (Inches)	Wet meadow minimum water depth (Inches)	Growing season Month - Year	Water level within 12" of soil surface during growing season at upper edge of wet meadow[1] (1 = yes / 0 = no)
												0.00								
Jan-78	21.24	-5.98	0.00	0.00	0.77	0.00	-0.20	5.77	0.00	0.00	5.57	5.57	-0.43	-6.43	-15.43	-24.00	-24.00	-24.00		
Feb-78	17.54	-8.04	0.00	0.00	0.88	0.00	-0.20	0.80	0.00	0.00	0.60	6.17	0.17	-5.83	-14.83	-23.83	-24.00	-24.00		
Mar-78	29.37	-1.46	0.00	0.00	0.99	0.00	-0.20	3.08	0.00	0.00	2.88	9.05	3.05	-2.95	-11.95	-20.95	-24.00	-24.00		
Apr-78	42.18	5.66	1.20	2.32	1.11	-1.02	-0.20	1.87	0.00	0.00	0.65	9.70	3.70	-2.30	-11.30	-20.30	-24.00	-24.00	Apr-78	0
May-78	58.24	14.58	4.98	6.82	1.22	-3.29	-0.20	1.90	0.00	0.00	-1.59	8.12	2.12	-3.88	-12.88	-21.88	-24.00	-24.00	May-78	0
Jun-78	64.75	18.19	6.94	8.77	1.28	-4.43	-0.20	3.58	0.00	0.00	-1.05	7.07	1.07	-4.93	-13.93	-22.93	-24.00	-24.00	Jun-78	0
Jul-78	71.89	22.16	9.33	10.97	1.26	-5.44	-0.20	2.78	0.00	0.00	-2.86	4.20	-1.80	-7.80	-16.80	-24.00	-24.00	-24.00	Jul-78	0
Aug-78	71.65	22.03	9.25	10.90	1.17	-5.01	-0.20	3.31	0.00	0.00	-1.90	2.30	-3.70	-9.70	-18.70	-24.00	-24.00	-24.00	Aug-78	0
Sep-78	59.85	15.47	5.44	7.29	1.05	-3.00	-0.20	3.93	0.00	0.00	0.73	3.03	-2.97	-8.97	-17.97	-24.00	-24.00	-24.00	Sep-78	0
Oct-78	49.55	9.75	2.72	4.31	0.92	-1.56	-0.20	2.68	0.00	0.00	0.92	3.94	-2.06	-8.06	-17.06	-24.00	-24.00	-24.00	Oct-78	0
Nov-78	40.22	4.56	0.87	1.82	0.81	-0.58	-0.20	1.25	0.00	0.00	0.47	4.41	-1.59	-7.59	-16.59	-24.00	-24.00	-24.00		
Dec-78	30.52	-0.82	0.00	0.00	0.75	0.00	-0.20	4.12	0.00	0.00	3.92	8.33	2.33	-3.67	-12.67	-21.67	-24.00	-24.00		
Jan-79	22.37	-5.35	0.00	0.00	0.77	0.00	-0.20	4.70	0.00	0.00	4.50	12.83	6.83	0.83	-8.17	-17.17	-23.17	-24.00		
Feb-79	12.86	-10.63	0.00	0.00	0.88	0.00	-0.20	2.54	0.00	0.00	2.34	15.17	9.17	3.17	-5.83	-14.83	-20.83	-24.00		
Mar-79	39.05	3.92	0.69	1.53	0.99	-0.59	-0.20	2.73	0.00	0.00	1.94	17.11	11.11	5.11	-3.89	-12.89	-18.89	-24.00		
Apr-79	45.07	7.26	1.75	3.09	1.11	-1.35	-0.20	3.89	0.00	0.00	2.34	19.45	13.45	7.45	-1.55	-10.55	-16.55	-22.55	Apr-79	0
May-79	58.56	14.76	5.07	6.91	1.22	-3.33	-0.20	3.07	0.00	0.00	-0.46	18.99	12.99	6.99	-2.01	-11.01	-17.01	-23.01	May-79	0
Jun-79	65.92	18.84	7.32	9.13	1.28	-4.61	-0.20	2.33	0.00	0.00	-2.48	16.51	10.51	4.51	-4.49	-13.49	-19.49	-24.00	Jun-79	0
Jul-79	71.68	22.04	9.26	10.91	1.26	-5.41	-0.20	2.33	0.00	0.00	-3.28	13.22	7.22	1.22	-7.78	-16.78	-22.78	-24.00	Jul-79	0
Aug-79	67.82	19.90	7.94	9.71	1.17	-4.47	-0.20	3.69	0.00	0.00	-0.98	12.25	6.25	0.25	-8.75	-17.75	-23.75	-24.00	Aug-79	0
Sep-79	61.42	16.34	5.91	7.76	1.05	-3.20	-0.20	5.25	0.00	0.00	1.85	14.10	8.10	2.10	-6.90	-15.90	-21.90	-24.00	Sep-79	0
Oct-79	50.90	10.50	3.04	4.70	0.92	-1.70	-0.20	2.91	0.00	0.00	1.01	15.11	9.11	3.11	-5.89	-14.89	-20.89	-24.00	Oct-79	0
Nov-79	44.52	6.95	1.64	2.94	0.81	-0.94	-0.20	3.25	0.00	0.00	2.11	17.22	11.22	5.22	-3.78	-12.78	-18.78	-24.00		
Dec-79	33.40	0.78	0.06	0.24	0.75	-0.07	-0.20	1.84	0.00	0.00	1.57	18.79	12.79	6.79	-2.21	-11.21	-17.21	-23.21		
Jan-80	25.55	-3.58	0.00	0.00	0.77	0.00	-0.20	1.47	0.00	0.00	1.27	20.06	14.06	8.06	-0.94	-9.94	-15.94	-21.94		
Feb-80	19.81	-6.77	0.00	0.00	0.88	0.00	-0.20	1.38	0.00	0.00	1.18	21.24	15.24	9.24	0.24	-8.76	-14.76	-20.76		
Mar-80	32.32	0.18	0.01	0.05	0.99	-0.02	-0.20	4.34	0.00	0.00	4.12	25.36	19.36	13.36	4.36	-4.64	-10.64	-16.64		
Apr-80	47.78	8.77	2.32	3.82	1.11	-1.67	-0.20	3.33	0.00	0.00	1.46	26.82	20.82	14.82	5.82	-3.18	-9.18	-15.18	Apr-80	0
May-80	59.81	15.45	5.43	7.28	1.22	-3.51	-0.20	1.34	0.00	0.00	-2.37	24.45	18.45	12.45	3.45	-5.55	-11.55	-17.55	May-80	0
Jun-80	62.97	17.20	6.38	8.23	1.28	-4.16	-0.20	4.45	0.00	0.00	0.09	24.54	18.54	12.54	3.54	-5.46	-11.46	-17.46	Jun-80	0
Jul-80	72.47	22.48	9.53	11.16	1.26	-5.53	-0.20	2.57	0.00	0.00	-3.16	21.38	15.38	9.38	0.38	-8.62	-14.62	-20.62	Jul-80	0
Aug-80	73.76	23.20	9.99	11.56	1.17	-5.32	-0.20	1.33	0.00	0.00	-4.19	17.19	11.19	5.19	-3.81	-12.81	-18.81	-24.00	Aug-80	0
Sep-80	63.38	17.44	6.51	8.36	1.05	-3.44	-0.20	3.40	0.00	0.00	-0.24	16.95	10.95	4.95	-4.05	-13.05	-19.05	-24.00	Sep-80	0
Oct-80	48.73	9.29	2.53	4.09	0.92	-1.48	-0.20	2.56	0.00	0.00	0.88	17.83	11.83	5.83	-3.17	-12.17	-18.17	-24.00	Oct-80	0
Nov-80	37.55	3.08	0.48	1.17	0.81	-0.37	-0.20	2.64	0.00	0.00	2.07	19.90	13.90	7.90	-1.10	-10.10	-16.10	-22.10		
Dec-80	22.58	-5.23	0.00	0.00	0.75	0.00	-0.20	3.27	0.00	0.00	3.07	22.97	16.97	10.97	1.97	-7.03	-13.03	-19.03		
Jan-81	15.00	-9.44	0.00	0.00	0.77	0.00	-0.20	1.34	0.00	0.00	1.14	24.11	18.11	12.11	3.11	-5.89	-11.89	-17.89		
Feb-81	33.71	0.95	0.08	0.31	0.88	-0.11	-0.20	2.72	0.00	0.00	2.41	26.52	20.52	14.52	5.52	-3.48	-9.48	-15.48		
Mar-81	36.37	2.43	0.34	0.89	0.99	-0.35	-0.20	1.01	0.00	0.00	0.46	26.99	20.99	14.99	5.99	-3.01	-9.01	-15.01		
Apr-81	49.98	9.99	2.82	4.44	1.11	-1.94	-0.20	2.04	0.00	0.00	-0.10	26.89	20.89	14.89	5.89	-3.11	-9.11	-15.11	Apr-81	0
May-81	59.15	15.08	5.24	7.09	1.22	-3.41	-0.20	2.61	0.00	0.00	-1.00	25.88	19.88	13.88	4.88	-4.12	-10.12	-16.12	May-81	0
Jun-81	68.02	20.01	8.01	9.77	1.28	-4.94	-0.20	1.89	0.00	0.00	-3.25	22.64	16.64	10.64	1.64	-7.36	-13.36	-19.36	Jun-81	0
Jul-81	73.26	22.92	9.82	11.40	1.26	-5.66	-0.20	2.68	0.00	0.00	-3.18	19.46	13.46	7.46	-1.54	-10.54	-16.54	-22.54	Jul-81	0
Aug-81	70.40	21.34	8.81	10.51	1.17	-4.83	-0.20	2.63	0.00	0.00	-2.40	17.05	11.05	5.05	-3.95	-12.95	-18.95	-24.00	Aug-81	0
Sep-81	61.55	16.42	5.95	7.80	1.05	-3.21	-0.20	5.58	0.00	0.00	2.17	19.22	13.22	7.22	-1.78	-10.78	-16.78	-22.78	Sep-81	0
Oct-81	47.85	8.81	2.34	3.84	0.92	-1.39	-0.20	6.66	0.00	0.00	5.07	24.29	18.29	12.29	3.29	-5.71	-11.71	-17.71	Oct-81	0
Nov-81	38.95	3.86	0.68	1.51	0.81	-0.48	-0.20	3.09	0.00	0.00	2.41	26.70	20.70	14.70	5.70	-3.30	-9.30	-15.30		
Dec-81	28.92	-1.71	0.00	0.00	0.75	0.00	-0.20	2.96	0.00	0.00	2.76	29.46	23.46	17.46	8.46	-0.54	-6.54	-12.54		
Jan-82	14.77	-9.57	0.00	0.00	0.77	0.00	-0.20	3.59	0.00	0.00	3.39	32.85	26.85	20.85	11.85	2.85	-3.15	-9.15		
Feb-82	25.05	-3.86	0.00	0.00	0.88	0.00	-0.20	1.26	0.00	0.00	1.06	33.91	27.91	21.91	12.91	3.91	-2.09	-8.09		
Mar-82	33.21	0.67	0.05	0.21	0.99	-0.08	-0.20	2.63	0.00	0.00	2.35	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-82	43.83	6.57	1.51	2.76	1.11	-1.21	-0.20	1.71	0.00	0.00	0.30	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-82	1
May-82	59.44	15.24	5.32	7.17	1.22	-3.46	-0.20	2.87	0.00	0.00	-0.79	35.21	29.21	23.21	14.21	5.21	-0.79	-6.79	May-82	1
