HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD COVER SHEET

Name of Site: Clearwater Finishing

EPA ID No.: SCD003303120

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Pathways, Components, or Threats Not Scored

The ground water and air migration pathways, the drinking water threat of the surface water migration pathway, and the soil exposure and subsurface intrusion pathway were not scored in this Hazard Ranking System (HRS) documentation record because the human food chain and environmental threats of the surface water migration pathway are sufficient to qualify the site for the National Priorities List (NPL). These pathways are of concern to the U.S. Environmental Protection Agency (EPA) and may be considered during future evaluation. At the time of the listing, the site score is sufficient without the pathways and threats mentioned above.

Ground Water Migration Pathway: The ground water migration pathway was not scored. Sampling results indicate that a release of volatile organic compounds, semi-volatile organic compounds, and metals has occurred to groundwater monitoring wells and, although it would not contribute significantly to the overall site score, the ground water migration pathway is of concern. Most of the population within a 4-mile radius of Clearwater Finishing are provided drinking water by a public water company. Specifically, residents within 0.5-mile radius of Clearwater Finishing are provided water by public authorities (Ref. 9, p. 11).

Drinking Water Threat, Surface Water Migration Pathway: No drinking water intakes are within the 15-mile target distance limit (TDL).

Soil Exposure and Subsurface Intrusion Pathway: Evaluating and scoring this pathway would not affect the site score and decision whether to list this site on the NPL. No resident population threat subject to actual contamination has been documented. No sub-slab soil gas or indoor air samples have been collected.

Air Migration Pathway: Evaluating and scoring this pathway would not affect the site score and decision whether to list this site on the NPL. No ambient air samples have been collected.

HAZARD RANKING SYSTEM (HRS) DOCUMENTATION RECORD

Name of Site:	Clearwater Finishing
EPA Region:	4
Date Prepared:	November 2019
Street Address of Site*:	Southeastern corner of Jefferson Davis Highway and Belvedere Clearwater Road
City, County, State, Zip:	Clearwater, Aiken County, South Carolina 29842
General Location in the State:	Southwestern portion of state
Topographic Maps:	North Augusta, South Carolina – Georgia 1980
Latitude:	33° 30' 3.2646" North
Longitude:	81° 53' 31.6674" West

Coordinates specified above for Clearwater Finishing were measured from sampling location CWF-005-SD, within Source No. 2 (Refs. 4; 5; 6, p. 14) (see Figure 3 of this HRS documentation record).

* The street address, coordinates, and contaminant locations presented in this HRS documentation record identify the general area the site is located. They represent one or more locations EPA considers to be part of the site based on the screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, disposed, or placed, or has otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

Pathway	**Pathway Score**
Ground Water[1] Migration	Not Scored
Surface Water Migration	95.99
Soil Exposure and Subsurface Intrusion	Not Scored
Air Migration	Not Scored
HRS SITE SCORE	**47.99**

[1]"Ground water" and "groundwater" are synonymous; the spelling is different due to "ground water" being codified as part of the HRS, while "groundwater" is the modern spelling.

WORKSHEET FOR COMPUTING HRS SITE SCORE

	S Pathway	S^2 Pathway
Ground Water Migration Pathway Score (S_{gw})	NS	NS
Surface Water Migration Pathway Score (S_{sw})	95.99	9,214.0801
Soil Exposure and Subsurface Intrusion Pathway Score (S_{sessi})	NS	NS
Air Migration Pathway Score (S_a)	NS	NS
$S^2_{gw} + S^2_{sw} + S^2_{sessi} + S^2_a$		9,214.0801
$(S^2_{gw} + S^2_{sw} + S^2_{sessi} + S^2_a) / 4$		2,303.52
$\sqrt{(S^2_{gw} + S^2_{sw} + S^2_{sessi} + S^2_a) / 4}$		**47.99**

Note:

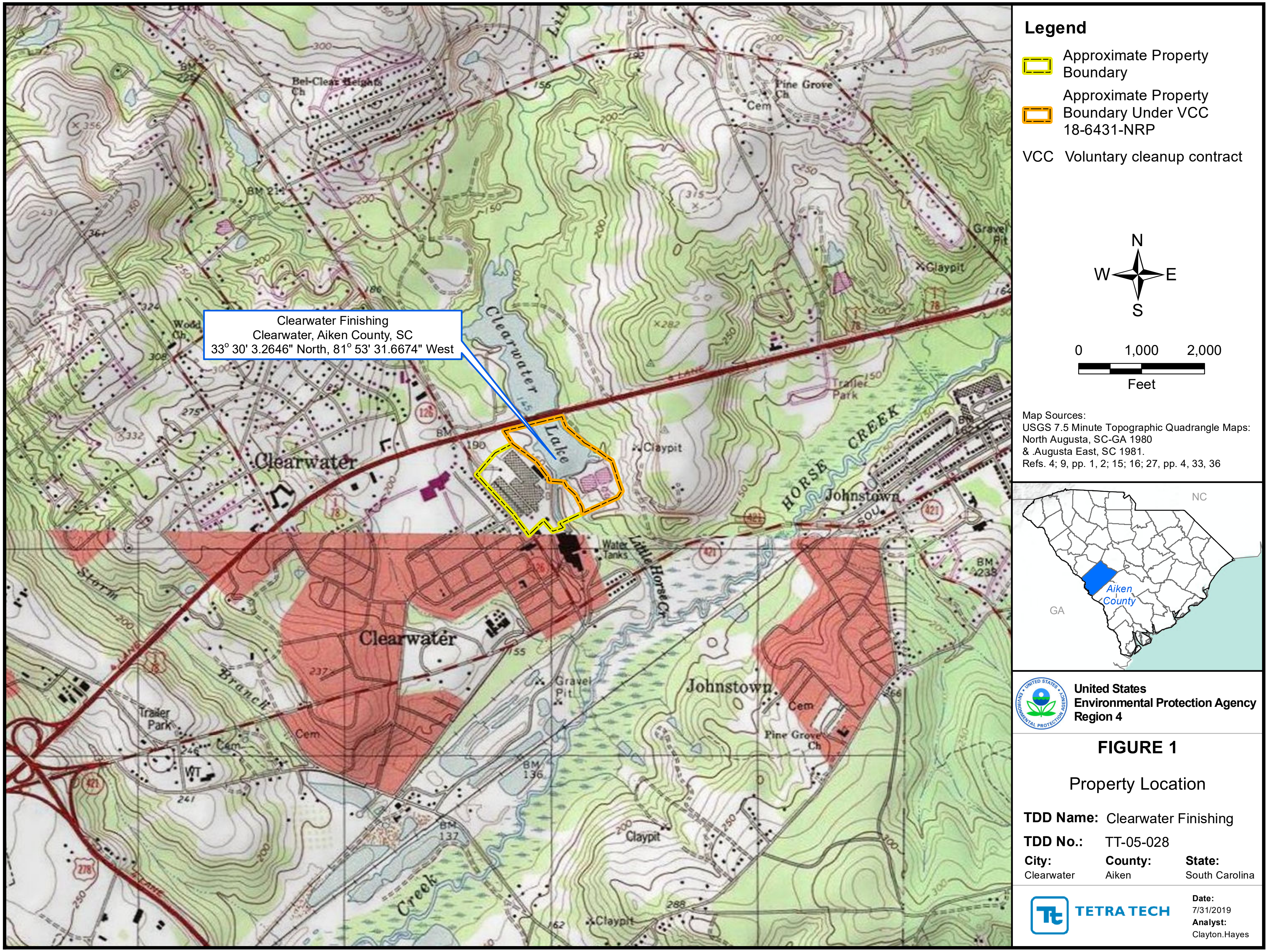
NS = Not scored

Table 4-1 – Surface Water Overland/Flood Migration Component Scoresheet			
Factor Categories and Factors	**Maximum Value**	**Value Assigned**	
Drinking Water Threat			
Likelihood of Release:			
1. Observed Release	550	550	
2. Potential to Release by Overland Flow:			
2a. Containment	10	NS	
2b. Runoff	25	NS	
2c. Distance to Surface Water	25	NS	
2d. Potential to Release by Overland Flow [lines 2a(2b + 2c)]	500	NS	
3. Potential to Release by Flood:			
3a. Containment (Flood)	10	NS	
3b. Flood Frequency	50	NS	
3c. Potential to Release by Flood (lines 3a x 3b)	500	NS	
4. Potential to Release (lines 2d + 3c, subject to a maximum of 500)	500	NS	
5. Likelihood of Release (higher of lines 1 and 4)	550		550
Waste Characteristics:			
6. Toxicity/Persistence	(a)	NS	
7. Hazardous Waste Quantity	(a)	NS	
8. Waste Characteristics	100		NS
Targets:			
9. Nearest Intake	50	NS	
10. Population:			
10a. Level I Concentrations	(b)	NS	
10b. Level II Concentrations	(b)	NS	
10c. Potential Contamination	(b)	NS	
10d. Population (lines 10a + 10b + 10c)	(b)	NS	
11. Resources	5	NS	
12. Targets (lines 9 + 10d + 11)	(b)		NS
Drinking Water Threat Score:			
13. Drinking Water Threat Score [(lines 5x8x12)/82,500, subject to a maximum of 100]	100		NS
Human Food Chain Threat			
Likelihood of Release:			
14. Likelihood of Release (same value as line 5)	550		550
Waste Characteristics:			
15. Toxicity/Persistence/Bioaccumulation	(a)	500,000,000	
16. Hazardous Waste Quantity	(a)	100	
17. Waste Characteristics	1,000		320
Targets:			
18. Food Chain Individual	50	20	

Table 4-1 –Surface Water Overland/Flood Migration Component Scoresheet (Continued)			
Factor Categories and Factors	**Maximum Value**	**Value Assigned**	
19. Population			
19a. Level I Concentrations	(b)	NS	
19b. Level II Concentrations	(b)	NS	
19c. Potential Human Food Chain Contamination	(b)	0.00033	
19d. Population (lines 19a + 19b + 19c)	(b)	0.00033	
20. Targets (lines 18 + 19d)	(b)		20.00033
Human Food Chain Threat Score:			
21. Human Food Chain Threat Score [(lines 14x17x20)/82500, subject to maximum of 100]	100		42.66
Environmental Threat			
Likelihood of Release:			
22. Likelihood of Release (same value as line 5)	550		550
Waste Characteristics:			
23. Ecosystem Toxicity/Persistence/Bioaccumulation	(a)	500,000,000	
24. Hazardous Waste Quantity	(a)	100	
25. Waste Characteristics	1,000		320
Targets:			
26. Sensitive Environments			
26a. Level I Concentrations	(b)	NS	
26b. Level II Concentrations	(b)	25	
26c. Potential Contamination	(b)	NS	
26d. Sensitive Environments (lines 26a + 26b + 26c)	(b)	25	
27. Targets (value from line 26d)	(b)		25
Environmental Threat Score:			
28. Environmental Threat Score [(lines 22x25x27)/82,500 subject to a maximum of 60]	60		53.33
Surface Water Overland/Flood Migration Component Score for a Watershed			
29. Watershed Score[c] (lines 13+21+28, subject to a maximum of 100)	100		95.99
Surface Water Overland/Flood Migration Component Score			
30. Component Score (S_{sw})[c] (highest score from line 29 for all watersheds evaluated; subject to a maximum of 100)	100		95.99

Notes:

a Maximum value applies to waste characteristics category
b Maximum value not applicable
c Do not round to nearest integer
NS Not scored



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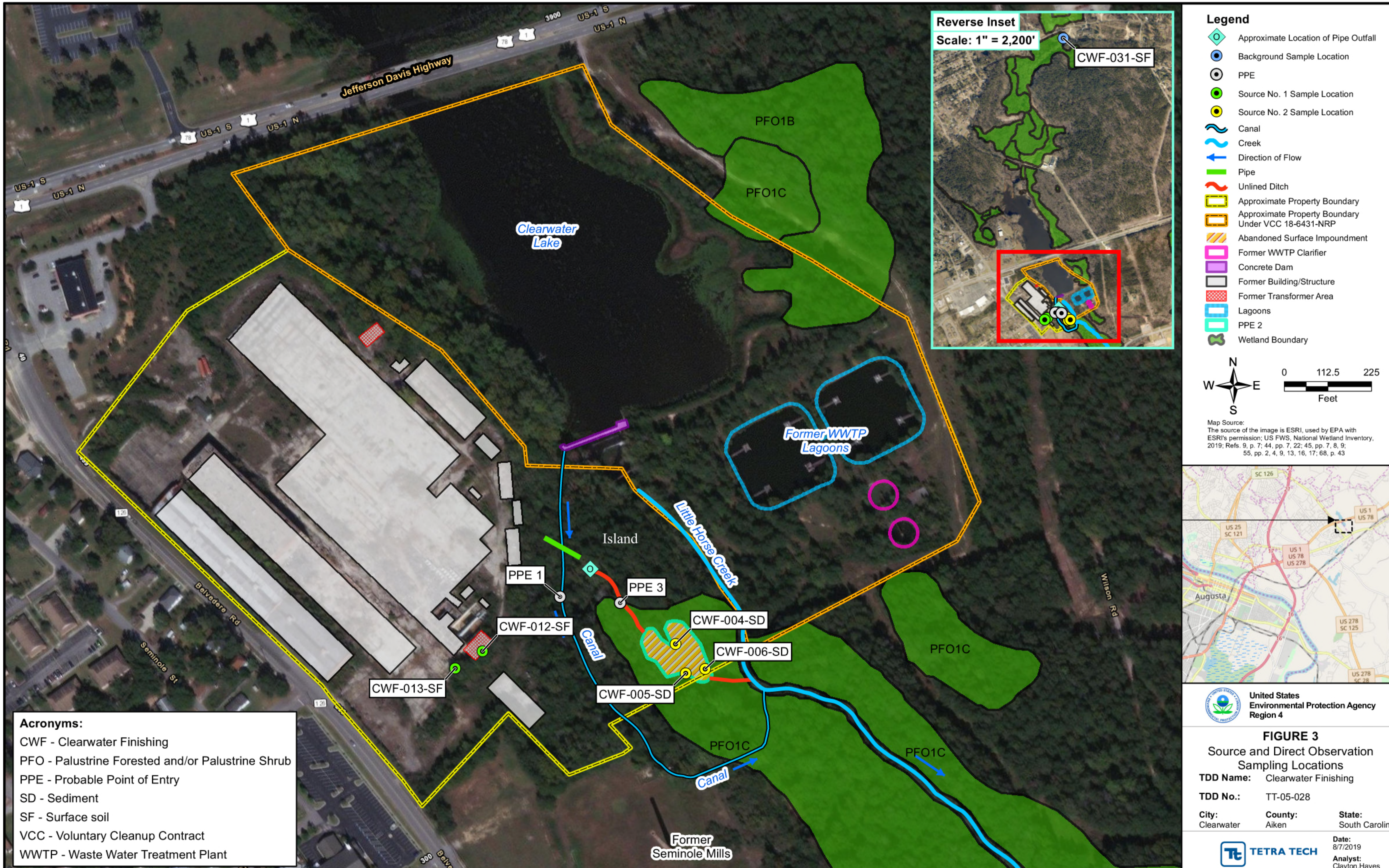
File: C:\Users\Clayton.Hayes\Desktop\TT-05-028_Clearwater_Finishing\mxd\Figure2_073119.mxd



Jefferson Davis Highway
US-1 S
US-1 N
3900
Clearwater Lake
PFO1B
PFO1C
Former WWTP Lagoons
Little Horse Creek
Island
Canal
PPE 1
PPE 3
CWF-004-SD
CWF-006-SD
CWF-005-SD
CWF-012-SF
CWF-013-SF
Belvedere Rd
Seminole St
Wilson Rd
Former Seminole Mills
Reverse Inset
Scale: 1" = 2,200'
CWF-031-SF
Legend
Approximate Location of Pipe Outfall
Background Sample Location
PPE
Source No. 1 Sample Location
Source No. 2 Sample Location
Canal
Creek
Direction of Flow
Pipe
Unlined Ditch
Approximate Property Boundary
Approximate Property Boundary Under VCC 18-6431-NRP
Abandoned Surface Impoundment
Former WWTP Clarifier
Concrete Dam
Former Building/Structure
Former Transformer Area
Lagoons
PPE 2
Wetland Boundary
N
W
E
S
0
112.5
225
Feet
Map Source:
The source of the image is ESRI, used by EPA with ESRI's permission; US FWS, National Wetland Inventory, 2019; Refs. 9, p. 7; 44, pp. 7, 22; 45, pp. 7, 8, 9; 55, pp. 2, 4, 9, 13, 16, 17; 68, p. 43
SC 126
Augusta
Acronyms:
CWF - Clearwater Finishing
PFO - Palustrine Forested and/or Palustrine Shrub
PPE - Probable Point of Entry
SD - Sediment
SF - Surface soil
VCC - Voluntary Cleanup Contract
WWTP - Waste Water Treatment Plant
United States Environmental Protection Agency Region 4
FIGURE 3
Source and Direct Observation Sampling Locations
TDD Name: Clearwater Finishing
TDD No.: TT-05-028
City: Clearwater
County: Aiken
State: South Carolina
TETRA TECH
Date: 8/7/2019
Analyst: Clayton.Hayes

REFERENCES

1. U.S. Environmental Protection Agency (EPA). Hazard Ranking System, Title 40 *Code of Federal Regulations* Part 300, 55 *Federal Register* 51532. December 14, 1990. A complete copy is available at: https://semspub.epa.gov/work/HQ/174028.pdf. 136 Pages.

1a. EPA. Addition a of Subsurface Intrusion Component to the Hazard Ranking System, 40 CFR Part 300, 82 Federal Register 2760. January 9, 2017. https://www.govinfo.gov/content/pkg/FR-2017-01-09/pdf/2016-30640.pdf. 48 Pages.

2. EPA. Superfund Chemical Data Matrix (SCDM) Query, December 2018. https://www.epa.gov/superfund/superfund-chemical-data-matrix-scdm-query. Accessed on April 24, 2019. 16 Pages.

3. Tetra Tech, Inc. (Tetra Tech). 15-Mile Surface Water Pathway Target Distance Limit. September 23, 2019. 1 Map.

4. Tetra Tech. Project Note to File with Attachment. Subject: Clearwater Finishing Site Coordinates. Attachment: Google Earth Aerial Map. February 20, 2019. 2 Pages.

5. Federal Communications Commission (FCC). Degrees Minutes Seconds to/from Decimal Degrees. https://www.fcc.gov/media/radio/dms-decimal. Accessed on February 20, 2019. 2 Pages.

6. South Carolina Department of Health and Environmental Control (SCDHEC), Bureau of Land and Waste Management. Clearwater Finishing Field Log Book. June 15, 2016. 33 Pages.

7. EPA. Superfund Enterprise Management System (SEMS) results for Clearwater Finishing site (SCD003303120). https://www.epa.gov/enviro/sems-search. Accessed on February 6, 2019. 2 Pages.

8. U.S. Geological Survey (USGS). Topographic Map. North Augusta Quadrangle, South Carolina – Georgia. 7.5-Minute Series. 2014. 1 Map.

9. SCDHEC, Division of Site Assessment and Remediation. Expanded Site Inspection (ESI) for Clearwater Finishing. September 29, 2016. 302 Pages.

10. Tetra Tech. Record of Telephone Conversation. Between Shanna Davis, Environmental Scientist and Lance Corporal Scott McDaniel, South Carolina Department of Natural Resources (SCDNR), Wildlife and Freshwater Fisheries Officer. Subject: Fishing in Clearwater Lake, Little Horse Creek, and Horse Creek. May 1, 2019. 1 Page.

11. South Carolina Tax Commission. Title to Real Estate between United Merchants, Inc. and Clearwater Finishing, Inc. Vol. 1087, pp. 134 to 136. 1989. 3 Pages.

12. William R. Gore Professional Land Surveyors. Boundary Survey for Clearwater Finishing Plant. July 28, 2003. 1 Map.

13. Schneider Geospatial. Tax Assessment for 4295 Jefferson Davis Highway (Parcel Number 024-07-017-001). https://beacon.schneidercorp.com/Application.aspx?AppID=844&LayerID=15264&PageTypeID=2&PageID=6877&KeyValue=024-07-17

001.%20%20Accessed%20on%20February%2024%2C%202019. Accessed on February 25, 2019. 3 Pages.

14. Schneider Geospatial. Tax Assessment for Jefferson Davis Highway (Parcel Number 024-07-017-002). https://beacon.schneidercorp.com/Application.aspx?AppID=844&LayerID=15264&PageTypeID=2&PageID=6877&KeyValue=024-07-17-001.%20%20Accessed%20on%20February%2024%2C%202019. Accessed on February 25, 2019. 2 Pages.

15. Schneider Geospatial. Tax Assessment for 300 Belvedere Road (Parcel Number 024-08-04-001). https://beacon.schneidercorp.com/Application.aspx?AppID=844&LayerID=15264&PageTypeID=2&PageID=6877&KeyValue=024-07-17-001.%20%20Accessed%20on%20February%2024%2C%202019. Accessed on February 25, 2019. 3 Pages.

16. Schneider Geospatial. Tax Assessment for Jefferson Davis Highway (Parcel Number 024-08-04-003). https://beacon.schneidercorp.com/Application.aspx?AppID=844&LayerID=15264&PageTypeID=2&PageID=6877&KeyValue=024-07-17-001.%20%20Accessed%20on%20February%2024%2C%202019. Accessed on February 25, 2019. 2 Pages.

17. South Carolina Department of Transportation (SCDOT). Belvedere Clearwater Road (SC 126) Widening Project Environmental Assessment. November 12, 2015. 586 Pages.

18. United Merchants and Manufacturers. Application of Foams to the Processing of Fabrics Final Report. December 1979. 54 Pages.

19. EPA. Profile of the Textile Industry. Enforcement and Compliance Assurance (2223A), EPA 310-R-97-009. September 1997. 148 Pages.

20. Clearwater Manufacturing Company (Finishing Plant). Fire Insurance Map. Surveyed August 4, 1930. 1 Map.

21. MACTEC Engineering and Consulting, Inc (MACTEC). Phase I Environmental Site Assessment Report of Seminole Mill Site. April 11, 2005. 102 Pages.

22. Earth Management Systems, Inc. Corrective Action Plan for Former Clearwater Finishing Plant. February 2000. 41 Pages.

23. J. Dunaway & Company, Inc. Polychlorinated Biphenyl Contaminated Soil Removal PCB Area 1 Work Plan for Former Clearwater Finishing Plant (Revision 1). August 24, 2007. 12 Pages.

24. Kant, Rita. "Textile Dyeing Industry an Environmental Hazard." *Natural Science*, 4 (1), 22-26. January 14, 2012. 5 Pages.

25. Bhardwaj, V. et al. "Toxicity of Heavy Metals Pollutants in Textile Mills Effluents." *International Journal of Scientific and Engineering Research*, 5 (7). July 2014. 3 Pages.

26. Topozone. Clearwater Lake Topo Map in Aiken County South Carolina. Map provided by Topozone.com. Accessed July 16, 2019. 1 Map.

27. SCDHEC. Voluntary Cleanup Contract 18-6431-NRP in the Matter of Clearwater Lake and Wastewater Treatment Plant, Aiken County and Breezy Hill Water and Sewer Company, Inc. File No. 50780. November 16, 2016. 36 Pages.

28. DHEC. Certified Mail from Robert F. Hodges, Bureau of Land and Waste Management to Willie Upson regarding Voluntary Cleanup Contract 98-5210-NRP Clearwater Finishing Site. July 3, 2019. 1 Page.

29. South Carolina Pollution Control Authority. Construction Permit for Clearwater Finishing, No. 2453. March 1973. 1 Page.

30. SCDHEC, Solid Waste Division. Notification of Hazardous Waste Activity for Clearwater Finishing Plant. September 14, 1979. 10 Pages.

31. SCDHEC. Memorandum from Debbie Browning, Bureau of Solid and Hazardous Waste to James M. Burckhalter, Lower Savannah District EQC. Subject: United Merchants and Manufacturing Site Visit. February 7, 1983. 2 Pages.

32. SCDHEC. EQC Complaint Investigation Report. December 7, 1989. 1 Page.

33. Oregon Department of Environmental Quality. PCB Fact Sheet: Sources of Polychlorinated Biphenyls. https://www.oregon.gov/deq/FilterDocs/ph-SourcePCBs.pdf. August 6, 2003. 11 Pages.

34. KEMI National Chemicals Inspectorate. Chemicals in Textiles, Report of a Government Commission. July 1997. 172 Pages.

35. Tschickardt, D., D. Breuer, H. Parlar, A. Hartwig. MAK Collection for Occupational Health and Safety 2016. Chlorinated biphenyls (PCBs), Vol. 1, No. 2. May 2014. 20 Pages.

36. Tetra Tech. Project Note with Attachments. Subject: 2016 ESI Chain-of-Custody Reports. Shanna Davis, Environmental Scientist. Attachment: Chain-of-Custody Records. March 5, 2019. 11 Pages.

37. SCDHEC. Memo to File. Subject: Clearwater Finishing Site. April 22, 2019. 2 Pages.

38. EPA, Science and Ecosystem Support Division (SESD). Operating Procedure for Soil Sampling, SESD-PROC-300-R3. August 21, 2014. 24 Pages.

39. SCDHEC. ESI Quality Assurance Project Plan for Clearwater Finishing. May 20, 2016. 22 Pages.

40. Tetra Tech. Record of Telephone Conversation. Between Jessica Vickers, Quality Assurance Manager and Nardina Turner, EPA Region 4 Superfund Sample Control and Quality Assurance Coordinator. Subject: Data Review, Validation, and Verification conducted at the EPA SESD. July 25, 2013. 1 Page.

41. EPA, SESD. Laboratory Operations and Quality Assurance Manual. April 2, 2015. 116 Pages.

42. Tetra Tech. Record of Telephone Conversation. Between Jessica Vickers, Quality Assurance Manager and Nardina Turner, EPA Region 4 Superfund Sample Control and Quality Assurance Coordinator. Subject: Definitions of Minimum Reporting Limit, Contract Required Quantitation Limit, and Sample Quantitation Limit. July 25, 2013. 1 Page.

43. EPA, Contract Laboratory Program. Statement of Work for Organic Superfund Methods for Multi-Media and Multi-Concentration. September 2015. 136 Pages.

44. SCDHEC. Trip Report for Clearwater Finishing Site. March 15, 2019. 22 Pages.

45. Tetra Tech. Project Note with Attachments. Subject: Historical Aerials Depicting Portions of the Clearwater Finishing Facility. Attachments: Historical Aerial Photos. July 16, 2019. 9 Pages.

46. United Merchants, Central Engineering Division. Plot Plan for Clearwater Finishing. August 9, 1966. 1 Map.

47. Earth Management Systems, Inc. Site Characterization Report for Former Clearwater Finishing Plant. Volume 1. November 1999. 396 Pages.

48. H. Brad Hubbard. Soil Removal Report PCB Area 1 for Former Clearwater Finishing Plant. March 28, 2008. 114 Pages.

49. EPA, SESD. Operating Procedure for Sediment Sampling, SESDPROC-200-R3. August 21, 2014. 23 Pages.

50. USGS. Topographic Map. Augusta East Quadrangle Georgia – South Carolina. 7.5 Minute Series. 2011. 1 Map.

51. 3 Biotech. Biodegradation of Waste Lubricants by a Newly Isolated *Ochrobactrum* sp. C1. By Bhattacharya, Munna; Dipa Biswas; Santanu Sana; Sriparna Datta. March 3, 2015. 11 Pages.

52. USGS. Surface-Water Annual Statistics for South Carolina. National Water Information System Search for Little Horse Creek Near Graniteville, South Carolina. https://nwis.waterdata.usgs.gov/sc/nwis/annual/?format=sites_selection_links&search_site_no=02196689&agency_cd=USGS&. Accessed on July 16, 2019. 2 Pages.