Jun-82	63.03	17.24	6.40	8.25	1.28	-4.17	-0.20	4.64	0.00	0.00	0.27	35.49	29.49	23.49	14.49	5.49	-0.51	-6.51	Jun-82	1
Jul-82	70.40	21.34	8.81	10.51	1.26	-5.21	-0.20	3.83	0.00	0.00	-1.58	33.90	27.90	21.90	12.90	3.90	-2.10	-8.10	Jul-82	1
Aug-82	65.27	18.49	7.11	8.93	1.17	-4.11	-0.20	2.60	0.00	0.00	-1.71	32.20	26.20	20.20	11.20	2.20	-3.80	-9.80	Aug-82	1
Sep-82	60.57	15.87	5.65	7.51	1.05	-3.09	-0.20	4.22	0.00	0.00	0.93	33.12	27.12	21.12	12.12	3.12	-2.88	-8.88	Sep-82	1
Oct-82	50.35	10.20	2.91	4.54	0.92	-1.65	-0.20	0.72	0.00	0.00	-1.13	32.00	26.00	20.00	11.00	2.00	-4.00	-10.00	Oct-82	1
Nov-82	43.90	6.61	1.52	2.77	0.81	-0.88	-0.20	4.52	0.00	0.00	3.44	35.43	29.43	23.43	14.43	5.43	-0.57	-6.57		
Dec-82	34.06	1.15	0.11	0.38	0.75	-0.11	-0.20	2.55	0.00	0.00	2.24	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Jan-83	23.42	-4.77	0.00	0.00	0.77	0.00	-0.20	1.92	0.00	0.00	1.72	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-83	26.41	-3.11	0.00	0.00	0.88	0.00	-0.20	1.07	0.00	0.00	0.87	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-83	35.71	2.06	0.26	0.74	0.99	-0.29	-0.20	2.30	0.00	0.00	1.81	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-83	44.22	6.79	1.58	2.86	1.11	-1.25	-0.20	6.34	0.00	0.00	4.89	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-83	1
May-83	53.61	12.01	3.72	5.47	1.22	-2.63	-0.20	3.33	0.00	0.00	0.50	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	May-83	1
Jun-83	66.68	19.27	7.57	9.36	1.28	-4.73	-0.20	1.50	0.00	0.00	-3.43	32.57	26.57	20.57	11.57	2.57	-3.43	-9.43	Jun-83	1
Jul-83	72.00	22.22	9.37	11.01	1.26	-5.46	-0.20	2.31	0.00	0.00	-3.35	29.22	23.22	17.22	8.22	-0.78	-6.78	-12.78	Jul-83	0
Aug-83	69.02	20.56	8.34	10.08	1.17	-4.64	-0.20	2.80	0.00	0.00	-2.04	27.18	21.18	15.18	6.18	-2.82	-8.82	-14.82	Aug-83	0
Sep-83	62.50	16.94	6.24	8.09	1.05	-3.33	-0.20	2.98	0.00	0.00	-0.55	26.63	20.63	14.63	5.63	-3.37	-9.37	-15.37	Sep-83	0
Oct-83	50.29	10.16	2.90	4.52	0.92	-1.64	-0.20	1.98	0.00	0.00	0.14	26.77	20.77	14.77	5.77	-3.23	-9.23	-15.23	Oct-83	0
Nov-83	39.00	3.89	0.69	1.52	0.81	-0.48	-0.20	4.30	0.00	0.00	3.62	30.39	24.39	18.39	9.39	0.39	-5.61	-11.61		
Dec-83	22.45	-5.30	0.00	0.00	0.75	0.00	-0.20	5.50	0.00	0.00	5.30	35.69	29.69	23.69	14.69	5.69	-0.31	-6.31		
Jan-84	18.61	-7.44	0.00	0.00	0.77	0.00	-0.20	1.30	0.00	0.00	1.10	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-84	31.98	-0.01	0.00	0.00	0.88	0.00	-0.20	2.88	0.00	0.00	2.68	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-84	24.52	-4.16	0.00	0.00	0.99	0.00	-0.20	2.39	0.00	0.00	2.19	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-84	45.92	7.73	1.92	3.31	1.11	-1.45	-0.20	3.16	0.00	0.00	1.51	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-84	1
May-84	52.40	11.34	3.41	5.12	1.22	-2.47	-0.20	4.97	0.00	0.00	2.30	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	May-84	1
Jun-84	65.42	18.56	7.15	8.97	1.28	-4.53	-0.20	2.02	0.00	0.00	-2.71	33.29	27.29	21.29	12.29	3.29	-2.71	-8.71	Jun-84	1
Jul-84	68.00	20.00	8.00	9.77	1.26	-4.84	-0.20	3.66	0.00	0.00	-1.38	31.90	25.90	19.90	10.90	1.90	-4.10	-10.10	Jul-84	1
Aug-84	68.73	20.40	8.24	9.99	1.17	-4.59	-0.20	5.17	0.00	0.00	0.38	32.28	26.28	20.28	11.28	2.28	-3.72	-9.72	Aug-84	1
Sep-84	57.63	14.24	4.81	6.64	1.05	-2.73	-0.20	2.61	0.00	0.00	-0.32	31.95	25.95	19.95	10.95	1.95	-4.05	-10.05	Sep-84	1
Oct-84	52.18	11.21	3.36	5.06	0.92	-1.83	-0.20	1.95	0.00	0.00	-0.08	31.87	25.87	19.87	10.87	1.87	-4.13	-10.13	Oct-84	1
Nov-84	38.23	3.46	0.58	1.33	0.81	-0.42	-0.20	3.48	0.00	0.00	2.86	34.73	28.73	22.73	13.73	4.73	-1.27	-7.27		
Dec-84	33.44	0.80	0.06	0.25	0.75	-0.07	-0.20	4.38	0.00	0.00	4.11	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Jan-85	21.92	-5.60	0.00	0.00	0.77	0.00	-0.20	2.49	0.00	0.00	2.29	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-85	27.25	-2.64	0.00	0.00	0.88	0.00	-0.20	1.55	0.00	0.00	1.35	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-85	36.31	2.39	0.33	0.87	0.99	-0.34	-0.20	2.61	0.00	0.00	2.07	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-85	47.77	8.76	2.32	3.82	1.11	-1.67	-0.20	1.22	0.00	0.00	-0.65	35.35	29.35	23.35	14.35	5.35	-0.65	-6.65	Apr-85	1
May-85	59.48	15.27	5.34	7.19	1.22	-3.46	-0.20	3.39	0.00	0.00	-0.27	35.07	29.07	23.07	14.07	5.07	-0.93	-6.93	May-85	1
Jun-85	61.95	16.64	6.07	7.92	1.28	-4.00	-0.20	2.80	0.00	0.00	-1.40	33.67	27.67	21.67	12.67	3.67	-2.33	-8.33	Jun-85	1
Jul-85	69.77	20.99	8.60	10.32	1.26	-5.12	-0.20	2.75	0.00	0.00	-2.57	31.11	25.11	19.11	10.11	1.11	-4.89	-10.89	Jul-85	1
Aug-85	68.85	20.47	8.29	10.03	1.17	-4.61	-0.20	1.44	0.00	0.00	-3.37	27.73	21.73	15.73	6.73	-2.27	-8.27	-14.27	Aug-85	0
Sep-85	63.48	17.49	6.54	8.39	1.05	-3.45	-0.20	3.88	0.00	0.00	0.23	27.96	21.96	15.96	6.96	-2.04	-8.04	-14.04	Sep-85	0
Oct-85	51.35	10.75	3.15	4.82	0.92	-1.75	-0.20	3.39	0.00	0.00	1.44	29.40	23.40	17.40	8.40	-0.60	-6.60	-12.60	Oct-85	0
Nov-85	41.22	5.12	1.04	2.07	0.81	-0.66	-0.20	5.18	0.00	0.00	4.32	33.72	27.72	21.72	12.72	3.72	-2.28	-8.28		
Dec-85	26.02	-3.32	0.00	0.00	0.75	0.00	-0.20	1.80	0.00	0.00	1.60	35.32	29.32	23.32	14.32	5.32	-0.68	-6.68		
Jan-86	23.85	-4.53	0.00	0.00	0.77	0.00	-0.20	2.41	0.00	0.00	2.21	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-86	23.41	-4.77	0.00	0.00	0.88	0.00	-0.20	2.27	0.00	0.00	2.07	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-86	37.31	2.95	0.45	1.11	0.99	-0.43	-0.20	2.82	0.00	0.00	2.19	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-86	49.15	9.53	2.63	4.20	1.11	-1.84	-0.20	3.42	0.00	0.00	1.38	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-86	1
May-86	60.92	16.07	5.76	7.61	1.22	-3.67	-0.20	2.67	0.00	0.00	-1.20	34.80	28.80	22.80	13.80	4.80	-1.20	-7.20	May-86	1
Jun-86	64.33	17.96	6.81	8.64	1.28	-4.37	-0.20	4.89	0.00	0.00	0.32	35.12	29.12	23.12	14.12	5.12	-0.88	-6.88	Jun-86	1
Jul-86	70.95	21.64	9.00	10.68	1.26	-5.30	-0.20	5.23	0.00	0.00	-0.27	34.86	28.86	22.86	13.86	4.86	-1.14	-7.14	Jul-86	1
Aug-86	66.71	19.28	7.57	9.37	1.17	-4.31	-0.20	3.36	0.00	0.00	-1.15	33.71	27.71	21.71	12.71	3.71	-2.29	-8.29	Aug-86	1
Sep-86	60.43	15.80	5.62	7.47	1.05	-3.08	-0.20	5.47	0.00	0.00	2.19	35.90	29.90	23.90	14.90	5.90	-0.10	-6.10	Sep-86	1
Oct-86	49.66	9.81	2.75	4.35	0.92	-1.58	-0.20	3.32	0.00	0.00	1.54	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Oct-86	1
Nov-86	36.78	2.66	0.39	0.98	0.81	-0.31	-0.20	3.74	0.00	0.00	3.23	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		