53. USGS. Surface-Water Annual Statistics for South Carolina. National Water Information System Search for Horse Creek at Clearwater, South Carolina. https://nwis.waterdata.usgs.gov/sc/nwis/annual/?site_no=02196690&por_02196690_126845=2206469,00060,126845,2005,2019&year_type=W&format=html_table&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list. Accessed on July 16, 2019. 2 Pages.

54. USGS. Surface-Water Annual Statistics for South Carolina. National Water Information System Search for Savannah River Near Jackson, South Carolina. https://nwis.waterdata.usgs.gov/sc/nwis/annual/?site_no=02197320&por_02197320_126926=1099082,00060,126926,1972,2002&year_type=W&format=html_table&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list. Accessed on July 16, 2019. 2 Pages.

55. Oneida Total Integrated Enterprises (OTIE). Letter Report with Attachments. From: Scott M. Horzen, Senior Ecologist. To: Stacy Kowalski, HRS Coordinator. Subject: Clearwater Wetland Investigation, Revision 2. Attachments: Figures, Table, Photographic Log, and Reference Citations. April 19, 2019. 22 Pages.

56. EPA. Substance Registry Services. Aroclor 1254. https://ofmpub.epa.gov/sor_internet/registry/substreg/searchandretrieve/substancesearch/search.do?details=displayDetails&selectedSubstanceId=38818. 5 Pages.

57. SCDHEC. Memorandum to File. Regarding Surface Water Runoff/Overland Flow from Samples CWF-012-SF and CWF-013-SF. To: Clearwater File. From: Timothy Kadar, Project Manager, SCDHEC. July 22, 2019. 2 Pages.

58. SCDHEC. ESI for Clearwater Finishing. September 26, 2007. 49 Pages.

59. Auerbach Associates, Inc. A Study of Flame Retardants for Textiles. February 1976. 176 Pages.

60. U.S. Interdepartmental Task Force on PCBs. Polychlorinated Biphenyls and the Environment. May 1972. 192 Pages.

61. U.S. Department of Health and Human Services. Toxicological Profile for Chromium. September 2000. 461 Pages.

62. SCDHEC. Preliminary Assessment/Site Investigation for Seminole Mill. March 3, 2004. 20 Pages.

63. EPA. Action Memorandum. From: Steve Spurlin, On-Scene Coordinator, Emergency Response and Removal Branch. To: Joseph R. Franzmathes, Director Waste Management Division. Subject: Request for a Removal Action – Clearwater Finishing Site. July 14, 1994. 7 Pages.

64. Tetra Tech. Project Note. Subject: Calculating the Perimeter of Source No. 2 (Surface Impoundment). September 24, 2019. 2 Pages.

65. SCDHEC. Voluntary Cleanup Contract for Seminole Mill. June 7, 2007. 29 Pages.

66. MACTEC. Report of Soil and Ground-Water Sampling and Chemical Analysis for Seminole Mill Site. March 24, 2006. 20 Pages.

67. CTC Public Benefit Corporation. Phase II Environmental Site Assessment Report for Former Clearwater Finishing Plant. December 15, 2010. 962 Pages.

68. Hybrid Engineering, Inc. Report of Additional Assessment Actions. SCDHEC Voluntary Cleanup Contract 17-6431-NRP Breezy Hill Water and Sewer Company, Inc. April 2019. 286 Pages.

69. SCDHEC. Clearwater Finishing Plant, Site Inspection (SI) Report with Attachments. Attachments: Trip Report for SI Site Reconnaissance and Sampling Investigation and Analytical Data. March 25, 1996. 161 Pages.

70. Dunaway Fletcher and Moore Engineering and Consulting. Chromium/Copper Contamination Investigation Report. Former Clearwater Finishing Site. December 3, 2004. 106 Pages.

71. Hard Chrome Specialists. Hard Chrome Plating vs. Decorative Chrome Plating. https://hcsplating.com/finishes/hard-chrome-plating/hard-chrome-vs-decorative-chrome-plating/. 6 Pages.

SITE DESCRIPTION

For HRS scoring purposes, the Clearwater Finishing (CWF) site is the result of a release of polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), and metals associated with manufacture of textiles. Source No. 1 is contaminated soil in the southern portion of the CWF facility and Source No. 2 is an abandoned surface impoundment (see Sections 2.2.1, Source Nos. 1 and 2; and Figures 1, 2, and 3 of this HRS documentation record). Source No. 2 waste material is in direct contact with palustrine forested wetlands that surround the entire perimeter of the surface impoundment; therefore, an observed release by direct observation has been documented (Refs. 37; 55, pp. 9, 16, 17) (see Section 4.1.2.1.1 and Figure 3 of this HRS documentation record). A perennial ditch at the southeastern edge of Source No. 2 leads to Little Horse Creek which is fished for human consumption (Refs. 10; 37; 44, p. 2, 19). Samples collected from Source Nos. 1 and 2 contained PAHs, PCB-1254, arsenic, cadmium, chromium, hexavalent chromium, copper, lead, mercury, and zinc (Ref. 9, pp. 8, 9, 10, 49, 50, 52, 53, 55, 70, 71, 73, 74, 192, 196, 222, 223, 226, 227) (see Figure 3 of this HRS documentation record). Hexavalent chromium is also known as chromium VI (Ref. 61, p. 1). PCB-1254 is also known as Aroclor-1254 (Ref. 56, p. 1). In this HRS documentation record, the terms hexavalent chromium and PCB-1254 will be used.

Geographic coordinates at the CWF site are latitude 33° 30' 03.2646" north and longitude 81° 53' 31.6674" west, measured at the location of sample CWF-005-SD collected at Source No. 2 during the June 2016 South Carolina Department of Health and Environmental Control (SCDHEC) sampling event (Refs. 4; 5; 6, p. 14). The EPA identification number, as recorded in the Superfund Enterprise Management System (SEMS), is SCD003303120 (Ref. 7). The CWF facility is bordered north by Jefferson Davis Highway and Clearwater Lake beyond, east by vacant land, south by former Seminole Mill (a former textile mill), and west by Belvedere Road and residential properties beyond (see Figure 2 of this HRS documentation record). The former textile mill south of the CWF facility is referred to as both Seminole Mill and Seminole Mills in historical documents (Refs. 21, p. v; 66, p. 2). Seminole Mill is the term used in this HRS documentation record.

During operations, CWF (division of United Merchants and Manufacturers Inc.) owned 64.39 acres, more or less, of land (Refs. 11, p. 1; 12; 30, p. 4). The parcel including the former manufacturing plant and wastewater treatment plant (WWTP) (00-036.0-01-082, 64.38 acres) was subdivided into four parcels in 2003 (Refs. 9, pp. 2, 7; 12). The two northwestern parcels (024-07-17-001 and 024-07-17-002, 3.9 acres and 1.64 acres, respectively) are owned by R&B Partners, and a CVS Pharmacy was built on the parcels (Refs. 13, pp. 1 to 3; 14). The parcel including the former manufacturing plant (024-08-04-001, 20.31 acres) is owned by a private citizen (Ref. 15, pp. 1 to 3). The parcel including the southern portion of Clearwater Lake south of Jefferson Davis Highway and the WWTP (024-08-04-003, 38.44 acres) is owned by Sparkling Clearwater, LLC (Ref. 16).

OPERATIONAL HISTORY

CWF is a closed, abandoned textile finishing plant that operated from 1929 to 1988 (Refs. 17, pp. 497, 501; 20). Operations included bleaching, printing, dyeing, and foam finishing of textile fabric (Ref. 18, pp. 10, 24; 20). The adjacent Seminole Mill plant began operations in 1900 and was a weaving mill (Ref. 17, pp. 496, 497). Both Seminole Mill and CWF were owned by United Merchants and Manufacturers, Inc. (United Merchants), and operated in tandem; Seminole Mill was a rayon fabric manufacturer and CWF was a dyeing and finishing plant (Refs. 17, pp. 496, 497; 21, p. 4-8; 65, p. 5). In 1970, CWF began screen-printing cotton, synthetic, and spun glass yarn fabrics (Ref. 17, p. 501). Prior to 1983, CWF conducted plating operations that utilized cyanides and electroplating operations that utilized chromium (Refs. 30, p. 9, 10; 31). Chromium plating provides exceptional resistance to wear when used with textiles (Ref. 71, p. 2). The Seminole Mill plant closed in 1982 (Ref. 17, p. 501). CWF operated until 1988, when bankruptcy was filed (Ref. 17, p. 501). In 1989, United Merchants deeded CWF to Clearwater Finishing, Inc., a private investment group (Ref. 11).

During operations, CWF consisted of 11 buildings with three main interconnecting warehouses and an on-property WWTP at the southern end of Clearwater Lake (Ref. 22, p. 1). Additionally, two electrical transformer stations, 27 aboveground storage tanks (AST) grouped in five tank farm areas, as well as three lone tanks, and one underground storage tank (UST) were present on the property (Refs. 22, p. 2; 23, pp. 3, 11). In 1979 and 1980, CWF submitted Notification of Hazardous Waste Activity forms to SCDHEC (Ref. 30, pp. 1 through 10). The forms stated that 6,200 pounds per year of waste lubricating oils, 800 pounds per year of cleaning solvents, 4,500 pounds per year of chromium plating bath sludge from the bottom of chromium electroplating tanks, and 10,000 pounds over a 20 to 25-year interval of spent chromium plating bath solution were stored on the property and ultimately shipped off property for disposal (Ref. 30, pp. 1 to 10). In 1989, SCDHEC received a complaint from a former employee of CWF. The employee conveyed that chromium contamination was present at the CWF facility roller print area near the print house. The president of the company stated that the contamination was likely due to cracks in the concrete pad (Ref. 32).

Between 1992 and 2012, 13 fires on the property were reported. Two of the three warehouses, an 850-square-foot portion of an original 3-story brick building, and the WWTP are the only structures that remain on the property (Refs. 9, p. 3; 27, p. 4).

INDUSTRY PRACTICES

Firms in the textile industry engage in spinning natural and manmade fibers into yarns and threads. These are then converted by weaving and knitting into fabrics. The fabrics, and in some cases the yarns and threads used to make them, are dyed and finished (Ref. 19, p. 4). The process of converting raw fibers into finished textile products is complex; thus, most textile mills specialize; CWF was a printing, dyeing, and finishing plant (Refs. 18, pp. 10, 24; 19, p. 13; 20).

Printing, dyeing, and finishing are typical wet processing steps (Ref. 19, p. 27). Fabrics are often printed with color and patterns by application of a variety of techniques and machine types. The most common printing method is rotary screen. Pigments are used in approximately 75 to 85 percent of all printing operations. Resin binders are typically used to attach pigments to substrates. Solvents are used for transporting the pigment and resin mixture to the substrate. Solvents then evaporate, leaving a hard-opaque coating (Ref. 19, p. 36). Two principle processes in fabric dyeing are beck dyeing and continuous dyeing. In beck dyeing, a small amount of dyestuff and auxiliary additives are dissolved and dispersed in large amounts of water, and the dyestuff is exhausted onto fabrics. In conventional continuous dyeing, a small amount of dye is dissolved or dispersed in large amounts of water and is applied by impregnation and padding. The fabric is then subjected to color fixation followed by a washing operation (Ref. 18, p. 26). Finishing involves chemical or mechanical treatments of fiber, yarn, or fabric to improve appearance, texture, or performance. Mechanical finishing involves brushing, ironing, or other physical treatments used to increase the luster and feel of textiles. Chemical finishes can impart a variety of properties ranging from decreasing static cling to increasing flame resistance. Application of chemical finishes usually occurs in conjunction with mechanical finishing steps (Ref. 19, p. 37). PCBs were used in flame retardant mixtures because of their extreme resistance to thermal and chemical degradation, high thermal conductivity, and low electrical conductivity (Refs. 35, p. 1268; 59, p. 5-32).

Wastewater is the textile industry's largest waste stream (Ref. 19, p. 40). Large-volume wastes include washwater from preparation and continuous dyeing, alkaline waste from preparation, and batch dye waste containing large amounts of salt, acid, or alkali (Ref. 19, p. 40). For example, in beck dyeing, 40 to 50 pounds of water are consumed per pound of fabric. At least 98 percent of this water is wastewater that must be processed before it is returned to the process stream. In continuous dyeing, 20 to 25 pounds of water is consumed per pound of fabric, of which only 4 percent is evaporated, and the remaining 96 percent added to waste effluents (Ref. 18, p. 26).

SITE OPERATIONS

CWF operated surface impoundments that received wastewater from the facility with little to no treatment before construction of the WWTP in the mid-to-late 1970s. Wastewater from the manufacturing plant was piped over the canal and discharged onto the ground on an island (surrounded by Clearwater Lake to the north, Little Horse Creek to the east, and a canal to the south and west). The effluent was channeled to the south by an unlined ditch that extended into unlined surface impoundments (Ref. 44, p. 2). A ditch at the southeastern side of the surface impoundments drained to Little Horse Creek (Ref. 44, pp. 2, 19).

A 1962 aerial photograph shows two distinct surface impoundments on the island, each about 400 feet long and 30 feet wide (Refs. 44, p. 2; 45, pp. 1, 2). More recent aerial photographs show the surface impoundments merged and appearing much smaller (Ref. 45, pp. 3 through 9). During the 2019 SCDHEC visit, one surface impoundment was visible at the southern edge of the island (Ref. 44, p. 2). Therefore, from this point forward, the singular version (impoundment) will be used in this HRS documentation record.

In 1973, CWF received a construction permit for a WWTP to collect waste from chromium plating and stripping operations, and to treat the waste by precipitation of chromium. According to the permit, the chemical sludge was to be dewatered by filtration and subsequently buried (Ref. 29). The WWTP was built sometime in the mid-to-late 1970s and included two lagoons and two clarifiers. A pipe, about 4 feet in diameter, leads from the manufacturing plant to the WWTP (Refs. 37; 44, pp. 2, 6). Whether the WWTP discharged effluent to Little Horse Creek is unknown; however, an outfall pipe leading from the WWTP is located on Little Horse Creek (upstream of Source No. 2) indicating that some processed wastewater was discharged (Ref. 37). Samples collected from the WWTP lagoons and clarifiers contain arsenic, cadmium, chromium, copper, lead, mercury, zinc, hexavalent chromium and PCB-1254 (Refs. 9, pp. 7, 11; 67, pp. 49, 98, 99; 68, pp. 24, 25, 26, 29, 30) (see Additional Information Section below).