Hydrograph preparation as described in - Gary J. Pierce. 1993. Planning Hydrology for Constructed Wetlands Wetland Training Institute, Inc. Poolseville, MD. WTI 93-2. 49pp.

Attachment H-2
Honeywell Wastebeds 1-8
Mitigation Wetlands and Upland Restoration Basis of Design
Wetland A Monthly Hydrograph Supporting Data - Wetland Starting Empty
1978 to 2008

Water Budget Graphing Calculations

Month	Avg. Temp. (Degrees F)	Avg. Temp. (Degrees C)	Heat Index (I)	Evapotranspiration (ET)	Evapotranspiration Correction Factor	Corrected ET (Inches)	Infiltration (Inches)	Precipitation (Inches)	Groundwater (Inches)	Runoff (Inches)	Total depth change (Inches)	Deep Emergent Max Depth (Inches)	Deep Emergent Midpoint Depth (Inches)	Shallow Emergent Max Depth (Inches)	Shallow Emergent Midpoint Depth (Inches)	Wet Meadow Max Depth (Inches)	Wet Meadow Midpoint Depth (Inches)	Wet meadow minimum water depth (Inches)	Growing season Month - Year	Water level within 12" of soil surface during growing season at upper edge of wet meadow[1] (1 = yes / 0 = no)
Dec-86	31.60	-0.22	0.00	0.00	0.75	0.00	-0.20	3.33	0.00	0.00	3.13	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Jan-87	23.79	-4.56	0.00	0.00	0.77	0.00	-0.20	3.03	0.00	0.00	2.83	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-87	21.61	-5.77	0.00	0.00	0.88	0.00	-0.20	0.63	0.00	0.00	0.43	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-87	37.94	3.30	0.54	1.26	0.99	-0.49	-0.20	1.86	0.00	0.00	1.17	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-87	51.82	11.01	3.27	4.95	1.11	-2.17	-0.20	3.31	0.00	0.00	0.94	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-87	1
May-87	60.32	15.73	5.58	7.44	1.22	-3.58	-0.20	1.41	0.00	0.00	-2.37	33.63	27.63	21.63	12.63	3.63	-2.37	-8.37	May-87	1
Jun-87	68.27	20.15	8.09	9.85	1.28	-4.97	-0.20	5.04	0.00	0.00	-0.13	33.49	27.49	21.49	12.49	3.49	-2.51	-8.51	Jun-87	1
Jul-87	73.61	23.12	9.94	11.52	1.26	-5.71	-0.20	2.16	0.00	0.00	-3.75	29.74	23.74	17.74	8.74	-0.26	-6.26	-12.26	Jul-87	0
Aug-87	68.48	20.27	8.16	9.92	1.17	-4.56	-0.20	2.12	0.00	0.00	-2.64	27.10	21.10	15.10	6.10	-2.90	-8.90	-14.90	Aug-87	0
Sep-87	61.13	16.19	5.82	7.68	1.05	-3.16	-0.20	5.99	0.00	0.00	2.63	29.73	23.73	17.73	8.73	-0.27	-6.27	-12.27	Sep-87	0
Oct-87	47.68	8.71	2.30	3.80	0.92	-1.38	-0.20	3.13	0.00	0.00	1.55	31.28	25.28	19.28	10.28	1.28	-4.72	-10.72	Oct-87	1
Nov-87	40.87	4.93	0.98	1.99	0.81	-0.63	-0.20	3.02	0.00	0.00	2.19	33.47	27.47	21.47	12.47	3.47	-2.53	-8.53		
Dec-87	32.31	0.17	0.01	0.04	0.75	-0.01	-0.20	1.99	0.00	0.00	1.78	35.25	29.25	23.25	14.25	5.25	-0.75	-6.75		
Jan-88	23.10	-4.95	0.00	0.00	0.77	0.00	-0.20	1.50	0.00	0.00	1.30	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-88	24.55	-4.14	0.00	0.00	0.88	0.00	-0.20	2.13	0.00	0.00	1.93	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-88	34.40	1.34	0.14	0.45	0.99	-0.17	-0.20	1.79	0.00	0.00	1.42	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-88	45.72	7.62	1.88	3.26	1.11	-1.43	-0.20	2.70	0.00	0.00	1.07	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-88	1
May-88	59.69	15.39	5.40	7.25	1.22	-3.49	-0.20	3.05	0.00	0.00	-0.64	35.36	29.36	23.36	14.36	5.36	-0.64	-6.64	May-88	1
Jun-88	64.08	17.82	6.73	8.57	1.28	-4.33	-0.20	2.46	0.00	0.00	-2.07	33.29	27.29	21.29	12.29	3.29	-2.71	-8.71	Jun-88	1
Jul-88	74.03	23.35	10.09	11.65	1.26	-5.78	-0.20	5.72	0.00	0.00	-0.26	33.03	27.03	21.03	12.03	3.03	-2.97	-8.97	Jul-88	1
Aug-88	71.73	22.07	9.27	10.92	1.17	-5.02	-0.20	3.77	0.00	0.00	-1.45	31.58	25.58	19.58	10.58	1.58	-4.42	-10.42	Aug-88	1
Sep-88	60.80	16.00	5.72	7.58	1.05	-3.12	-0.20	1.88	0.00	0.00	-1.44	30.14	24.14	18.14	9.14	0.14	-5.86	-11.86	Sep-88	1
Oct-88	46.60	8.11	2.07	3.50	0.92	-1.27	-0.20	3.57	0.00	0.00	2.10	32.24	26.24	20.24	11.24	2.24	-3.76	-9.76	Oct-88	1
Nov-88	42.98	6.10	1.35	2.53	0.81	-0.81	-0.20	3.95	0.00	0.00	2.94	35.18	29.18	23.18	14.18	5.18	-0.82	-6.82		
Dec-88	27.73	-2.37	0.00	0.00	0.75	0.00	-0.20	1.92	0.00	0.00	1.72	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Jan-89	28.55	-1.92	0.00	0.00	0.77	0.00	-0.20	1.06	0.00	0.00	0.86	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-89	22.70	-5.17	0.00	0.00	0.88	0.00	-0.20	1.71	0.00	0.00	1.51	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-89	32.84	0.47	0.03	0.14	0.99	-0.05	-0.20	3.13	0.00	0.00	2.88	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-89	43.43	6.35	1.43	2.65	1.11	-1.16	-0.20	1.52	0.00	0.00	0.16	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-89	1
May-89	58.18	14.54	4.96	6.80	1.22	-3.28	-0.20	4.27	0.00	0.00	0.79	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	May-89	1
Jun-89	67.25	19.58	7.75	9.54	1.28	-4.82	-0.20	5.41	0.00	0.00	0.39	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Jun-89	1
Jul-89	71.06	21.70	9.04	10.72	1.26	-5.32	-0.20	2.20	0.00	0.00	-3.32	32.68	26.68	20.68	11.68	2.68	-3.32	-9.32	Jul-89	1
Aug-89	68.16	20.09	8.05	9.82	1.17	-4.51	-0.20	2.68	0.00	0.00	-2.03	30.65	24.65	18.65	9.65	0.65	-5.35	-11.35	Aug-89	1
Sep-89	61.75	16.53	6.01	7.86	1.05	-3.24	-0.20	5.96	0.00	0.00	2.52	33.17	27.17	21.17	12.17	3.17	-2.83	-8.83	Sep-89	1
Oct-89	51.68	10.93	3.23	4.91	0.92	-1.78	-0.20	4.08	0.00	0.00	2.10	35.27	29.27	23.27	14.27	5.27	-0.73	-6.73	Oct-89	1
Nov-89	38.80	3.78	0.66	1.47	0.81	-0.47	-0.20	2.78	0.00	0.00	2.11	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Dec-89	15.65	-9.08	0.00	0.00	0.75	0.00	-0.20	2.13	0.00	0.00	1.93	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Jan-90	33.21	0.67	0.05	0.21	0.77	-0.06	-0.20	2.13	0.00	0.00	1.87	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-90	29.53	-1.37	0.00	0.00	0.88	0.00	-0.20	3.95	0.00	0.00	3.75	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-90	37.52	3.06	0.48	1.16	0.99	-0.45	-0.20	3.70	0.00	0.00	3.05	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-90	49.30	9.61	2.67	4.25	1.11	-1.86	-0.20	4.09	0.00	0.00	2.03	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-90	1
May-90	54.45	12.47	3.94	5.71	1.22	-2.75	-0.20	5.62	0.00	0.00	2.67	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	May-90	1
Jun-90	67.25	19.58	7.75	9.54	1.28	-4.82	-0.20	2.92	0.00	0.00	-2.10	33.90	27.90	21.90	12.90	3.90	-2.10	-8.10	Jun-90	1
Jul-90	71.77	22.10	9.29	10.94	1.26	-5.43	-0.20	3.72	0.00	0.00	-1.91	32.00	26.00	20.00	11.00	2.00	-4.00	-10.00	Jul-90	1
Aug-90	70.29	21.27	8.78	10.48	1.17	-4.82	-0.20	5.33	0.00	0.00	0.31	32.31	26.31	20.31	11.31	2.31	-3.69	-9.69	Aug-90	1
Sep-90	61.15	16.19	5.83	7.68	1.05	-3.16	-0.20	3.45	0.00	0.00	0.09	32.40	26.40	20.40	11.40	2.40	-3.60	-9.60	Sep-90	1
Oct-90	52.79	11.55	3.51	5.23	0.92	-1.90	-0.20	6.09	0.00	0.00	3.99	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Oct-90	1
Nov-90	42.23	5.69	1.21	2.34	0.81	-0.74	-0.20	3.23	0.00	0.00	2.29	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Dec-90	33.50	0.83	0.07	0.26	0.75	-0.08	-0.20	5.24	0.00	0.00	4.96	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Jan-91	24.34	-4.26	0.00	0.00	0.77	0.00	-0.20	2.44	0.00	0.00	2.24	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-91	29.80	-1.22	0.00	0.00	0.88	0.00	-0.20	1.54	0.00	0.00	1.34	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-91	37.68	3.15	0.50	1.20	0.99	-0.46	-0.20	4.07	0.00	0.00	3.41	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-91	50.95	10.53	3.06	4.71	1.11	-2.06	-0.20	3.90	0.00	0.00	1.64	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-91	1
May-91	62.73	17.07	6.31	8.16	1.22	-3.93	-0.20	3.90	0.00	0.00	-0.23	35.77	29.77	23.77	14.77	5.77	-0.23	-6.23	May-91	1
Jun-91	68.43	20.24	8.14	9.90	1.28	-5.00	-0.20	1.67	0.00	0.00	-3.53	32.24	26.24	20.24	11.24	2.24	-3.76	-9.76	Jun-91	1
Jul-91	72.34	22.41	9.49	11.12	1.26	-5.51	-0.20	2.86	0.00	0.00	-2.85	29.38	23.38	17.38	8.38	-0.62	-6.62	-12.62	Jul-91	0
Aug-91	71.77	22.10	9.29	10.94	1.17	-5.03	-0.20	4.03	0.00	0.00	-1.20	28.18	22.18	16.18	7.18	-1.82	-7.82	-13.82	Aug-91	0
Sep-91	60.47	15.81	5.63	7.48	1.05	-3.08	-0.20	4.20	0.00	0.00	0.92	29.10	23.10	17.10	8.10	-0.90	-6.90	-12.90	Sep-91	0
Oct-91	53.10	11.72	3.59	5.32	0.92	-1.93	-0.20	2.62	0.00	0.00	0.49	29.60	23.60	17.60	8.60	-0.40	-6.40	-12.40	Oct-91	0
Nov-91	39.97	4.43	0.83	1.76	0.81	-0.56	-0.20	2.72	0.00	0.00	1.96	31.56	25.56	19.56	10.56	1.56	-4.44	-10.44		
Dec-91	30.68	-0.73	0.00	0.00	0.75	0.00	-0.20	3.10	0.00	0.00	2.90	34.46	28.46	22.46	13.46	4.46	-1.54	-7.54		
Jan-92	24.73	-4.04	0.00	0.00	0.77	0.00	-0.20	2.62	0.00	0.00	2.42	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-92	26.43	-3.09	0.00	0.00	0.88	0.00	-0.20	2.46	0.00	0.00	2.26	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-92	29.27	-1.51	0.00	0.00	0.99	0.00	-0.20	3.80	0.00	0.00	3.60	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-92	44.38	6.88	1.61	2.90	1.11	-1.27	-0.20	3.54	0.00	0.00	2.07	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-92	1
May-92	57.53	14.18	4.78	6.61	1.22	-3.18	-0.20	5.21	0.00	0.00	1.83	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	May-92	1
Jun-92	63.95	17.75	6.69	8.53	1.28	-4.31	-0.20	1.78	0.00	0.00	-2.73	33.27	27.27	21.27	12.27	3.27	-2.73	-8.73	Jun-92	1
Jul-92	67.31	19.61	7.77	9.55	1.26	-4.74	-0.20	8.00	0.00	0.00	3.06	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Jul-92	1
Aug-92	67.50	19.72	7.83	9.61	1.17	-4.42	-0.20	2.64	0.00	0.00	-1.98	34.02	28.02	22.02	13.02	4.02	-1.98	-7.98	Aug-92	1
Sep-92	61.25	16.25	5.86	7.71	1.05	-3.18	-0.20	4.55	0.00	0.00	1.17	35.19	29.19	23.19	14.19	5.19	-0.81	-6.81	Sep-92	1
Oct-92	46.56	8.09	2.06	3.49	0.92	-1.27	-0.20	2.69	0.00	0.00	1.22	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Oct-92	1
Nov-92	39.65	4.25	0.78	1.68	0.81	-0.53	-0.20	3.75	0.00	0.00	3.02	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Dec-92	30.95	-0.58	0.00	0.00	0.75	0.00	-0.20	2.57	0.00	0.00	2.37	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Jan-96	20.01	-6.66	0.00	0.00	0.77	0.00	-0.20	3.35	0.00	0.00	3.15	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-96	23.12	-4.93	0.00	0.00	0.88	0.00	-0.20	1.25	0.00	0.00	1.05	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-96	30.20	-1.00	0.00	0.00	0.99	0.00	-0.20	1.74	0.00	0.00	1.54	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-96	42.35	5.75	1.23	2.37	1.11	-1.04	-0.20	4.28	0.00	0.00	3.04	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-96	1
May-96	54.67	12.59	4.00	5.77	1.22	-2.78	-0.20	3.02	0.00	0.00	0.04	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	May-96	1
Jun-96	66.80	19.33	7.60	9.40	1.28	-4.75	-0.20	3.05	0.00	0.00	-1.90	34.10	28.10	22.10	13.10	4.10	-1.90	-7.90	Jun-96	1
Jul-96	69.42	20.79	8.48	10.21	1.26	-5.06	-0.20	4.24	0.00	0.00	-1.02	33.08	27.08	21.08	12.08	3.08	-2.92	-8.92	Jul-96	1
Aug-96	70.31	21.28	8.78	10.48	1.17	-4.82	-0.20	1.71	0.00	0.00	-3.31	29.77	23.77	17.77	8.77	-0.23	-6.23	-12.23	Aug-96	0
Sep-96	63.07	17.26	6.41	8.26	1.05	-3.40	-0.20	4.38	0.00	0.00	0.78	30.55	24.55	18.55	9.55	0.55	-5.45	-11.45	Sep-96	1
Oct-96	50.63	10.35	2.98	4.62	0.92	-1.67	-0.20	2.14	0.00	0.00	0.27	30.81	24.81	18.81	9.81	0.81	-5.19	-11.19	Oct-96	1
Nov-96	34.68	1.49	0.16	0.51	0.81	-0.16	-0.20	5.78	0.00	0.00	5.42	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Dec-96	34.84	1.58	0.18	0.54	0.75	-0.16	-0.20	4.45	0.00	0.00	4.09	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Jan-97	23.82	-4.54	0.00	0.00	0.77	0.00	-0.20	1.46	0.00	0.00	1.26	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-97	30.32	-0.93	0.00	0.00	0.88	0.00	-0.20	2.25	0.00	0.00	2.05	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-97	33.55	0.86	0.07	0.27	0.99	-0.11	-0.20	3.57	0.00	0.00	3.26	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-97	44.22	6.79	1.58	2.86	1.11	-1.25	-0.20	1.77	0.00	0.00	0.32	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-97	1
May-97	52.19	11.22	3.36	5.06	1.22	-2.44	-0.20	2.43	0.00	0.00	-0.21	35.79	29.79	23.79	14.79	5.79	-0.21	-6.21	May-97	1
Jun-97	67.87	19.93	7.96	9.73	1.28	-4.91	-0.20	1.64	0.00	0.00	-3.47	32.32	26.32	20.32	11.32	2.32	-3.68	-9.68	Jun-97	1
Jul-97	69.90	21.06	8.64	10.35	1.26	-5.14	-0.20	2.78	0.00	0.00	-2.56	29.76	23.76	17.76	8.76	-0.24	-6.24	-12.24	Jul-97	0
Aug-97	68.40	20.22	8.13	9.89	1.17	-4.55	-0.20	4.06	0.00	0.00	-0.69	29.07	23.07	17.07	8.07	-0.93	-6.93	-12.93	Aug-97	0
Sep-97	60.10	15.61	5.52	7.37	1.05	-3.03	-0.20	2.75	0.00	0.00	-0.48	28.59	22.59	16.59	7.59	-1.41	-7.41	-13.41	Sep-97	0
Oct-97	49.05	9.47	2.61	4.18	0.92	-1.51	-0.20	1.50	0.00	0.00	-0.21	28.37	22.37	16.37	7.37	-1.63	-7.63	-13.63	Oct-97	0
Nov-97	37.17	2.87	0.43	1.07	0.81	-0.34	-0.20	4.28	0.00	0.00	3.74	32.11	26.11	20.11	11.11	2.11	-3.89	-9.89		
Dec-97	30.44	-0.87	0.00	0.00	0.75	0.00	-0.20	4.13	0.00	0.00	3.93	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Jan-98	29.60	-1.34	0.00	0.00	0.77	0.00	-0.20	4.76	0.00	0.00	4.56	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-98	31.16	-0.47	0.00	0.00	0.88	0.00	-0.20	3.14	0.00	0.00	2.94	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-98	37.84	3.24	0.52	1.23	0.99	-0.48	-0.20	2.94	0.00	0.00	2.26	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-98	48.12	8.95	2.40	3.92	1.11	-1.71	-0.20	2.09	0.00	0.00	0.18	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-98	1
May-98	62.89	17.16	6.36	8.21	1.22	-3.95	-0.20	2.37	0.00	0.00	-1.78	34.22	28.22	22.22	13.22	4.22	-1.78	-7.78	May-98	1
Jun-98	66.28	19.05	7.43	9.24	1.28	-4.67	-0.20	4.62	0.00	0.00	-0.25	33.97	27.97	21.97	12.97	3.97	-2.03	-8.03	Jun-98	1
Jul-98	70.10	21.16	8.71	10.42	1.26	-5.17	-0.20	3.63	0.00	0.00	-1.74	32.23	26.23	20.23	11.23	2.23	-3.77	-9.77	Jul-98	1
Aug-98	71.13	21.74	9.07	10.74	1.17	-4.94	-0.20	4.77	0.00	0.00	-0.37	31.86	25.86	19.86	10.86	1.86	-4.14	-10.14	Aug-98	1
Sep-98	63.95	17.75	6.69	8.53	1.05	-3.51	-0.20	2.41	0.00	0.00	-1.30	30.56	24.56	18.56	9.56	0.56	-5.44	-11.44	Sep-98	1
Oct-98	51.84	11.02	3.27	4.96	0.92	-1.80	-0.20	2.53	0.00	0.00	0.53	31.09	25.09	19.09	10.09	1.09	-4.91	-10.91	Oct-98	1
Nov-98	41.68	5.38	1.12	2.19	0.81	-0.70	-0.20	2.06	0.00	0.00	1.16	32.26	26.26	20.26	11.26	2.26	-3.74	-9.74		