During site visits in 2004, 2016, and 2019, the following observations were reported. The locations of the pipes discussed in the observations below are depicted in Reference 44, page 22.

- A large pipe (Pipe 1, about 4 feet in diameter), originating from the former dyeing operation area, crosses the canal and extends to the WWTP. The pipe is about 150 feet south of the Clearwater Lake Dam (Ref. 44, pp. 6, 22).
- A second pipe (Pipe 2, about 2 feet in diameter), originating from the rotary screen print building, crosses the canal about 90 feet south of the large-diameter pipe. The pipe runs from northwest to southeast, and discharged on the island (Ref. 44, pp. 7, 22).
- In 2004, an additional pipe (about 2 feet in diameter) was observed. A footbridge was built on top of the pipe. The pipe originated near the manufacturing plant's dyeing operations and the water treatment system for the plant's water intake/supply. The pipe extended to where a large vitrified clay pipe (VCP) and slightly smaller concrete pipe emptied into the unlined ditch on the island. The pipe and footbridge were removed between 2004 and 2007 (Ref. 44, pp. 8, 9, 12, 22).
- A VCP (Pipe 3) and a slightly smaller concrete pipe (Pipe 4) were observed on the southern side of the outfall discharge point for Pipe 2. While the exact point of origin for Pipe 3 could not be determined during the August 5, 2019 Clearwater Finishing Site Visit, it is believed this pipe is the remnant of the pipe upon which the footbridge was built. Because VCP lacks tensile strength (it has high compressive strength), the pipe needed a framework to support its length across the canal. Following a straight-line westward, Pipe 3 originates near the plant's dyeing operations and the water treatment system for the plant's water intake/supply. Pipe 4, concrete pipe, appeared to be another discharge point for Pipe 2. Both pipes discharged into the unlined ditch on the island (Ref. 44, pp. 9, 12, 22).

- Wastewater from Pipe 2 terminated in a concrete channel about 15 to 20 feet long. The channel was approximately 3 feet wide and 4 feet deep. Wastewater flowed over a drum screen and into the unlined ditch that flowed southeast to the surface impoundment (Ref. 44, p. 10).
- The unlined ditch was formed by earthen embankments and flowed about 175 feet into the surface impoundment (Ref. 44, pp. 14, 15, 16).
- Textile material was caught on the end of the drum screen (Ref. 44, p. 10, 11).
- Small bits of waste dye pellets (green, red, yellow, and magenta) were visible at the bottom of the concrete channel, in the unlined ditch below the discharge point for Pipe 2, and along the western side of the unlined ditch (Ref. 44, pp. 10, 14, 15).
- Unnaturally greenish tinted soil was observed at the discharge point for Pipe 2, and along the unlined ditch that received runoff from the impoundment and drained to Little Horse Creek (Ref. 44, p. 21).

During a 2018 SCDHEC inspection, personnel observed (1) the surface impoundment was flush with the ground, (2) no banks or berms were around the surface impoundment, and (3) a fence was not present (Ref. 37).

A surface water intake is on the northern portion of Clearwater Lake (north of the Jefferson Davis Highway Bridge and the CWF facility). This portion of the lake is owned and operated by Breezy Hill Water and Sewer, Inc. (Breezy Hill), a non-profit utilities company. Breezy Hill and SCDHEC entered into a voluntary cleanup contract (VCC) on September 24, 2018 with respect to the approximate 30-acre property that includes the southern portion of Clearwater Lake and dam and the CWF WWTP (Ref. 68, pp. 1, 2, 32). Breezy Hill will acquire this property to control the Clearwater Lake Dam (Ref. 68, pp. 2, 32). Current plans include repairing the Clearwater Lake Dam and demolishing/closing the CWF WWTP (Ref. 68, p. 2). The VCC specified response actions to be taken by Breezy Hill (Ref. 68, p. 3). In 2018, Breezy Hill conducted sampling of ground water, sediment and surface water from the southern portion of Clearwater Lake, and sludge from the former CWF WWTP (Ref. 68, pp. 31, 43, 45, 46, 136, 137, 216, 217). The results of the sampling event were presented to SCDHEC in the report titled, “Report of Additional Assessment Actions, SCDHEC Voluntary Cleanup Contract 17-6431-NRP” (Ref. 68, pp. i, 31).

Because of Breezy Hill’s voluntary work, only the abandoned surface impoundment and contaminated soil on the CWF property are evaluated in this HRS documentation record.

In 1998, Clearwater Development Corporation entered into a VCC (#98-5210-NRP) with SCDHEC before assuming ownership of CWF in May 2000 from the Aiken County Forfeited Land Commission (Refs. 28, pp 1 through 8; 67, p. 4). The VCC directives included sampling of soils in selected areas, sampling of sediments in the wastewater treatment lagoons and at discharge points, and a hydrogeologic assessment to determine the nature and extent of groundwater contamination (Ref. 67, pp. 9, 10). To date, the following investigations have occurred at the CWF facility as a part of the VCC: site characterization, 1999; corrective action plan, 2000; removal of PCB-contaminated soil, 2004, 2007, and 2008; sediment sampling and chemical analysis, 2006; and Phase I and Phase II environmental site assessments (ESA), 2010 (Refs. 22, p. 1; 48, pp. 3, 4, 5, 8, 10; 67, pp. 3, 6, 7, 8, 9, 10). On July 3, 2019, SCDHEC terminated the VCC #98-5210-NRP with Clearwater Development Corporation. (Ref. 28).

PREVIOUS INVESTIGATIONS

In January and April 1994, the EPA Emergency Response and Removal Branch (ERRB) conducted a site investigation at the CWF facility. During the investigation, EPA noted approximately 1,000 drums in various stages of deterioration; 20 ASTs used to store caustics, acids, solvents, and other unknown substances; chlorine gas cylinders; and laboratory chemicals (Ref. 63, pp. 1, 2). In August 1994, EPA performed a removal action (Ref. 22, pp. 2, 3). Removed from the CWF facility were 2,694 drums, 10,500 gallons of caustic liquid, 12,600 gallons of base/neutral liquid, 7,500 gallons of acid/neutral liquid, 35 drums of oxidizers and peroxides, 3,500 gallons of a low pH liquid blend, 240 tons of organic/inorganic solids, 80 tons of inorganic solids, 12,450 gallons of liquid flammables, and 83 containers of laboratory chemicals (Ref. 22, p. 3).

Beginning in 1996, SCDHEC conducted numerous investigations at the CWF facility. Table 1 below summarizes some previous investigations conducted between 1996 and 2010, and lists hazardous substances detected in collected samples.

TABLE 1: Summary of Previous Investigations

Agency/ Company	Investigation	Date	Samples Collected	Hazardous Substances Detected	References
SCDHEC	Site Inspection[1]	1996	Soil, sediment, surface water, and wastewater	PCB-1254 PCB-1260 SVOCs Chromium Mercury Zinc	69, pp. 1, 3 through 10, 14
Clearwater Development Corporation	Site Characterization[1]	September 1999	Soil, ground water, sediment, and sludge	PCB-1254 PCB-1260 SVOCs Arsenic Chromium Copper Mercury Zinc	47, pp. i, iii, iv, 5, 74, 85, 87, 89, 91, 93, 94, 96, 97, 99
Clearwater Development Corporation	Contamination Assessment	April 2004	Soil, ground water, surface water, and sediment	Chromium Copper	70, pp. 1 to 5, 13, 14, 18, 19, 20
SDCHEC	PA/SI[1]	March 2004	Sediment	SVOCs PCB-1254 Chromium Copper Lead Mercury Zinc	62, pp. 7, 10, 12, 13, 14
SCDHEC	ESI	October 2004	Surface water and sediment	PCB-1254 Arsenic Cadmium Chromium Copper Mercury Zinc	58, pp. 9, 10, 11, 12, 26 to 48

TABLE 1: Summary of Previous Investigations					
Agency/ Company	**Investigation**	**Date**	**Samples Collected**	**Hazardous Substances Detected**	**References**
SCHDEC	ESI	February 2007	Groundwater and sediment	Chromium Copper Lead Mercury Zinc	58, pp. 14, 15
Aiken County	Phase II ESA[1]	September 2010	Soil, groundwater, surface water, sediment	SVOCs PCB-1254 PCB-1260 Arsenic Cadmium Chromium Hexavalent chromium Lead Mercury Zinc	67, pp. 10, 40 to 44, 48, 49, 59 to 79, 317, 526, 716, 792, 836, 909

Notes:

1	Investigations where samples were collected from Source Nos. 1 and/or 2 as defined in this HRS documentation record. Samples collected from 1996 to 2010 are not evaluated in this HRS documentation record.
ESA	Environmental site assessment
ESI	Expanded site inspection
PA/SI	Preliminary Assessment/Site Inspection
PCB	Polychlorinated biphenyl
SCDHEC	South Carolina Department of Health and Environmental Control
SVOC	Semivolatile organic compound

In 2016, SCDHEC conducted an ESI at the CWF facility (Ref. 9, p. 1). Surface soil samples were collected at the former manufacturing plant area; and samples were collected from the abandoned surface impoundment (also referred to as Source C), WWTP, southern portion of Clearwater Lake, the canal, and Little Horse Creek (Ref. 9, pp. 10, 17, 18, 19, 21, 22, 23, 24, 26). All samples were analyzed for PCBs, semivolatile organic compounds (SVOC), and metals (Ref. 9, pp. 36, 38, 172, 175).

Soil samples collected within the former manufacturing plant area contained benzo(a)pyrene (up to 6,000 micrograms per kilogram [µg/kg]), benz(a)anthracene (up to 6,700 µg/kg), PCB-1254 (up to 16,000 µg/kg), arsenic (up to 5.4 milligrams per kilogram [mg/kg]), chromium (up to 93 mg/kg), hexavalent chromium (at 16 mg/kg), copper (up to 1,500 mg/kg), lead (up to 390 mg/kg), mercury (up to 0.51 mg/kg), and zinc (up to 700 mg/kg), among others (Ref. 9, pp. 7, 8, 9, 226, 228). Samples collected at the abandoned surface impoundment contained PCB-1254 (up to 610J µg/kg) ("J" denotes an estimated value), arsenic (up to 2.0 mg/kg), cadmium (up to 0.74 mg/kg), chromium (up to 3,100 mg/kg), hexavalent chromium (up to 320 mg/kg), copper (up to 2,700 mg/kg), lead (up to 340 mg/kg), and mercury (up to 0.89 mg/kg), among others (Ref. 9, pp. 7, 10). Samples collected from the WWTP clarifiers contained arsenic (up to 1.5 mg/kg), cadmium (up to 0.35 mg/kg), chromium (up to 46 mg/kg), copper (up to 98 mg/kg), lead (up to 19 mg/kg), and mercury (up to 0.18 mg/kg), among others (Ref. 9, pp. 7, 11).

Two sediment samples collected at the southern portion of Clearwater Lake contained arsenic (up to 2.4 mg/kg), cadmium (up to 0.17 mg/kg), chromium (up to 920 mg/kg), hexavalent chromium (up to 55 mg/kg), copper (up to 250 mg/kg), lead (up to 18 mg/kg), and mercury (up to 0.072 mg/kg), among others (Ref. 9, pp. 17, 18). One sediment sample was collected from the canal, and three sediment samples were collected from Little Horse Creek (Ref. 9, pp. 19, 20, 21). The samples contained

PCB-1254 (up to 0.26 mg/kg), arsenic (up to 1.3 mg/kg), cadmium (up to 1.5 mg/kg), chromium (up to 1,100 mg/kg), hexavalent chromium (up to 33 mg/kg), copper (up to 3,000 mg/kg), lead (up to 270 mg/kg), and mercury (up to 1.9 mg/kg), among others (Ref. 9, pp. 19, 20, 21).

Additional Information

Although not included as part of the site for HRS scoring purposes due to the 2018 Breezy Hill and SCDHEC VCC, site-related contamination has been detected in the CWF WWTP lagoons and clarifiers. In 2010, 2016, and 2018, samples were collected from the lagoons and clarifiers (Refs. 9, pp. 7, 121 through 126, 289 through 296; 67, pp. 29, 48, 96 through 99, 542 to 549, 620 to 627; 68, pp. 24 to 30, 217). Samples collected in 2010 were analyzed for volatile organic compounds (VOC), SVOCs, metals, hexavalent chromium, and cyanide (Ref. 67, pp. 29, 48, 96 through 99, 542 to 549, 620 to 627). Samples collected in 2016 were analyzed for SVOCs, PCBs, metals, and hexavalent chromium (Ref. 9, pp. 7, 121 through 126, and 285 through 296). Samples collected in 2018 were analyzed for VOCs, SVOCs, PCBs, metals, and cyanide (Ref. 68, pp. 24 to 30, 217). Lagoon samples contained carbon disulfide, arsenic, cadmium, chromium, hexavalent chromium, copper, lead, mercury, and zinc, among others (Ref. 58, pp. 11, 46, 47; 67, pp. 48, 96 through 99). Clarifier samples contained arsenic, cadmium, chromium, copper, lead, mercury, zinc, and PCB-1254 (Ref. 9, pp. 7, 121 through 126, 289 through 296).

In 2010, 10 groundwater monitoring wells were installed and sampled, and seven pre-existing monitoring wells were sampled (Ref. 67, pp. 26, 48, 727 to 756, 794 to 813, 837 to 846, 857 to 861, 867 to 877, 910 to 926). All samples were analyzed for VOCs, SVOCs, metals, and cyanide. Two samples were also analyzed for pesticides, PCBs, and herbicides. Results from two of the wells (MW03 and MW-11), were not used because the optimum turbidity value (less than 10 NTU) for sampling could not be achieved at MW-03 or MW-11 (Ref. 67, pp. 26, 27). Groundwater samples contained VOCs including chlorobenzene, ethylbenzene, methylcyclohexane, tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride; SVOCs including fluoranthene, 1-methylnaphthalene, 2-methylnaphthalene, naphthalene, and phenanthrene; and metals including arsenic, chromium, copper, and zinc, among others (Ref. 67, pp. 50, 83 through 94). Shallow groundwater flow is from the west and northwest to the east and southeast, suggesting a discharge into Clearwater Lake/Little Horse Creek drainage basin (Ref. 9, p. 11).

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Number of source: 1

Name of source: Contaminated soil in the southern portion of the CWF facility

Source Type: Contaminated soil

Description and Location of Source (with reference to a map of site):

Source No. 1 is an area of soil in the southern portion of the CWF facility contaminated with PAHs, PCB-1254, arsenic, cadmium, chromium, hexavalent chromium, copper, lead, mercury, and zinc, as indicated by results from two samples (see Figure 3 of this HRS documentation record). Surface soil samples were collected in the area of a former transformer (Refs. 9, pp. 7, 8; 23, p. 11). Soil within Source No. 1 likely became contaminated because of site operations and decommissioning and disposal of the PCB transformer (Ref. 37). The transformers at the facility were for the sole use of operations at Clearwater (Ref. 37).

Operations at CWF included bleaching, printing, dyeing, and finishing of textile fabric (Ref. 18, pp. 10, 24; 20). Metals, including lead, chromium, cadmium, and copper, are widely used for production of color pigments of textile dyes (Ref. 25, pp. 664). Chromium is used as a mordant to form a dye complex that fixes the fiber and dye together (Ref. 24, p. 22). PCBs were used in large quantities in the textile industry due to ease and inexpensive manufacture of PCBs, as well as their advantageous physico-chemical properties, such as extreme resistance to thermal and chemical degradation, high thermal conductivity, and low electrical conductivity (Ref. 35, p. 1268). Hazardous waste information forms submitted in 1979 and 1980 revealed production each year of 6,200 pounds of waste lubricating oils, 800 pounds of cleaning solvents, and 4,500 pounds of chromium plating bath sludge from the bottom of chromium electroplating tanks. Additionally, 10,000 pounds of spent chromium plating bath solution were produced over a 20 to 25-year interval (Ref. 30, pp. 7 to 10). Waste lubricating oils contain PAHs, PCBs, and heavy metals, among others (Ref. 51, p. 807).

Removal of PCB-contaminated soil occurred at the facility between 2004 and 2008 (Refs. 48, pp. 3, 4, 5; 67, pp. 7, 8). Documentation of a removal at or in the vicinity of Source No. 1 is not available; however, 2016 data show contamination, including PCB contamination, still exists in the southern portion of the facility at Source No. 1. Samples collected to characterize Source No. 1 in 2016 contained PAHs, PCB-1254, arsenic, cadmium, chromium, hexavalent chromium, copper, lead, mercury, and zinc at concentrations above background levels (Refs. 9, pp. 7, 70, 71, 73, 74, 222 through 224, 226 through 228, 127, 128, 298 through 300; 37) (see Table 2 of this HRS documentation record).

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

SCDHEC June 2016 Expanded Site Inspection

The soil samples listed in Table 2 of this HRS documentation record were collected during the June 2016 ESI (Refs. 6, pp. 20, 21, 31; 36, pp. 4, 7, 9). The background sample was collected about 1.3 miles northeast of Source No. 1 and was used to determine background levels of PAHs, PCB-1254, and metals for comparison to results from soil samples from Source No. 1 (Refs. 6, pp. 31; 55, p. 9).

The background soil sample was collected within 0 to 6 inches below ground surface (bgs), as were the samples of soil from Source No. 1 (Refs. 6, p. 31; 37). The background sample and Source No. 1 soil samples were collected in accordance with the EPA-approved quality assurance project plan (QAPP), dated May 2016, and the EPA Region 4, Science and Ecosystem Support Division (SESD), Field Branches Quality System and Technical Procedures (FBQSTP) for Soil Sampling, SESDPROC-300-R3, dated August 2014 (Refs. 37; 38; 39, pp. 8, 12).

The samples were analyzed for total metals, mercury, and hexavalent chromium by the EPA Region 4 Analytical Support Branch (ASB) via EPA Methods 6010 and 200.8 (total metals), 7473 (mercury), and 218.6 (hexavalent chromium) (Ref. 9, pp. 36, 38, 70 to 74, 127, 128). The metals data were verified in accordance with the ASB Laboratory Operations and Quality Assurance Manual (LOQAM) (Refs. 9, p. 36; 40; 41). The minimum reporting limits (MRL) are listed on the analytical data sheets in Reference 9. Each MRL is sample-specific and corresponds to the lowest quantitative point on the calibration curve; it is adjusted for the amount of sample prepared and any dilutions performed, as well as for percent moisture. The MRLs are equivalent to sample quantitation limits (SQL) as defined in Section 1.1, Definitions, of the HRS (Refs. 1, Section 1.1; 9, p. 39; 42).

The samples also were analyzed for PCBs and SVOCs in accordance with the EPA Contract Laboratory Program (CLP) Statement of Work (SOW) SOM02.3/SOM02.3B (Refs. 9, pp. 172, 175, 222 through 228, 297 through 300; 43). EPA Region 4 SESD reviewed all CLP data according to the contract SOW and EPA guidelines (Ref. 40). The contract required quantitation limits (CRQL) are listed on the analytical data sheets in Reference 9. Each CRQL is sample-specific and corresponds to the lowest quantitative point on the calibration curve; it is adjusted for the amount of sample prepared and any dilutions performed, as well as for percent moisture (Ref. 42). The CRQL is equivalent to HRS-defined CRQL (Refs. 1, Section 1.1; 9, p. 176; 42).

The background sample and soil samples from Source No. 1 were collected during the same time frame, in accordance with the same sampling procedures and approved QAPP, and from similar types of soil (including dry sandy and sandy soil) (Refs. 6, pp. 20, 21, 31; 37; 39).

Chain-of-custody records for the background sample and Source No. 1 soil samples are in Reference 36. Logbook notes are in Reference 6. Locations of samples listed in Table 2 are shown on Figure 3 of this HRS documentation record. Specific page numbers in chain-of-custody records and logbook notes are listed in Table 2.

TABLE 2: Analytical Results from Source No. 1				
Sample ID	Hazardous Substance	Hazardous Substance Conc.	MRL/CRQL[2]	References[1]
Background Soil Sample				
CWF-031-SF	Arsenic	0.20U mg/kg	0.20 mg/kg	6, p. 31; 9, p. 127; 36, p. 9
CWF-031-SF	Cadmium	0.099U mg/kg	0.099 mg/kg	6, p. 31; 9, p. 127; 36, p. 9
CWF-031-SF	Copper	0.99U mg/kg	0.99U mg/kg	6, p. 31; 9, p. 127; 36, p. 9
CWF-031-SF	Chromium	1.5 mg/kg	0.49 mg/kg	6, p. 31; 9, p. 127; 36, p. 9

TABLE 2: Analytical Results from Source No. 1				
Sample ID	**Hazardous Substance**	**Hazardous Substance Conc.**	**MRL/CRQL[2]**	**References[1]**
CWF-031-SF	Hexavalent Chromium	5.2U mg/kg	5.2 mg/kg	6, p. 31; 9, p. 127; 36, p. 9
CWF-031-SF	Lead	0.92 mg/kg	0.20 mg/kg	6, p. 31; 9, p. 127; 36, p. 9
CWF-031-SF	Mercury	0.047U mg/kg	0.047 mg/kg	6, p. 31; 9, p. 127; 36, p. 9
CWF-031-SF	Zinc	2.6 mg/kg	0.99 mg/kg	6, p. 31; 9, p. 128; 36, p. 9
CWF-031-SF	PCB-1254	34U µg/kg	34 µg/kg	6, p. 31; 9, p. 300; 36, p. 11
CWF-031-SF	Benz(a)anthracene	180U µg/kg	180 µg/kg	6, p. 31; 9, p. 298; 36, p. 11
CWF-031-SF	Benzo(a)pyrene	180U µg/kg	180 µg/kg	6, p. 31; 9, p. 298; 36, p. 11
CWF-031-SF	Benzo(k)fluoranthene	180U µg/kg	180 µg/kg	6, p. 31; 9, p. 298; 36, p. 11
CWF-031-SF	Benzo(g,h,i)perylene	180U µg/kg	180 µg/kg	6, p. 31; 9, p. 298; 36, p. 11
CWF-031-SF	Chrysene	180U µg/kg	180 µg/kg	6, p. 31; 9, p. 298; 36, p. 11
CWF-031-SF	Fluoranthene	180U µg/kg	180 µg/kg	6, p. 31; 9, p. 298; 36, p. 11
CWF-031-SF	Indeno(1,2,3-cd)pyrene	180U µg/kg	180 µg/kg	6, p. 31; 9, p. 299; 36, p. 11
CWF-031-SF	Phenanthrene	180U µg/kg	180 µg/kg	6, p. 31; 9, p. 299; 36, p. 11
Soil Samples from Source No. 1				
CWF-012-SF	Arsenic	4.9 mg/kg	0.20 mg/kg	6, p. 21; 9, p. 70; 36, p. 7
CWF-012-SF	Cadmium	1.3 mg/kg	0.099 mg/kg	6, p. 21; 9, p. 70; 36, p. 7
CWF-012-SF	Copper	12 mg/kg	0.99 mg/kg	6, p. 21; 9, p. 70; 36, p. 7
CWF-012-SF	Lead	16 mg/kg	0.20 mg/kg	6, p. 21; 9, p. 70; 36, p. 7
CWF-012-SF	Zinc	74 mg/kg	0.99 mg/kg	6, p. 21; 9, p. 71; 36, p. 7
CWF-012-SF	Benz(a)anthracene	710 µg/kg	170 µg/kg	6, p. 21; 9, p. 222; 36, p. 4
CWF-012-SF	Benzo(a)pyrene	670 µg/kg	170 µg/kg	6, p. 21; 9, p. 222; 36, p. 4
CWF-012-SF	Benzo(k)fluoranthene	390 µg/kg	170 µg/kg	6, p. 21; 9, p. 222; 36, p. 4
CWF-012-SF	Chrysene	1,000 µg/kg	170 µg/kg	6, p. 21; 9, p. 222; 36, p. 4
CWF-012-SF	Fluoranthene	1,800 µg/kg	170 µg/kg	6, p. 21; 9, p. 222; 36, p. 4
CWF-012-SF	Phenanthrene	1,200 µg/kg	170 µg/kg	6, p. 21; 9, p. 223; 36, p. 4
CWF-013-SF	Arsenic	2.5 mg/kg	0.20 mg/kg	6, p. 20; 9, p. 73; 36, p. 7

TABLE 2: Analytical Results from Source No. 1				
Sample ID	**Hazardous Substance**	**Hazardous Substance Conc.**	**MRL/CRQL[2]**	**References[1]**
CWF-013-SF	Cadmium	2.9 mg/kg	0.099 mg/kg	6, p. 20; 9, p. 73; 36, p. 7
CWF-013-SF	Chromium	38 mg/kg	2.5 mg/kg	6, p. 20; 9, p. 73; 36, p. 7
CWF-013-SF	Hexavalent chromium	16 mg/kg	5.0 mg/kg	6, p. 20; 9, p. 73; 36, p. 7
CWF-013-SF	Lead	390 mg/kg	5.0 mg/kg	6, p. 20; 9, p. 73; 36, p. 7
CWF-013-SF	Mercury	0.51 mg/kg	0.049 mg/kg	6, p. 20; 9, p. 73; 36, p. 7
CWF-013-SF	Zinc	610 mg/kg	5.0 mg/kg	6, p. 20; 9, p. 74; 36, p. 7
CWF-013-SF	PCB-1254	16,000 µg/kg	1,700 µg/kg	6, p. 20; 9, p. 228; 36, p. 4
CWF-013-SF	Benz(a)anthracene	6,700 µg/kg	3,500 µg/kg	6, p. 20; 9, p. 226; 36, p. 4
CWF-013-SF	Benzo(a)pyrene	6,000 µg/kg	3,500 µg/kg	6, p. 20; 9, p. 226; 36, p. 4
CWF-013-SF	Benzo(g,h,i)perylene	4,100 µg/kg	3,500 µg/kg	6, p. 20; 9, p. 226; 36, p. 4
CWF-013-SF	Chrysene	7,800 µg/kg	3,500 µg/kg	6, p. 20; 9, p. 226; 36, p. 4
CWF-013-SF	Fluoranthene	16,000 µg/kg	6,900 µg/kg	6, p. 20; 9, p. 226; 36, p. 4
CWF-013-SF	Indeno(1,2,3-cd)pyrene	3,900 µg/kg	3,500 µg/kg	6, p. 20; 9, p. 227; 36, p. 4
CWF-013-SF	Phenanthrene	16,000 µg/kg	3,500 µg/kg	6, p. 20; 9, p. 227; 36, p. 4

Notes:

1	See Figure 3 of this HRS documentation record and Reference 55, p. 9
2	MRL associated with EPA Region 4 ASB and CRQL associated with EPA CLP
Conc.	Concentration
CRQL	Contract required quantitation limit
CWF	Clearwater Finishing
ID	Identification
µg/kg	Micrograms per kilogram
mg/kg	Milligrams per kilogram
SF	Surface soil
MRL	Minimum reporting limit. The MRL is equivalent to the sample quantitation limit as defined in Section 1.1, Definitions of the HRS (Refs. 1, Section 1.1; 9, pp. 39, 176; 42).
U	Analyte not detected at or above reporting limit (Ref. 9, pp. 39, 176).

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

Soil samples collected from Source No. 1 contained PAHs, PCB-1254, arsenic, cadmium, chromium, hexavalent chromium, copper, lead, mercury, and zinc (see Table 2 of this HRS documentation record). Source No. 1 is an area of contaminated soil in the southern portion of the CWF facility (Refs. 6, pp. 20, 21, 31; 9, pp. 7, 70, 71, 73, 74, 224, 228). The locations of background and Source No. 1 samples are depicted in Reference 55, p. 9 and Figure 3 of this HRS documentation record. During the 2016 SCDHEC ESI, the following were not observed: (1) maintained engineered cover, (2) functioning and maintained run-on control system, and (3) runoff management system (Ref. 37). Therefore, a containment factor value of 10, as noted in Table 3, was assigned for Source No. 1 (Ref. 1, Section 3.1.2.1, Table 3-2).