Hydrograph preparation as described in - Gary J. Pierce. 1993. Planning Hydrology for Constructed Wetlands Wetland Training Institute, Inc. Poolseville, MD. WTI 93-2. 49pp.

Attachment H-2
Honeywell Wastebeds 1-8
Mitigation Wetlands and Upland Restoration Basis of Design
Wetland A Monthly Hydrograph Supporting Data - Wetland Starting Empty
1978 to 2008

Water Budget Graphing Calculations

Month	Avg. Temp. (Degrees F)	Avg. Temp. (Degrees C)	Heat Index (I)	Evapotranspiration (ET)	Evapotranspiration Correction Factor	Corrected ET (Inches)	Infiltration (Inches)	Precipitation (Inches)	Groundwater (Inches)	Runoff (Inches)	Total depth change (Inches)	Deep Emergent Max Depth (Inches)	Deep Emergent Midpoint Depth (Inches)	Shallow Emergent Max Depth (Inches)	Shallow Emergent Midpoint Depth (Inches)	Wet Meadow Max Depth (Inches)	Wet Meadow Midpoint Depth (Inches)	Wet meadow minimum water depth (Inches)	Growing season Month - Year	Water level within 12" of soil surface during growing season at upper edge of wet meadow[1] (1 = yes / 0 = no)
Dec-98	35.40	1.89	0.23	0.67	0.75	-0.20	-0.20	1.74	0.00	0.00	1.34	33.60	27.60	21.60	12.60	3.60	-2.40	-8.40		
Jan-99	22.50	-5.28	0.00	0.00	0.77	0.00	-0.20	5.33	0.00	0.00	5.13	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-99	29.55	-1.36	0.00	0.00	0.88	0.00	-0.20	1.43	0.00	0.00	1.23	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-99	31.52	-0.27	0.00	0.00	0.99	0.00	-0.20	3.53	0.00	0.00	3.33	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-99	46.52	8.06	2.05	3.48	1.11	-1.52	-0.20	1.75	0.00	0.00	0.03	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-99	1
May-99	60.68	15.93	5.69	7.54	1.22	-3.63	-0.20	0.81	0.00	0.00	-3.02	32.98	26.98	20.98	11.98	2.98	-3.02	-9.02	May-99	1
Jun-99	69.80	21.00	8.61	10.32	1.28	-5.21	-0.20	1.78	0.00	0.00	-3.63	29.34	23.34	17.34	8.34	-0.66	-6.66	-12.66	Jun-99	0
Jul-99	74.95	23.86	10.43	11.94	1.26	-5.92	-0.20	2.55	0.00	0.00	-3.57	25.77	19.77	13.77	4.77	-4.23	-10.23	-16.23	Jul-99	0
Aug-99	68.85	20.47	8.29	10.03	1.17	-4.61	-0.20	1.02	0.00	0.00	-3.79	21.98	15.98	9.98	0.98	-8.02	-14.02	-20.02	Aug-99	0
Sep-99	65.18	18.43	7.08	8.90	1.05	-3.67	-0.20	5.35	0.00	0.00	1.48	23.46	17.46	11.46	2.46	-6.54	-12.54	-18.54	Sep-99	0
Oct-99	49.50	9.72	2.71	4.30	0.92	-1.56	-0.20	2.77	0.00	0.00	1.01	24.47	18.47	12.47	3.47	-5.53	-11.53	-17.53	Oct-99	0
Nov-99	44.32	6.84	1.60	2.89	0.81	-0.92	-0.20	3.16	0.00	0.00	2.04	26.51	20.51	14.51	5.51	-3.49	-9.49	-15.49		
Dec-99	30.90	-0.61	0.00	0.00	0.75	0.00	-0.20	1.40	0.00	0.00	1.20	27.71	21.71	15.71	6.71	-2.29	-8.29	-14.29		
Jan-00	21.31	-5.94	0.00	0.00	0.77	0.00	-0.20	2.80	0.00	0.00	2.60	30.31	24.31	18.31	9.31	0.31	-5.69	-11.69		
Feb-00	28.81	-1.77	0.00	0.00	0.88	0.00	-0.20	2.46	0.00	0.00	2.26	32.57	26.57	20.57	11.57	2.57	-3.43	-9.43		
Mar-00	40.05	4.47	0.85	1.78	0.99	-0.69	-0.20	2.37	0.00	0.00	1.48	34.05	28.05	22.05	13.05	4.05	-1.95	-7.95		
Apr-00	44.28	6.82	1.59	2.88	1.11	-1.26	-0.20	4.24	0.00	0.00	2.78	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-00	1
May-00	59.06	15.04	5.21	7.06	1.22	-3.40	-0.20	4.75	0.00	0.00	1.15	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	May-00	1
Jun-00	65.58	18.66	7.21	9.02	1.28	-4.56	-0.20	4.46	0.00	0.00	-0.30	35.70	29.70	23.70	14.70	5.70	-0.30	-6.30	Jun-00	1
Jul-00	66.98	19.44	7.66	9.45	1.26	-4.69	-0.20	2.73	0.00	0.00	-2.16	33.54	27.54	21.54	12.54	3.54	-2.46	-8.46	Jul-00	1
Aug-00	68.15	20.08	8.05	9.81	1.17	-4.51	-0.20	2.48	0.00	0.00	-2.23	31.31	25.31	19.31	10.31	1.31	-4.69	-10.69	Aug-00	1
Sep-00	60.65	15.92	5.68	7.53	1.05	-3.10	-0.20	3.13	0.00	0.00	-0.17	31.14	25.14	19.14	10.14	1.14	-4.86	-10.86	Sep-00	1
Oct-00	50.89	10.49	3.04	4.69	0.92	-1.70	-0.20	2.25	0.00	0.00	0.35	31.49	25.49	19.49	10.49	1.49	-4.51	-10.51	Oct-00	1
Nov-00	38.42	3.56	0.60	1.37	0.81	-0.44	-0.20	2.98	0.00	0.00	2.34	33.83	27.83	21.83	12.83	3.83	-2.17	-8.17		
Dec-00	21.65	-5.75	0.00	0.00	0.75	0.00	-0.20	2.36	0.00	0.00	2.16	35.99	29.99	23.99	14.99	5.99	-0.01	-6.01		
Jan-01	25.58	-3.57	0.00	0.00	0.77	0.00	-0.20	1.57	0.00	0.00	1.37	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-01	27.59	-2.45	0.00	0.00	0.88	0.00	-0.20	1.77	0.00	0.00	1.57	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-01	29.92	-1.16	0.00	0.00	0.99	0.00	-0.20	5.38	0.00	0.00	5.18	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-01	47.83	8.80	2.33	3.84	1.11	-1.68	-0.20	1.53	0.00	0.00	-0.35	35.65	29.65	23.65	14.65	5.65	-0.35	-6.35	Apr-01	1
May-01	59.29	15.16	5.28	7.13	1.22	-3.44	-0.20	2.24	0.00	0.00	-1.40	34.25	28.25	22.25	13.25	4.25	-1.75	-7.75	May-01	1
Jun-01	67.20	19.56	7.73	9.52	1.28	-4.81	-0.20	3.58	0.00	0.00	-1.43	32.83	26.83	20.83	11.83	2.83	-3.17	-9.17	Jun-01	1
Jul-01	69.35	20.75	8.46	10.19	1.26	-5.05	-0.20	2.08	0.00	0.00	-3.17	29.65	23.65	17.65	8.65	-0.35	-6.35	-12.35	Jul-01	0
Aug-01	73.61	23.12	9.94	11.52	1.17	-5.30	-0.20	4.84	0.00	0.00	-0.66	29.00	23.00	17.00	8.00	-1.00	-7.00	-13.00	Aug-01	0
Sep-01	62.25	16.81	6.16	8.01	1.05	-3.30	-0.20	4.05	0.00	0.00	0.55	29.55	23.55	17.55	8.55	-0.45	-6.45	-12.45	Sep-01	0
Oct-01	53.31	11.84	3.64	5.38	0.92	-1.95	-0.20	2.15	0.00	0.00	0.00	29.55	23.55	17.55	8.55	-0.45	-6.45	-12.45	Oct-01	0
Nov-01	47.25	8.47	2.21	3.68	0.81	-1.17	-0.20	2.92	0.00	0.00	1.55	31.10	25.10	19.10	10.10	1.10	-4.90	-10.90		
Dec-01	36.77	2.65	0.39	0.98	0.75	-0.29	-0.20	2.19	0.00	0.00	1.70	32.80	26.80	20.80	11.80	2.80	-3.20	-9.20		
Jan-02	32.92	0.51	0.03	0.15	0.77	-0.05	-0.20	2.13	0.00	0.00	1.88	34.68	28.68	22.68	13.68	4.68	-1.32	-7.32		
Feb-02	32.27	0.15	0.01	0.04	0.88	-0.01	-0.20	1.44	0.00	0.00	1.23	35.91	29.91	23.91	14.91	5.91	-0.09	-6.09		
Mar-02	36.32	2.40	0.33	0.88	0.99	-0.34	-0.20	2.75	0.00	0.00	2.21	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-02	48.48	9.16	2.48	4.02	1.11	-1.76	-0.20	4.38	0.00	0.00	2.42	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-02	1
May-02	54.03	12.24	3.83	5.59	1.22	-2.69	-0.20	5.77	0.00	0.00	2.88	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	May-02	1
Jun-02	67.95	19.97	7.98	9.75	1.28	-4.93	-0.20	5.35	0.00	0.00	0.22	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Jun-02	1
Jul-02	73.73	23.18	9.98	11.55	1.26	-5.73	-0.20	1.75	0.00	0.00	-4.18	31.82	25.82	19.82	10.82	1.82	-4.18	-10.18	Jul-02	1
Aug-02	72.97	22.76	9.71	11.31	1.17	-5.20	-0.20	2.71	0.00	0.00	-2.69	29.13	23.13	17.13	8.13	-0.87	-6.87	-12.87	Aug-02	0
Sep-02	66.88	19.38	7.63	9.42	1.05	-3.88	-0.20	3.55	0.00	0.00	-0.53	28.60	22.60	16.60	7.60	-1.40	-7.40	-13.40	Sep-02	0
Oct-02	50.40	10.22	2.92	4.55	0.92	-1.65	-0.20	3.98	0.00	0.00	2.13	30.73	24.73	18.73	9.73	0.73	-5.27	-11.27	Oct-02	1
Nov-02	40.63	4.80	0.94	1.93	0.81	-0.61	-0.20	3.21	0.00	0.00	2.40	33.12	27.12	21.12	12.12	3.12	-2.88	-8.88		
Dec-02	28.68	-1.85	0.00	0.00	0.75	0.00	-0.20	2.84	0.00	0.00	2.64	35.76	29.76	23.76	14.76	5.76	-0.24	-6.24		