TABLE 3: Containment Factors for Source No. 1

Containment Description	Containment Factor Value	References
Gas release to air	NS	NA
Particulate release to air	NS	NA
Release to ground water	NS	NA
Release to surface water via overland migration and/or flood: No engineered and maintained run-on and runoff control systems	10	37

Notes:

NA Not applicable
NS Not scored

2.4.2.1 HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity (Tier A)

Total hazardous constituent quantity for Source No. 1 could not be adequately determined according to HRS requirements; that is, total mass of all CERCLA hazardous substances in the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). Sufficient historical and current data (manifests, potentially responsible party [PRP records, State records, permits, waste concentration data, etc.] are not available to adequately calculate the total or partial mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to calculate a total or partial Hazardous Constituent Quantity estimate for Source No. 1 with reasonable confidence. Scoring proceeds to the evaluation of Tier B, hazardous wastestream quantity (Ref. 1, Section 2.4.2.1.1).

Hazardous Constituent Quantity Assigned Value: NS

2.4.2.1.2 Hazardous Wastestream Quantity (Tier B)

The total hazardous wastestream quantity for Source No. 1 could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). Insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, annual reports, etc.) are available to adequately calculate the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants or the source and the associated releases from the source. Therefore, there is insufficient information to adequately calculate the total or partial mass of the wastestream plus the mass of all CERCLA pollutants and contaminants in the source and the associated release from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous wastestream quantity for Source No. 1 with reasonable confidence. Scoring proceeds to the evaluation of Tier C, Volume (Ref. 1, Section 2.4.2.1.2).

Hazardous Wastestream Quantity Assigned Value: NS

2.4.2.1.3 Volume (Tier C)

The information available on the depth of Source No. 1 is not sufficiently specific to support a volume of contaminated soil with reasonable confidence; therefore, it is not possible to assign a volume (Tier C) in cubic yards (yd^3) for Source No. 1 (Ref. 1, Section 2.4.2.1.3, Table 2-5). Source No. 1 has been assigned a value of 0 for the volume measure (Ref. 1, Section 2.4.2.1.3). As a result, the evaluation of hazardous waste quantity proceeds to the evaluation of Tier D, area (Ref. 1, Section 2.4.2.1.3).

Volume Assigned Value: 0
Are the data complete for volume quantity for this area? No

2.4.2.1.4 Area (Tier D)

Estimated area of Source No. 1 is undetermined but greater than zero. The approximate area of Source No. 1 cannot be determined because only two surface samples were collected at Source No. 1. Soil within Source No. 1 likely became contaminated because of historical operations at the facility, as well as the former presence of a transformer (Ref. 37).

Sum (square feet): >0
Equation for Assigning Value (Ref. 1, Table 2-5): Area (A)/34,000

Area Assigned Value: >0

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source hazardous waste quantity (HWQ) value for Source No. 1 is undetermined but greater than zero (Ref. 1, Section 2.4.2.1.5).

Source HWQ Value: >0

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Number of source: 2

Name of source: Surface impoundment

Source Type: Surface impoundment

Description and Location of Source (with reference to a map of site):

Source No. 2 is an abandoned surface impoundment containing wastes resulting from facility operations as documented by hazardous substances contained in samples CWF-004-SD, CWF-005-SD, and CWF-006-SD (Ref. 37). Surface impoundment waste is dark black with streaks of green spongy material with a gelatin-like consistency. Naturally occurring sediment in wetlands surrounding the impoundment are sandy and visually different from the waste in the surface impoundment (Ref. 37). The waste material is in direct contact with palustrine forested wetlands that surround the entire perimeter of the surface impoundment (Refs. 37; 55, pp. 9, 16, 17). Samples CWF-004-SD, CWF-005-SD, and CWF-006-SD are consistent with waste but referred to as sediment samples in the June 2016 ESI (Ref. 9, p. 10). However, as shown above, these samples are waste and will be referred to as waste samples in this HRS documentation record (Ref. 37).

CWF operated a surface impoundment, which received wastewater from the facility with little to no treatment before the WWTP was built in the mid-to-late 1970s. Wastewater from the manufacturing plant was piped over the canal and discharged onto the ground on the island. The wastewater was channeled to the south by an unlined ditch to the unlined surface impoundment (Ref. 44, p. 2). A ditch on the southeastern side of the impoundment drained to Little Horse Creek (Ref. 44, p. 19).

A 1962 aerial shows two distinct surface impoundments on the island, each about 400 feet long and 30 feet wide (Ref. 45, pp. 1, 2). More recent aerial photographs show the surface impoundments merged and appearing much smaller (Ref. 45, pp. 2 through 9). During the 2019 SCDHEC visit, one surface impoundment was visible at the southern edge of the island (Ref. 44, p. 2). Approximate area of the surface impoundment is 12,858 square feet, based on 2007, 2011, and 2017 aerial photographs (Ref. 45, pp. 1, 7, 8, 9) (see Figure 3 of this HRS documentation record).

Samples collected to characterize Source No. 2 in 2016 contained PCB-1254, arsenic, cadmium, chromium, hexavalent chromium, copper, lead, mercury, and zinc (Ref. 9, pp. 7, 49, 50, 52, 53, 55, 192, 196).

2.2.2 HAZARDOUS SUBSTANCES ASSOCIATED WITH THE SOURCE

SCDHEC June 2016 Expanded Site Inspection

Source No. 2 samples listed in Table 4 below were collected during the June 2016 ESI (Refs. 6, pp. 13, 14, 16; 36, pp. 3, 6). The samples consisted of surface impoundment waste resulting from facility operations (Ref. 37). The samples were collected within 0 to 6 inches bgs in accordance with the EPA-approved QAPP, dated May 2016, and the EPA Region 4 SESD FBQSTP for Sediment Sampling, SESDPROC-200-R3, dated August 2014 (Refs. 6, pp. 13, 14, 16; 37; 39; 49).

The samples were analyzed for total metals, mercury, and hexavalent chromium by the EPA Region 4 SESD ASB via EPA Methods 6010 and 200.8 (total metals), 7473 (mercury), and 218.6 (hexavalent chromium) (Ref. 9, pp. 36, 49, 50, 52, 53, 55, 56). The metals data were verified in accordance with the EPA Region 4 ASB LOQAM (Refs. 9, p. 36; 40; 41). MRLs are listed on the analytical data sheets in Reference 9. Each MRL is sample-specific and corresponds to the lowest quantitative point on the calibration curve; it is adjusted for the amount of sample prepared and any dilutions performed, as well as for percent moisture. MRLs are equivalent to SQLs as defined in Section 1.1, Definitions, of the HRS (Refs. 1, Section 1.1; 9, p. 39; 42).

The samples were analyzed for PCBs in accordance with the EPA CLP SOW SOM02.3 (Refs. 9, pp. 192, 196; 43). EPA Region 4 SESD reviewed all CLP data according to the contract SOW and EPA guidelines (Ref. 40). The CRQLs are listed on the analytical data sheets in Reference 9. Each CRQL is sample-specific and corresponds to the lowest quantitative point on the calibration curve; it is adjusted for the amount of sample prepared and any dilutions performed, as well as for percent moisture (Ref. 42). The CRQL is equivalent to HRS-defined CRQL (Refs. 1, Section 1.1; 9, p. 176; 42).

Logbook notes are in Reference 6. Locations of the samples listed in Table 4 are in Reference 9, p. 7 and Reference 55, p. 9 (also see Figure 3 of this HRS documentation record). Specific page numbers in chain-of-custody records and logbook notes are listed in Table 4.

TABLE 4: Analytical Results for Source No. 2

Sample ID	Hazardous Substance	Hazardous Substance Concentration	MRL/CRQL[2]	References[1]
CWF-004-SD	Arsenic	0.88 mg/kg	0.20 mg/kg	6, p. 13; 9, p. 49; 36, p. 6
CWF-004-SD	Cadmium	0.14 mg/kg	0.099 mg/kg	6, p. 13; 9, p. 49; 36, p. 6
CWF-004-SD	Chromium	3,100 mg/kg	5.0 mg/kg	6, p. 13; 9, p. 49; 36, p. 6
CWF-004-SD	Hexavalent chromium	320 mg/kg	48 mg/kg	6, p. 13; 9, p. 49; 36, p. 6
CWF-004-SD	Copper	540 mg/kg	9.9 mg/kg	6, p. 13; 9, p. 49; 36, p. 6
CWF-004-SD	Lead	330 mg/kg	5.0 mg/kg	6, p. 13; 9, p. 49; 36, p. 6
CWF-004-SD	Mercury	0.49 mg/kg	0.050 mg/kg	6, p. 13; 9, p. 49; 36, p. 6
CWF-004-SD	Zinc	33 mg/kg	9.9 mg/kg	6, p. 13; 9, p. 50; 36, p. 6
CWF-004-SD	PCB-1254	480J[a] µg/kg	82 µg/kg	6, p. 13; 9, pp. 176, 192; 36, p. 3
CWF-005-SD	Arsenic	2.0 mg/kg	0.20 mg/kg	6, p. 14; 9, p. 52; 36, p. 6
CWF-005-SD	Cadmium	0.74 mg/kg	0.099 mg/kg	6, p. 14; 9, p. 52; 36, p. 6
CWF-005-SD	Chromium	2,500 mg/kg	5.0 mg/kg	6, p. 14; 9, p. 52; 36, p. 6

TABLE 4: Analytical Results for Source No. 2				
Sample ID	**Hazardous Substance**	**Hazardous Substance Concentration**	**MRL/CRQL[2]**	**References[1]**
CWF-005-SD	Hexavalent chromium	170 mg/kg	13 mg/kg	6, p. 14; 9, p. 52; 36, p. 6
CWF-005-SD	Copper	2,700 mg/kg	9.9 mg/kg	6, p. 14; 9, p. 52; 36, p. 6
CWF-005-SD	Lead	340 mg/kg	5.0 mg/kg	6, p. 14; 9, p. 52; 36, p. 6
CWF-005-SD	Mercury	0.89 mg/kg	0.048 mg/kg	6, p. 14; 9, p. 52; 36, p. 6
CWF-005-SD	Zinc	290 mg/kg	9.9 mg/kg	6, p. 14; 9, p. 53; 36, p. 6
CWF-005-SD	PCB-1254	610J[b] µg/kg	130 µg/kg	6, p. 14; 9, p. 196; 36, p. 3
CWF-006-SD	Arsenic	0.62 mg/kg	0.20 mg/kg	6, p. 16; 9, p. 55; 36, p. 6
CWF-006-SD	Lead	7.7 mg/kg	0.20 mg/kg	6, p. 16; 9, p. 55; 36, p. 6
CWF-006-SD	Mercury	0.063 mg/kg	0.049 mg/kg	6, p. 16; 9, p. 55; 36, p. 6

Notes:

1	See Figure 3 of this HRS documentation record
2	MRL associated with EPA Region 4 ASB and CRQL associated with EPA CLP
CWF	Clearwater Finishing
J[a]	Surrogate recovery is greater than established control limits (possibly biased high) (Ref. 9, p. 176). Although results are qualified as estimated, the presence of the analyte is not in question.
J[b]	Surrogate recovery is greater than established control limits (possibly biased high); sample results are estimated "J" due to percent moisture content between 70% and 89% (Ref. 9, p. 176). Although results are qualified as estimated, the presence of the analyte is not in question.
µg/kg	Micrograms per kilogram
mg/kg	Milligrams per kilogram
MRL	Minimum reporting limit
No.	Number
SD	Sediment
U	Analyte not detected at or above reporting limit (Ref. 9, pp. 39, 176).

2.2.3 HAZARDOUS SUBSTANCES AVAILABLE TO A PATHWAY

Samples collected at Source No. 2 contained PCB-1254, arsenic, cadmium, chromium, hexavalent chromium, copper, lead, mercury, and zinc (see Table 4 of this HRS documentation record). Source No. 2 is an abandoned surface impoundment on an island surrounded by Clearwater Lake to the north, Little Horse Creek to the east, and a canal to the west and south. Source No. 2 contains wastes resulting from facility operations as documented by hazardous substances contained in samples CWF-004-SD, CWF-005-SD, and CWF-006-SD (Ref. 37) (see Table 4 of this HRS documentation record). The waste material is in direct contact with palustrine forested wetlands that surround the entire perimeter of the surface impoundment (Refs. 37; 55, pp. 9, 16, 17). During a 2018 inspection, no diking, berms, or other engineered physical barriers were present (Ref. 37). Therefore, a containment factor value of 10, as noted in Table 5, was assigned for Source No. 2 (Ref. 1, Section 3.1.2.1, Table 3-2).

TABLE 5: Containment Factors for Source No. 2

Containment Description	Containment Factor Value	References
Gas release to air	NS	NA
Particulate release to air	NS	NA
Release to ground water	NS	NA
Release to surface water via overland flow by direct observation	10	37

Notes:

NA Not applicable
NS Not scored

2.4.2.1 HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity (Tier A)

The total hazardous constituent quantity for Source No. 2 could not be adequately determined according to the HRS requirements; that is, the total mass of all CERCLA hazardous substances in the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.1). Insufficient historical and current data [manifests, potentially responsible party (PRP) records, State records, permits, waste concentration data, etc.] are available to adequately calculate the total or partial mass of all CERCLA hazardous substances in the source and the associated releases from the source. Therefore, there is insufficient information to calculate a total or partial Hazardous Constituent Quantity estimate for Source No. 2 with reasonable confidence. Scoring proceeds to the evaluation of Tier B, hazardous wastestream quantity (Ref. 1, Section 2.4.2.1.1).