Jan-03	18.82	-7.32	0.00	0.00	0.77	0.00	-0.20	1.44	0.00	0.00	1.24	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-03	21.63	-5.76	0.00	0.00	0.88	0.00	-0.20	2.58	0.00	0.00	2.38	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-03	34.18	1.21	0.12	0.40	0.99	-0.16	-0.20	2.89	0.00	0.00	2.53	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-03	43.83	6.57	1.51	2.76	1.11	-1.21	-0.20	2.61	0.00	0.00	1.20	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-03	1
May-03	56.05	13.36	4.37	6.17	1.22	-2.98	-0.20	5.27	0.00	0.00	2.09	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	May-03	1
Jun-03	64.62	18.12	6.90	8.73	1.28	-4.41	-0.20	2.83	0.00	0.00	-1.78	34.22	28.22	22.22	13.22	4.22	-1.78	-7.78	Jun-03	1
Jul-03	71.18	21.77	9.08	10.75	1.26	-5.33	-0.20	3.30	0.00	0.00	-2.23	31.99	25.99	19.99	10.99	1.99	-4.01	-10.01	Jul-03	1
Aug-03	71.45	21.92	9.18	10.84	1.17	-4.98	-0.20	3.03	0.00	0.00	-2.15	29.83	23.83	17.83	8.83	-0.17	-6.17	-12.17	Aug-03	0
Sep-03	63.23	17.35	6.46	8.31	1.05	-3.42	-0.20	3.14	0.00	0.00	-0.48	29.35	23.35	17.35	8.35	-0.65	-6.65	-12.65	Sep-03	0
Oct-03	48.56	9.20	2.50	4.04	0.92	-1.47	-0.20	4.27	0.00	0.00	2.60	31.96	25.96	19.96	10.96	1.96	-4.04	-10.04	Oct-03	1
Nov-03	42.20	5.67	1.21	2.33	0.81	-0.74	-0.20	3.14	0.00	0.00	2.20	34.15	28.15	22.15	13.15	4.15	-1.85	-7.85		
Dec-03	30.02	-1.10	0.00	0.00	0.75	0.00	-0.20	3.10	0.00	0.00	2.90	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Jan-04	14.68	-9.62	0.00	0.00	0.77	0.00	-0.20	1.86	0.00	0.00	1.66	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-04	23.52	-4.71	0.00	0.00	0.88	0.00	-0.20	1.12	0.00	0.00	0.92	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-04	37.47	3.04	0.47	1.15	0.99	-0.45	-0.20	2.04	0.00	0.00	1.39	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-04	46.12	7.84	1.96	3.37	1.11	-1.48	-0.20	3.72	0.00	0.00	2.04	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-04	1
May-04	60.26	15.70	5.56	7.42	1.22	-3.57	-0.20	7.82	0.00	0.00	4.05	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	May-04	1
Jun-04	63.73	17.63	6.62	8.46	1.28	-4.27	-0.20	2.42	0.00	0.00	-2.05	33.95	27.95	21.95	12.95	3.95	-2.05	-8.05	Jun-04	1
Jul-04	69.50	20.83	8.51	10.23	1.26	-5.08	-0.20	6.95	0.00	0.00	1.67	35.62	29.62	23.62	14.62	5.62	-0.38	-6.38	Jul-04	1
Aug-04	68.65	20.36	8.22	9.97	1.17	-4.58	-0.20	5.09	0.00	0.00	0.31	35.93	29.93	23.93	14.93	5.93	-0.07	-6.07	Aug-04	1
Sep-04	65.00	18.33	7.02	8.85	1.05	-3.64	-0.20	3.23	0.00	0.00	-0.61	35.31	29.31	23.31	14.31	5.31	-0.69	-6.69	Sep-04	1
Oct-04	51.44	10.80	3.17	4.85	0.92	-1.76	-0.20	2.28	0.00	0.00	0.32	35.64	29.64	23.64	14.64	5.64	-0.36	-6.36	Oct-04	1
Nov-04	41.03	5.02	1.01	2.03	0.81	-0.65	-0.20	2.81	0.00	0.00	1.96	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Dec-04	29.13	-1.59	0.00	0.00	0.75	0.00	-0.20	3.80	0.00	0.00	3.60	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Jan-05	20.97	-6.13	0.00	0.00	0.77	0.00	-0.20	2.96	0.00	0.00	2.76	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-05	25.73	-3.48	0.00	0.00	0.88	0.00	-0.20	1.57	0.00	0.00	1.37	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-05	30.71	-0.72	0.00	0.00	0.99	0.00	-0.20	1.39	0.00	0.00	1.19	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-05	48.30	9.06	2.44	3.97	1.11	-1.74	-0.20	5.71	0.00	0.00	3.77	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-05	1
May-05	54.23	12.35	3.88	5.64	1.22	-2.72	-0.20	0.59	0.00	0.00	-2.33	33.67	27.67	21.67	12.67	3.67	-2.33	-8.33	May-05	1
Jun-05	72.65	22.58	9.60	11.21	1.28	-5.66	-0.20	1.95	0.00	0.00	-3.91	29.76	23.76	17.76	8.76	-0.24	-6.24	-12.24	Jun-05	0
Jul-05	74.66	23.70	10.32	11.85	1.26	-5.88	-0.20	4.61	0.00	0.00	-1.47	28.29	22.29	16.29	7.29	-1.71	-7.71	-13.71	Jul-05	0
Aug-05	73.73	23.18	9.98	11.55	1.17	-5.31	-0.20	5.95	0.00	0.00	0.44	28.73	22.73	16.73	7.73	-1.27	-7.27	-13.27	Aug-05	0
Sep-05	65.37	18.54	7.14	8.96	1.05	-3.69	-0.20	1.75	0.00	0.00	-2.14	26.59	20.59	14.59	5.59	-3.41	-9.41	-15.41	Sep-05	0
Oct-05	52.11	11.17	3.34	5.04	0.92	-1.83	-0.20	6.40	0.00	0.00	4.37	30.96	24.96	18.96	9.96	0.96	-5.04	-11.04	Oct-05	1
Nov-05	44.00	6.67	1.54	2.80	0.81	-0.89	-0.20	4.66	0.00	0.00	3.57	34.53	28.53	22.53	13.53	4.53	-1.47	-7.47		
Dec-05	26.19	-3.23	0.00	0.00	0.75	0.00	-0.20	2.56	0.00	0.00	2.36	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Jan-06	33.44	0.80	0.06	0.25	0.77	-0.08	-0.20	2.96	0.00	0.00	2.68	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-06	27.20	-2.67	0.00	0.00	0.88	0.00	-0.20	1.66	0.00	0.00	1.46	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-06	34.02	1.12	0.11	0.37	0.99	-0.14	-0.20	1.86	0.00	0.00	1.52	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-06	47.80	8.78	2.33	3.83	1.11	-1.68	-0.20	3.93	0.00	0.00	2.05	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-06	1
May-06	58.18	14.54	4.96	6.80	1.22	-3.28	-0.20	2.25	0.00	0.00	-1.23	34.77	28.77	22.77	13.77	4.77	-1.23	-7.23	May-06	1
Jun-06	67.15	19.53	7.72	9.50	1.28	-4.80	-0.20	5.09	0.00	0.00	0.09	34.86	28.86	22.86	13.86	4.86	-1.14	-7.14	Jun-06	1
Jul-06	74.15	23.41	10.13	11.68	1.26	-5.80	-0.20	10.12	0.00	0.00	4.12	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Jul-06	1
Aug-06	69.23	20.68	8.41	10.15	1.17	-4.67	-0.20	3.21	0.00	0.00	-1.66	34.34	28.34	22.34	13.34	4.34	-1.66	-7.66	Aug-06	1
Sep-06	60.73	15.96	5.70	7.56	1.05	-3.11	-0.20	4.04	0.00	0.00	0.73	35.07	29.07	23.07	14.07	5.07	-0.93	-6.93	Sep-06	1
Oct-06	49.24	9.58	2.65	4.23	0.92	-1.53	-0.20	5.70	0.00	0.00	3.97	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Oct-06	1
Nov-06	44.68	7.05	1.67	2.98	0.81	-0.95	-0.20	2.62	0.00	0.00	1.47	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Dec-06	37.40	3.00	0.47	1.13	0.75	-0.33	-0.20	3.76	0.00	0.00	3.23	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Jan-07	27.23	-2.65	0.00	0.00	0.77	0.00	-0.20	4.20	0.00	0.00	4.00	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-07	18.46	-7.52	0.00	0.00	0.88	0.00	-0.20	2.49	0.00	0.00	2.29	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-07	31.55	-0.25	0.00	0.00	0.99	0.00	-0.20	4.16	0.00	0.00	3.96	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-07	43.73	6.52	1.49	2.73	1.11	-1.20	-0.20	4.42	0.00	0.00	3.02	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-07	1
May-07	58.53	14.74	5.06	6.90	1.22	-3.33	-0.20	0.86	0.00	0.00	-2.67	33.33	27.33	21.33	12.33	3.33	-2.67	-8.67	May-07	1
Jun-07	68.33	20.19	8.11	9.87	1.28	-4.99	-0.20	3.67	0.00	0.00	-1.52	31.82	25.82	19.82	10.82	1.82	-4.18	-10.18	Jun-07	1
Jul-07	69.81	21.00	8.61	10.33	1.26	-5.12	-0.20	3.61	0.00	0.00	-1.71	30.11	24.11	18.11	9.11	0.11	-5.89	-11.89	Jul-07	1
Aug-07	70.84	21.58	8.96	10.65	1.17	-4.90	-0.20	1.76	0.00	0.00	-3.34	26.77	20.77	14.77	5.77	-3.23	-9.23	-15.23	Aug-07	0
Sep-07	65.33	18.52	7.13	8.95	1.05	-3.69	-0.20	3.20	0.00	0.00	-0.69	26.08	20.08	14.08	5.08	-3.92	-9.92	-15.92	Sep-07	0
Oct-07	57.98	14.44	4.91	6.74	0.92	-2.44	-0.20	4.02	0.00	0.00	1.38	27.46	21.46	15.46	6.46	-2.54	-8.54	-14.54	Oct-07	0
Nov-07	37.93	3.30	0.54	1.26	0.81	-0.40	-0.20	4.17	0.00	0.00	3.57	31.03	25.03	19.03	10.03	1.03	-4.97	-10.97		

Hydrograph preparation as described in - Gary J. Pierce. 1993. Planning Hydrology for Constructed Wetlands Wetland Training Institute, Inc. Poolseville, MD. WTI 93-2. 49pp.

Attachment H-2
Honeywell Wastebeds 1-8
Mitigation Wetlands and Upland Restoration Basis of Design
Wetland A Monthly Hydrograph Supporting Data - Wetland Starting Empty
1978 to 2008

Water Budget Graphing Calculations

Month	Avg. Temp. (Degrees F)	Avg. Temp. (Degrees C)	Heat Index (I)	Evapotranspiration (ET)	Evapotranspiration Correction Factor	Corrected ET (Inches)	Infiltration (Inches)	Precipitation (Inches)	Groundwater (Inches)	Runoff (Inches)	Total depth change	Deep Emergent Max Depth (Inches)	Deep Emergent Midpoint Depth (Inches)	Shallow Emergent Max Depth (Inches)	Shallow Emergent Midpoint Depth (Inches)	Wet Meadow Max Depth (Inches)	Wet Meadow Midpoint Depth (Inches)	Wet meadow minimum water depth (Inches)	Growing season Month - Year	Water level within 12" of soil surface during growing season at upper edge of wet meadow[1] (1 = yes / 0 = no)
Dec-07	27.89	-2.28	0.00	0.00	0.75	0.00	-0.20	5.04	0.00	0.00	4.84	35.87	29.87	23.87	14.87	5.87	-0.13	-6.13		
Jan-08	29.48	-1.40	0.00	0.00	0.77	0.00	-0.20	1.36	0.00	0.00	1.16	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Feb-08	25.71	-3.50	0.00	0.00	0.88	0.00	-0.20	4.71	0.00	0.00	4.51	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Mar-08	31.65	-0.20	0.00	0.00	0.99	0.00	-0.20	5.00	0.00	0.00	4.80	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		
Apr-08	51.62	10.90	3.22	4.90	1.11	-2.14	-0.20	2.99	0.00	0.00	0.65	36.00	30.00	24.00	15.00	6.00	0.00	-6.00	Apr-08	1
May-08	53.68	12.04	3.74	5.49	1.22	-2.64	-0.20	1.78	0.00	0.00	-1.06	34.94	28.94	22.94	13.94	4.94	-1.06	-7.06	May-08	1
Jun-08	69.73	20.96	8.58	10.30	1.28	-5.20	-0.20	3.75	0.00	0.00	-1.65	33.28	27.28	21.28	12.28	3.28	-2.72	-8.72	Jun-08	1
Jul-08	71.31	21.84	9.13	10.79	1.26	-5.35	-0.20	4.28	0.00	0.00	-1.27	32.01	26.01	20.01	11.01	2.01	-3.99	-9.99	Jul-08	1
Aug-08	66.94	19.41	7.65	9.44	1.17	-4.34	-0.20	3.62	0.00	0.00	-0.92	31.09	25.09	19.09	10.09	1.09	-4.91	-10.91	Aug-08	1
Sep-08	62.68	17.05	6.29	8.14	1.05	-3.35	-0.20	2.47	0.00	0.00	-1.08	30.00	24.00	18.00	9.00	0.00	-6.00	-12.00	Sep-08	1
Oct-08	48.29	9.05	2.44	3.96	0.92	-1.44	-0.20	4.87	0.00	0.00	3.23	33.24	27.24	21.24	12.24	3.24	-2.76	-8.76	Oct-08	1
Nov-08	38.18	3.44	0.57	1.32	0.81	-0.42	-0.20	3.19	0.00	0.00	2.57	35.81	29.81	23.81	14.81	5.81	-0.19	-6.19		
Dec-08	28.87	-1.74	0.00	0.00	0.75	0.00	-0.20	3.89	0.00	0.00	3.69	36.00	30.00	24.00	15.00	6.00	0.00	-6.00		

Monthly Heat Index =	41	
Weir Height =	36	Inches
Latitude =	43	Degrees
a =	1.14	
Curve Number =	58	
S =	7.24	inches
Threshold Precipitation =	1.45	inches
Watershed Area =	11.19	acres
Wetland Area =	2.90	acres

[1]This column is intended to assist the reader in quickly evaluating whether water levels at the upper edge of Wetland A are within 12" of the soil surface.

APPENDIX 8
SUPPORTING DOCUMENTATION FOR AREA-WEIGHTED AVERAGE CONCENTRATIONS FOR THE SYW-12 SITE

Appendix 8
Supporting Documentation for Area Weighted Average Concentrations for the SYW-12 Site

This appendix to the SYW-12 Site Feasibility Study (FS) describes the approach to calculating Area-Weighted Average Concentrations (AWACs) for the SYW-12 Site under pre-remediation and select post-remediation scenarios. AWACs are representative concentrations of a focused subset of constituents (i.e., representative FS constituents of concern [COCs]) calculated in a manner that balances the effects of sampling designs that are neither random nor gridded; as such, AWACs are representative of site-wide conditions and serve as a suitable basis for characterizing current and future conditions and assessing remedy effectiveness.

AWACs were calculated for the six representative FS COCs: cadmium, chromium, mercury, benzo(a)pyrene, 4,4'-DDT and its metabolites (DDx), and total PCBs. These constituents were identified as risk and remedy drivers and selected by comparing the 95% Upper Confidence Limit of the mean (95% UCL) concentrations to New York State Part 375 soil cleanup objectives (SCOs) for Commercial Use and Protection of Ecological Resources, as well as considering U.S. Fish and Wildlife's designation of persistent, bioaccumulative, and toxic (PBT) compounds and identification of risk-driving constituents that are generally representative of larger compound groups (e.g., mixtures of polycyclic aromatic hydrocarbons [PAHs]) and thus are suitable sentinels for evaluating and optimizing remedy effectiveness.

Samples used in the AWAC computation for the six representative FS COCs were collected from soil depth intervals within 0 to 2 ft below ground surface (bgs) horizon (i.e., 0-0.5, 0.5-1, and 1-2 ft). The 0-2 ft soil interval was selected to maintain consistency with the surface soil horizon used to evaluate potential ecological impacts in the baseline ecological risk assessment (BERA) and potential human health exposures from passive recreational uses at the Site. Analytical results collected from 21 locations during a sampling event conducted in December 2006 were used in this analysis.