Hazardous Constituent Quantity Assigned Value: NS

2.4.2.1.2 Hazardous Wastestream Quantity (Tier B)

The total hazardous wastestream quantity for Source No. 2 could not be adequately determined according to the HRS requirements; that is, the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source is not known and cannot be estimated with reasonable confidence (Ref. 1, Section 2.4.2.1.2). Insufficient historical and current data (manifests, PRP records, State records, permits, waste concentration data, annual reports, etc.) are available to adequately calculate the total mass of all hazardous wastestreams and CERCLA pollutants and contaminants or the source and the associated releases from the source. Therefore, there is insufficient information to adequately calculate the total or partial mass of the wastestream plus the mass of all CERCLA pollutants and contaminants in the source and the associated release from the source. Therefore, there is insufficient information to evaluate the associated releases from the source to calculate the hazardous wastestream quantity for Source No. 2 with reasonable confidence. Scoring proceeds to the evaluation of Tier C, Volume (Ref. 1, Section 2.4.2.1.2).

Hazardous Wastestream Quantity Assigned Value: NS

2.4.2.1.3 Volume (Tier C)

The information available on the depth of Source No. 2 is not sufficiently specific to support a volume of the surface impoundment with reasonable confidence; therefore, it is not possible to assign a volume (Tier C) in cubic yards (yd^3) for Source No. 2 (Ref. 1, Section 2.4.2.1.3). Source No. 2 has been assigned a value of undetermined but greater than zero for the volume measure (Ref. 1, Section 2.4.2.1.3). As a result, the evaluation of hazardous waste quantity proceeds to the evaluation of Tier D, area (Ref. 1, Section 2.4.2.1.3).

Volume Assigned Value: 0
Are the data complete for volume quantity for this area? No

2.4.2.1.4 Area (Tier D)

The estimated area of Source No. 2 is 12,858 square feet. The area was determined by use of 2007, 2011, and 2017 aerial photographs of the surface impoundment (Ref. 45, pp. 1, 7, 8, 9).

Sum (square feet): 12,858
Equation for Assigning Value (Ref. 1, Table 2-5): Area (A)/13

Area Assigned Value: 989.07

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source HWQ value for Source No. 2 is 989.07 (Ref. 1, Section 2.4.2.1.5).

Source HWQ Value: 989.07

SUMMARY OF SOURCE DESCRIPTIONS

TABLE 6: Summary of Source Descriptions

Source No.	Source Hazardous Waste Quantity Value	Source Hazardous Constituent Quantity Complete? (Yes/No)	Containment Factor Value by Pathway			
			Ground Water (Ref. 1, Table 3-2)	Surface Water Overland/ Flood (Ref. 1, Table 4-2)	Air	
					Gas (Ref. 1, Table 6-3)	Particulate (Ref. 1, Table 6-9)
1	>0	No	NS	10	NS	NS
2	989.07	No	NS	10	NS	NS

Notes:

NS Not scored

Description of Other Possible On-Site Sources

Other possible on-site sources include a possible former landfill within the northwestern portion of the CWF facility, and contaminated soil throughout the CWF facility not included in Source No. 1.

- Possible former landfill area – The possible former landfill area is located at a former parking lot in the northwestern portion of the CWF facility (Refs. 46; 67, p. 48). The location of the possible former landfill is depicted in Reference 67, p. 48. In 2010, test pits were excavated. Waste material was not observed during excavation of any test pit. Four samples were collected from the test pits and analyzed for VOCs, SVOCs, metals, and cyanide (Ref. 67, p. 14). The samples were found to contain acetone (at 0.062 mg/kg), xylenes (at 0.016 mg/kg), several PAHs including benzo(a)pyrene (at 1.5 mg/kg), arsenic (up to 1.8 mg/kg), chromium (up to 18 mg/kg), copper (up to 6.3 mg/kg), lead (up to 8.5 mg/kg), mercury (up to 0.036 mg/kg), and zinc (up to 16 mg/kg) (Ref. 67, pp. 58, 65, 79).
- Contaminated soil – Based on soil samples collected in 2010, SVOCs, PCBs, and metals are present in areas throughout the CWF facility (Ref. 67, pp. 48, 49, 52 to 79). Sample locations are depicted in Reference 67, p. 48. These areas are not evaluated as part of Source No. 1 because the data are not of known and documented quality: chain-of-custody forms, logbook notes, and laboratory-generated analytical data sheets equivalent to CLP Form 1s are not available. Additionally, the data are more than 9 years old (Ref. 67, pp. 48, 49, 52 to 79).

4.0 SURFACE WATER MIGRATION PATHWAY

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

4.1.1.1 Definition of Hazardous Substance Migration Path for Overland/Flood Component

The hazardous substance migration pathway includes both the overland segment and the in-water segment that hazardous substances would take as they migrate away from sources. The overland segment begins at the source and proceeds downgradient to the probable point of entry (PPE) to surface water. The in-water segment at the PPE continues in the direction of flow (Refs. 1, Section 4.1.1.1; 3).

Surface water runoff from Source No. 1 is described and depicted in Reference 57, a memorandum prepared by SCDHEC. SCDHEC states that runoff from Source No. 1 is channeled into a swale along the edge of an access road located east of Source No. 1. The swale contains vegetative growth which restricts and slows the flow of runoff within the swale. The swale travels north east about 180 feet along the access road then turns east towards a perennial canal, flows about 100 feet, and discharges into the canal. The canal flows to and enters Little Horse Creek. Due to vegetative growth along the swale, only heavy rainfall events would produce enough stormwater runoff to flow from Source No. 1 to the canal (Ref. 57). The point at which the swale meets the canal is PPE 1 (see Figure 3 of this HRS documentation record).

Source No. 2, surface impoundment wastes, is in direct contact with palustrine forested wetlands (Refs. 37; 55, p. 9). Palustrine forested wetlands surround Source No. 2; therefore, PPE 2 extends about 640 feet along the perimeter of Source No. 2 (Refs. 37; 55, pp. 9, 16, 17; 65) (see Figure 3 of this HRS documentation record). The wetland frontage along the perimeter of the Source No. 2 was calculated using Geographic Information System (GIS) software. A detailed description of the calculation is provided in Reference 64. A ditch located on the southeastern corner of Source No. 2, flows about 55 feet where it meets Little Horse Creek (Ref. 44, pp. 19, 20).

PPE 3 is located where the unlined ditch between the Pipe 2 outfall discharge point and Source No. 2 transects the palustrine forested wetlands (Refs. 37; 44, pp. 14, 16, 17, 18; 55, p. 9) (see Figure 3 of this HRS documentation record). The unlined ditch flows about 150 feet south before merging with Source No. 2 (see Figure 3 of this HRS documentation record).

The 15-mile surface water migration pathway target distance limit (TDL) is measured from the most downstream PPE (PPE 2, specifically the southeastern corner of PPE 2) (Ref. 3). From PPE 2, surface water drains into a ditch, located at the southeastern corner of Source No. 2, transected by HRS-eligible wetlands, that flows east about 55 feet where it meets perennial Little Horse Creek. This ditch is located within palustrine forested wetlands and is therefore perennial (Refs. 3; 37; 44, p. 19; 55, p. 9) (see Figure 3 of this HRS documentation record). Little Horse Creek flows about 0.43 mile south before converging with Horse Creek (Refs. 3; 8; 26). Horse Creek continues west for about 2 miles where it joins the Savannah River (Refs. 3; 50). The Savannah River flows south for more than 12.57 miles, completing the 15-mile surface water migration pathway TDL (Refs. 3; 50).

The flow rate for the canal is less than 10 cubic feet per second (cfs) (Ref. 37). Average flow rate in Little Horse Creek near Graniteville, South Carolina, was 33.81 cfs for water years 1990 to 1999 (Ref. 52). Average flow rate in Horse Creek at Clearwater, South Carolina, was 171 cfs for water years 2006 to 2017 (Ref. 53). Average flow rate in the Savannah River near Jackson, South Carolina was 6,276.8 cfs for water years 1981 to 2002 (Ref. 54).

4.1.2.1 LIKELIHOOD OF RELEASE

4.1.2.1.1 OBSERVED RELEASE

An observed release by direct observation to palustrine forested wetlands is documented in the sections below.

Direct Observation

Source No. 2 is an abandoned surface impoundment containing waste resulting from facility operations as documented by hazardous substances contained in samples CWF-004-SD, CWF-005-SD, and CWF-006-SD6 (Refs. 9, p. 7; 37) (see Sections 2.2.1 and 2.2.2, Source No. 2, and Figure 3 of this HRS documentation record). The surface impoundment waste is dark black with streaks of green spongy material with a gelatin-like consistency. Naturally occurring wetland sediment surrounding the impoundment are sandy and visually different from the waste in the surface impoundment (Ref. 37). The waste material is in direct contact with palustrine forested wetlands that surround the entire perimeter of the surface impoundment (Refs. 37; 55, pp. 9, 16, 17) (see Figure 3 of this HRS documentation record). Therefore, an observed release by direct observation has been documented. Source No. 2 samples contain arsenic, cadmium, chromium, hexavalent chromium, copper, lead, mercury, zinc, and PCB-1254 (Ref. 9, pp. 7, 49, 50, 52, 53, 55, 192, 196) (see Table 7 of this HRS documentation record).

CWF, an abandoned textile finishing plant, operated from 1929 to 1988 (Ref. 17, pp. 497, 501). Textile dyeing and finishing industry operations, among the most chemically intensive of industrial processes, reportedly have significantly and negatively affected the environment (Ref. 24, pp. 22, 23). Heavy metals, particularly lead, chromium, cadmium, copper, and nickel, are widely used to produce color pigments in textile dyes (Ref. 25, pp. 664). Chromium is a mordant to form a dye complex that fixes the fiber and dye together (Ref. 24, p. 22). PCBs were used in large quantities in the textile industry because of ease and inexpensiveness of their manufacture, as well as their advantageous physico-chemical properties such as extreme resistance to thermal and chemical degradation, high thermal conductivity, and low electrical conductivity (Ref. 35, p. 1268). Some common uses of PCB-1254 in the textile industry include (1) styrene-butadiene co-polymers to ensure better chemical resistance, (2) polyvinyl chloride – secondary plasticizers to increase flame retardance and chemical resistance, and (3) chlorinated rubber – enhanced resistance, flame retardant mixtures, electrical insulation properties (Refs. 33, pp. 7, 8; 34, p. 125; 59, p. 5-32; 60, pp. 13, 41, 67).

Prior to 1983, CWF conducted electroplating operations that utilized chromium and cyanides (Refs. 30, pp. 9, 10; 31). Waste streams from electroplating can include hexavalent chromium. The most significant anthropogenic point sources of chromium in surface waters and ground waters are the wastewaters from electroplating operations, leather tanning industries, and textile manufacturing (Ref. 61, p. 290). Hard chromium plating provides exceptional resistance to wear when used with textiles (Ref. 71, p. 2).

CWF operated a surface impoundment that received wastewater from the facility with little to no treatment before the WWTP was built in the mid-to-late 1970s. Wastewater from the manufacturing plant was piped over the canal and discharged onto the ground on the island. The wastewater was channeled to the south by an unlined ditch to the unlined surface impoundment (Ref. 44, p. 2). An unlined ditch on the southeastern side of the impoundment drained to Little Horse Creek (Ref. 44, pp. 19, 20).

Several pipes discharged wastewater effluent from the facility into the unlined ditch on the island (see Ref. 44, p. 22 for the location of the pipes discussed below). The unlined ditch was formed by earthen embankments and begins at the discharge point of Pipe 2, a small pipe that originates from the former rotary screen print building (Ref. 44, pp. 7, 10, 11, 14, 16). Pipe 2 terminated in a concrete channel, and effluent flowed over a drum screen prior to discharging into the unlined ditch (Ref. 44, p. 10). Three additional pipes discharged into the unlined ditch. One of the pipes originated near the plant's dyeing operations (Ref. 44, pp. 6, 9, 12). The unlined ditch extended about 175 feet to the surface impoundment (Ref. 44, pp. 14, 16).

During 2004, 2016, and 2019 site visits, SCDHEC observed (1) textile material on the drum screen (Pipe 2 terminated in a concrete channel and effluent flowed over the drum screen prior to discharging into the unlined ditch); (2) small bits of waste dye pellets (green, red, yellow, and magenta) at the bottom of Pipe 2's concrete channel, in the unlined ditch below the Pipe 2 discharge point, and along the western side of the unlined ditch; and (3) unnaturally greenish tinted soil at the Pipe 2 discharge point and along the unlined ditch (Ref. 44, pp. 10, 11, 14, 15, 21).

During operations, surface runoff may have entered the southern portion of Clearwater Lake or the canal (Ref. 37). Whether the WWTP discharged effluent to Little Horse Creek is unknown; however, an outfall pipe leading to the WWTP is located on Little Horse Creek indicating that some processed wastewater was likely discharged (Ref. 37). During previous sampling events (2010, 2016, and 2018), sediment samples were collected from the southern portion of Clearwater Lake, the canal upstream of runoff from Source No. 1, and Little Horse Creek upstream of the confluence with the unlined ditch from the abandoned surface impoundment. Most samples were analyzed for PCBs and metals. All samples contained the same hazardous substances as Source No. 2 samples, except for PCB-1254 (Refs. 9, pp. 7, 11, 17 through 21; 67, pp. 48, 96 to 99; 68, pp. 14, 15, 18, 24, 25, 26, 29, 30, 43).