Because analytical results were available for multiple depth intervals (within the 0-2 ft range) at a given location, it was first necessary to calculate the representative surface soil concentrations at each location. In such cases and where available, detected results for multiple depth intervals (within the 0-2 ft range) were averaged. When no detected concentration was available at a particular sampling station (i.e., all intervals were non-detect), a proxy concentration was assigned consistent with the approach used in the Geddes Brook/Ninemile Creek FS Report (Parsons 2005). Per Parsons (2005), locations where COCs were non-detect were assessed spatially via a comparison to the nearest sample location with a detected concentration. Where the detection limit of the non-detect value(s) was greater than the nearest detected concentration, the non-detected value was considered inconsistent with the measured results, and excluded from the AWAC calculations. If the non-detected value was equal to or less than the nearest measured result, the non-detect value was considered consistent with the measured data and retained for use in the AWAC analysis. Based on this rubric, nine samples were excluded from the AWAC calculations. These excluded results occurred only for 4,4'-DDT and represent approximately 14% of the available samples for this constituent.

After calculating the representative surface soil concentrations for the six representative FS COCs at the 21 stations, ArcGIS was used to conduct the AWAC analysis for the 23.57-acre SYW-12 Site. The first step was to create a concentration 'surface' across the Site by using the software's inverse distance weighting (IDW) function for each COC. The use of IDW is consistent with its application in the Geddes Brook/Ninemile Creek FS Report (Parsons 2005). IDW is a process that assigns values to unknown points using values from known points (sample data) based on the premise that closer values are more similar than values farther away. The result of the IDW procedure is a raster (2ft x 2ft grid) encompassing the entire Site, each cell of which is assigned a concentration. Concentrations are then area-weighted by multiplying the mean concentration of the interpolated grid by the area of the Site (See Appendix 7 Figures 1 through 6). Pre-remediation AWACs are computed by summing the weighted concentrations and dividing the sum by the total area of the Site. Based on this arithmetic, the pre-remediation AWACs are equal to the mean concentration of the interpolated grid. Table 1 presents the pre-remediation AWAC developed for the site.

Table 1. Pre-remediation AWAC values for the SYW-12 Site Representative Feasibility Study COCs.

Constituent of Concern	Pre-Remedy AWAC (mg/kg)
Cadmium	14.3
Chromium	124
Mercury	1.82
Benzo(a)pyrene	2.62
4,4'-DDT	0.026
Total PCBs	0.778

Post-remediation AWACs were developed for the remedial footprint associated with Alternatives 3 and 4 as presented in the SYW-12 Site FS. The remedial footprint of Alternatives 3 and 4 could expand up to an additional 2.3 acres and 1 acre, respectively, based on the results of the PDI. For the purpose of the FS, AWACs are presented for Alternative 3 and Alternative 4, assuming no additional expansion of the remedy footprint. To compute the post-remediation AWACs, the acreage associated with the remedy was multiplied by representative average topsoil concentrations for each COC for that Alternative to derive an area-weighted concentration for the remedial footprint. Representative topsoil concentrations were from Oneida Greenhouse soil sampled in 2019 and used in the remedies at several Onondaga Lake subsites (e.g., Wastebed B/Harbor Brook Site, Wastebed 1-8 Site, LCP Bridge Street Site) and are presented in Table 2.

Table 2. Representative Topsoil Concentrations for Backfill Soil.

Constituent of Concern	Replacement Soil Concentration (mg/kg)
Cadmium	0.558
Chromium	19.28
Mercury	0.054
Benzo(a)pyrene[a]	0.440
4,4'-DDT[a]	0.002
Total PCBs[a]	0.089

[a] Constituent was non-detect in topsoil dataset, detection limit used in analysis.

The average concentrations representing soil excluded from the remedy were also multiplied by the area of the remaining footprint to develop a weighted concentration for the undisturbed portions of the Site. The weighted concentration for the undisturbed areas and the remedial footprint (reflecting the introduction of clean fill) were then summed and divided by the total acreage of the Site to compute AWACs for each alternative. Table 3 presents the AWACs developed for the three remedial alternatives.

Table 3. Post-Remediation AWACs for Alternatives 3 and 4.

Constituent of Concern	Part 375-6.8(b) Restricted Use SCOs			Post-Remedy Alternative 3 AWAC (mg/kg)	Post-Remedy Alternative 4 AWAC (mg/kg)
	Commercial (mg/kg)	Protection of Ecological Resources (mg/kg)	Protection of Groundwater (mg/kg)		
Cadmium	9.3	4	7.5	8.47	7.90
Chromium	1,500	41	No SCO	80.41	75.95
Mercury	2.8	0.18	0.73	1.03	0.959
Benzo(a)pyrene	1	2.6	22	1.87	1.74
4,4'-DDT	47	0.0033	136	0.015	0.014
Total PCBs	1	1	3.2	0.479	0.450

The post-remediation AWACs were developed to support continued refinement of the elements of the remedial program at the Site. The analysis can be updated if relevant additional information becomes available following the Pre-Design Investigation.

POTENTIAL FUTURE TRAIL EXTENSION

PLANNED RECREATIONAL TRAIL ALIGNMENT

SITE BOUNDARY

0 125 250 Feet

CADMIUM 0-2 FT AVERAGE SOIL RESULTS

HIGHEST CONCENTRATION (40.0 mg/kg)

LOWEST CONCENTRATION (1.53 mg/kg)

Notes

Concentration surface developed using analytical data and inverse distance weighting techniques.

SYW-12 0-2 FT INTERPOLATED CONCENTRATION SURFACE CADMIUM

APPENDIX-8

HONEYWELL INTERNATIONAL INC.

SYW-12 FEASIBILITY STUDY

SYRACUSE, NEW YORK

FIGURE 01

O'BRIEN & GERE ENGINEERS, INC.

A RAMBOLL COMPANY

RAMBOLL

POTENTIAL FUTURE TRAIL EXTENSION

PLANNED RECREATIONAL TRAIL ALIGNMENT

SITE BOUNDARY

0 125 250 Feet

CHROMIUM 0-2 FT AVERAGE SOIL RESULTS

HIGHEST CONCENTRATION (320 mg/kg)

LOWEST CONCENTRATION (12.7 mg/kg)

Notes

Concentration surface developed using analytical data and inverse distance weighting techniques.

SYW-12 0-2 FT INTERPOLATED CONCENTRATION SURFACE CHROMIUM

APPENDIX-8

HONEYWELL INTERNATIONAL INC.
SYW-12 FEASIBILITY STUDY
SYRACUSE, NEW YORK

FIGURE 02

O'BRIEN & GERE ENGINEERS, INC.
A RAMBOLL COMPANY

RAMBOLL

POTENTIAL FUTURE TRAIL EXTENSION

PLANNED RECREATIONAL TRAIL ALIGNMENT

SITE BOUNDARY

0 125 250 Feet

MERCURY 0-2 FT AVERAGE SOIL RESULTS

HIGHEST CONCENTRATION (5.3 mg/kg)

LOWEST CONCENTRATION (0.11 mg/kg)

Notes

Concentration surface developed using analytical data and inverse distance weighting techniques.

SYW-12 0-2 FT INTERPOLATED CONCENTRATION SURFACE MERCURY

APPENDIX-8

HONEYWELL INTERNATIONAL INC.

SYW-12 FEASIBILITY STUDY

SYRACUSE, NEW YORK

FIGURE 03

O'BRIEN & GERE ENGINEERS, INC.

A RAMBOLL COMPANY

RAMBOLL

POTENTIAL FUTURE TRAIL EXTENSION

PLANNED RECREATIONAL TRAIL ALIGNMENT

SITE BOUNDARY

0 125 250 Feet

BENZO(A)PYRENE 0-2 FT AVERAGE SOIL RESULTS

HIGHEST CONCENTRATION (7.10 mg/kg)

LOWEST CONCENTRATION (0.187mg/kg)

Notes

Concentration surface developed using analytical data and inverse distance weighting techniques.

SYW-12 0-2 FT INTERPOLATED CONCENTRATION SURFACE BENZO(A)PYRENE

APPENDIX-8

HONEYWELL INTERNATIONAL INC.

SYW-12 FEASIBILITY STUDY

SYRACUSE, NEW YORK

FIGURE 04

O'BRIEN & GERE ENGINEERS, INC.

A RAMBOLL COMPANY

RAMBOLL

POTENTIAL FUTURE TRAIL EXTENSION

PLANNED RECREATIONAL TRAIL ALIGNMENT

SITE BOUNDARY

0 125 250 Feet

4,4'-DDT 0-2 FT AVERAGE SOIL RESULTS

HIGHEST CONCENTRATION (100 µg/kg)

LOWEST CONCENTRATION (4.23 µg/kg)

Notes

Concentration surface developed using analytical data and inverse distance weighting techniques.

SYW-12 0-2 FT INTERPOLATED CONCENTRATION SURFACE 4,4'-DDT

APPENDIX-8

HONEYWELL INTERNATIONAL INC.

SYW-12 FEASIBILITY STUDY

SYRACUSE, NEW YORK

FIGURE 05

O'BRIEN & GERE ENGINEERS, INC.

A RAMBOLL COMPANY

RAMBOLL

POTENTIAL FUTURE TRAIL EXTENSION

PLANNED RECREATIONAL TRAIL ALIGNMENT

SITE BOUNDARY

0 125 250 Feet

TOTAL PCBs 0-2 FT AVERAGE SOIL RESULTS

HIGHEST CONCENTRATION (2336 µg/kg)

LOWEST CONCENTRATION (44.0 µg/kg)

Notes

Concentration surface developed using analytical data and inverse distance weighting techniques.

SYW-12 0-2 FT INTERPOLATED CONCENTRATION SURFACE TOTAL PCBS

APPENDIX-8

HONEYWELL INTERNATIONAL INC.

SYW-12 FEASIBILITY STUDY

SYRACUSE, NEW YORK

FIGURE 06

O'BRIEN & GERE ENGINEERS, INC.

A RAMBOLL COMPANY

RAMBOLL