- Southern portion of Clearwater Lake (CWF-002-SD, CWF-003-SD, CWF-SD-09, Sediment 1, Sediment 2, Sediment 3, Sediment 4, Sediment 5). Samples Sediment 1 through 5 were collected in 2018, samples CWF-002-SD and CWF-03-SD were collected in 2016, and sample CWF-SD-09 was collected in 2010 (Refs. 9, pp. 17, 18, 38; 67, pp. 48, 98, 561, 562; 68, pp. 14, 15, 18, 43). The samples contained arsenic (at 2.4 mg/kg), cadmium (at 0.17 mg/kg), chromium (up to 920 mg/kg), copper (up to 250 mg/kg), lead (up to 18), mercury (at 0.072 mg/kg), zinc (up to 53 mg/kg), and hexavalent chromium (up to 55 mg/kg) (Refs. 9, pp. 17, 18, 38). PCB-1254 was not detected at concentrations exceeding its MRL (2016) or detection limit (2010) (Refs. 9, pp. 184, 188; 67, p. 562)
- Little Horse Creek, upstream of Source No. 2 (CWF-009-SD): Sample CWF-009-SD was collected in 2016 (Ref. 9, pp. 21, 157). The sample contained chromium (0.86 mg/kg), copper (1.1 mg/kg), and zinc (2.1 mg/kg) (Ref. 9, pp. 20, 21). Arsenic, cadmium, mercury, hexavalent chromium, and PCB-1254 were not detected at concentrations exceeding their respective minimum reporting limit (Ref. 9, pp. 157, 212).
- Canal, upstream of Source No. 2 (CWF-008-SD, CWF-SD-07, CWF-SD-08): Samples were collected in 2016 (CWF-008-SD) and 2010 (CWF-SD-07 and CWF-SD-08) (Refs. 9, pp. 21, 61; 67, pp. 48, 565, 566, 581, 582). The samples contained arsenic (at 0.24 mg/kg), chromium (up to 44 mg/kg), copper (up to 14 mg/kg), lead (up to 7.7 mg/kg), and zinc (up to 14 mg/kg). Cadmium, mercury, hexavalent chromium, and PCB-1254 were not detected at concentrations exceeding their respective MRLs (2016 sample) or detection limits (2010 samples) (Refs. 9, pp. 19, 21, 61, 62; 67, pp. 48, 98, 99, 565, 566, 581, 582).

Concentrations of cadmium, chromium, hexavalent chromium, copper, mercury, and PCB-1254 in samples collected at Source No. 2 are significantly higher than the concentrations of those analytes detected in samples collected from Little Horse Creek and the canal upstream from Source No. 2 (Refs. 9, pp. 19, 21, 61, 62, 157; 67, pp. 48, 98, 99, 565, 566, 581, 582) (see Table 4 of this HRS documentation record).

PCB-1254 was detected in Source No. 2 at concentrations up to 610J µg/kg (see Table 4 of this HRS documentation record). PCB-1254 can be traced from the CWF rotary screen print building to Source No. 2 as described below:

- Surface soil sample CWF-014-SF, collected at the discharge point of Pipe 2 (small-diameter pipe) outfall that discharges to the unlined ditch and flows to the abandoned surface impoundment, was found to contain PCB-1254 at 13,000 µg/kg (Ref. 9, p. 7, 9, 232). Pipe 2 originates from the former rotary screen print building (Ref. 44, pp. 7, 22).

- Waste samples collected from the abandoned surface impoundment contained concentrations of PCB-1254 up to 610J µg/kg (Ref. 9, pp. 7, 192, 196).

Additionally, PCB-1254 has been detected in samples collected within other areas of the CWF facility including (1) a sludge sample collected from the force main, which conveyed wastewater from the manufacturing plant to the WWTP (PCB-1254 at 170 µg/kg); (2) the WWTP clarifier (PCB-1254 at 250 μg/kg); (3) the northwestern corner of the CWF facility (PCB-1254 at 100 μg/kg); (4) the tank storage area in the southwestern portion of the CWF facility (PCB-1254 at 100 μg/kg); and (5) the tank storage area in the southeastern portion of the CWF facility (PCB-1254 at 520 μg/kg) (Refs. 47, pp. 53, 74, 99, 147; 68, pp. 25, 30; 69, pp. 4, 5, 7, 23, 24, 25). These results indicate that during operations, PCB-1254 was used at the CWF facility.

Although both sources flow to the same watershed, PCB-1254 detected at Source No. 2 is not the result of overland flow from Source No. 1. Source No. 1 is contaminated soil in a former transformer area. PCBs, specifically PCB-1254, were commonly used in transformers during the operational period of the facility (Refs. 23, p. 3; 33, p. 7). Drainage from Source No. 1 does not flow to Pipe 2 (small-diameter pipe) that leads to the island containing Source No. 2 (Refs. 44, p. 22; 57) (see Figure 3 of this HRS documentation record). Surface water runoff from Source No. 1 flows north-northeast and discharges into the canal at PPE 1 (Ref. 57) (see Figure 3 of this HRS documentation record). Therefore, PCB-1254 detected at Source No. 2 is not the result of overland flow from Source No. 1. No samples were collected from the canal downstream of PPE 1 during the 2016 SCDHEC ESI (Ref. 9, pp. 16, 19, 21) (see Figure 3 of this HRS documentation record).

Direct Observation Samples

Samples listed in Table 7 below were collected during the June 2016 ESI (Refs. 6, pp. 13, 14, 16; 36, pp. 3, 6). The samples were collected from surface impoundment waste within 0 to 6 inches bgs in accordance with the EPA-approved QAPP, dated May 2016, and the EPA Region 4 SESD FBQSTP for Sediment Sampling, SESDPROC-200-R3, dated August 2014 (Refs. 6, pp. 13, 14, 16; 37; 39; 49).

The samples were analyzed for total metals, mercury, and hexavalent chromium by the EPA Region 4 ASB via EPA Methods 6010 and 200.8 (total metals), 7473 (mercury), and 218.6 (hexavalent chromium) (Ref. 9, pp. 36, 49, 50, 52, 53, 55, 56). The data were verified in accordance with the ASB LOQAM (Refs. 9, p. 36; 40; 41). MRLs are listed on the analytical data sheets in Reference 9. Each MRL is sample-specific and corresponds to the lowest quantitative point on the calibration curve; it is adjusted for the amount of sample prepared and any dilutions performed, as well as for percent moisture. MRLs are equivalent to SQLs as defined in Section 1.1, Definitions, of the HRS (Refs. 1, Section 1.1; 9, pp. 39, 176; 42).

The samples were analyzed for PCBs in accordance with the EPA CLP SOW SOM02.3 (Refs. 9, pp. 192, 196; 43). EPA Region 4 SESD reviewed all data according to the contract SOW and EPA guidelines (Ref. 40). The CRQLs are listed on the analytical data sheets in Reference 9. Each CRQL is sample-specific and corresponds to the lowest quantitative point on the calibration curve; it is adjusted for the amount of sample prepared and any dilutions performed, as well as for percent moisture (Ref. 42). The CRQL is equivalent to HRS-defined CRQL (Ref. 1, Section 1.1; 9, p. 176; 42).

Logbook notes are in Reference 6. Locations of the samples listed in Table 7 are conveyed in Reference 9, p. 7 and Reference 55, p. 9. Specific page numbers in the chain-of-custody records and logbook notes are listed in Table 7.

TABLE 7: Direct Observation Source No. 2 Samples

Sample ID	Hazardous Substance	Hazardous Substance Concentration	MRL/CRQL[2]	References[1]
CWF-004-SD	Arsenic	0.88 mg/kg	0.20 mg/kg	6, p. 13; 9, p. 49; 36, p. 6
CWF-004-SD	Cadmium	0.14 mg/kg	0.099 mg/kg	6, p. 13; 9, p. 49; 36, p. 6
CWF-004-SD	Chromium	3100 mg/kg	5.0 mg/kg	6, p. 13; 9, p. 49; 36, p. 6
CWF-004-SD	Hexavalent chromium	320 mg/kg	48 mg/kg	6, p. 13; 9, p. 49; 36, p. 6

TABLE 7: Direct Observation Source No. 2 Samples				
Sample ID	**Hazardous Substance**	**Hazardous Substance Concentration**	**MRL/CRQL[2]**	**References[1]**
CWF-004-SD	Copper	540 mg/kg	9.9 mg/kg	6, p. 13; 9, p. 49; 36, p. 6
CWF-004-SD	Lead	330 mg/kg	5.0 mg/kg	6, p. 13; 9, p. 49; 36, p. 6
CWF-004-SD	Mercury	0.49 mg/kg	0.050 mg/kg	6, p. 13; 9, p. 49; 36, p. 6
CWF-004-SD	Zinc	33 mg/kg	9.9 mg/kg	6, p. 13; 9, p. 50; 36, p. 6
CWF-004-SD	PCB-1254	480J[a] µg/kg	82 µg/kg	6, p. 13; 9, pp. 176, 192; 36, p. 3
CWF-005-SD	Arsenic	2.0 mg/kg	0.20 mg/kg	6, p. 14; 9, p. 52; 36, p. 6
CWF-005-SD	Cadmium	0.74 mg/kg	0.099 mg/kg	6, p. 14; 9, p. 52; 36, p. 6
CWF-005-SD	Chromium	2500 mg/kg	5.0 mg/kg	6, p. 14; 9, p. 52; 36, p. 6
CWF-005-SD	Hexavalent chromium	170 mg/kg	13 mg/kg	6, p. 14; 9, p. 52; 36, p. 6
CWF-005-SD	Copper	2700 mg/kg	9.9 mg/kg	6, p. 14; 9, p. 52; 36, p. 6
CWF-005-SD	Lead	340 mg/kg	5.0 mg/kg	6, p. 14; 9, p. 52; 36, p. 6
CWF-005-SD	Mercury	0.89 mg/kg	0.048 mg/kg	6, p. 14; 9, p. 52; 36, p. 6
CWF-005-SD	Zinc	290 mg/kg	9.9 mg/kg	6, p. 14; 9, p. 53; 36, p. 6
CWF-005-SD	PCB-1254	610J[b] µg/kg	130 µg/kg	6, p. 14; 9, p. 196; 36, p. 3
CWF-006-SD	Arsenic	0.62 mg/kg	0.20 mg/kg	6, p. 16; 9, p. 55; 36, p. 6
CWF-006-SD	Lead	7.7 mg/kg	0.20 mg/kg	6, p. 16; 9, p. 55; 36, p. 6
CWF-006-SD	Mercury	0.063 mg/kg	0.049 mg/kg	6, p. 16; 9, p. 55; 36, p. 6

Notes:

1	See Figure 3 of this HRS documentation record
2	MRL associated with EPA Region 4 ASB and CRQL associated with EPA CLP
CRQL	Contract-required quantitation limit
CWF	Clearwater Finishing
J[a]	Surrogate recovery is greater than established control limits (possibly biased high) (Ref. 9, p. 176). Although results are qualified as estimated, the presence of the analyte is not in question.
J[b]	Surrogate recovery is greater than established control limits (possibly biased high); sample results are estimated "J" due to percent moisture content between 70% and 89% (Ref. 9, p. 176). Although results are qualified as estimated, the presence of the analyte is not in question.
ASB	EPA Region 4 Analytical Support Branch
CLP	EPA Contract Laboratory Program
µg/kg	Micrograms per kilogram
mg/kg	Milligrams per kilogram
MRL	Minimum reporting limit
No.	Number
SD	Sediment

<u>Hazardous Substances in the Release</u>

Arsenic	Hexavalent chromium
Cadmium	Zinc
Chromium	PCB-1254
Copper	Lead
Mercury	

Surface Water Observed Release Factor Value: 550
(Ref. 1, Section 4.1.2.1.1)

4.1.2 DRINKING WATER THREAT

The drinking water threat was not scored because it is not expected to contribute significantly to the overall site score.

4.1.3.2 HUMAN FOOD CHAIN THREAT WASTE CHARACTERISTICS

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

Table 8 summarizes toxicity, persistence, and bioaccumulation factor values for the hazardous substances detected in Source Nos. 1 and 2 with a containment factor value exceeding 0 and a bioaccumulation factor value of 500 or greater. The combined toxicity, persistence, and bioaccumulation factor values are assigned in accordance with References 1 and 1a, Section 4.1.3.2.1.

TABLE 8: Toxicity/Persistence/Bioaccumulation

Hazardous Substance	Source No.	Toxicity Factor Value	Persistence Factor Value[1]	Human Food Chain Bioaccumulation Value[2]	Toxicity/ Persistence/ Bioaccumulation Factor Value (Ref. 1, Table 4-16)	Reference
Cadmium	1, 2	10,000	1	50,000	500,000,000	2, pp. 6, 7
Copper	1, 2	100	1	50,000	5,000,000	2, p. 10
Lead	1, 2	10,000	1	5,000	50,000,000	2, p.12
Mercury	1, 2	10,000	1	50,000	500,000,000	2, pp. 12, 13
Zinc	1, 2	10	1	500	5,000	2, p. 15
PCB (PCB-1254)	1, 2	10,000	1	50,000	500,000,000	2, p. 14
Benz(a)anthracene	1	100	1	50,000	5,000,000	2, p. 2
Benzo(a)pyrene	1	10,000	1	50,000	500,000,000	2, p. 3
Benzo(g,h,i)perylene	1	0	1	50,000	0	2, p. 4
Benzo(k)fluoranthene	1	10	1	50,000	500,000	2, p. 6
Fluoranthene	1	100	1	5,000	500,000	2, p. 5
Indeno(1,2,3-cd)pyrene	1	100	1	50,000	5,000,000	2, p. 11
Phenanthrene	1	1	0.4	5,000	2,000	2, pp. 13, 14

Notes:

1 Persistence factor value for rivers
2 Bioaccumulation factor value for fresh water
PCB Polychlorinated biphenyl

For the human food chain threat, cadmium, mercury, PCB, and benzo(a)pyrene have the highest toxicity/persistence/bioaccumulation factor value of 500,000,000 (Ref. 2, pp. 3, 6, 7, 12, 13, 14).

Toxicity/Persistence/Bioaccumulation Factor Value: 500,000,000
(Refs. 1, Section 4.1.3.2.1.4; 1a)

4.1.3.2.2 HAZARDOUS WASTE QUANTITY

TABLE 9: Hazardous Waste Quantity		
Source No.	**Source Type**	**Source Hazardous Waste Quantity**
1	Contaminated soil (Source No. 1)	>0
2	Surface impoundment (Source No. 2)	989.07

See Section 2.4.2.1.5, Source HWQ Value, of this HRS documentation record.

Total Source HWQ: 989.07

The hazardous constituent quantity for Source No. 1 is unknown but greater than zero. Source No. 2 HWQ is 989.07, which equates to a pathway HWQ factor value of 100 (Refs. 1, Tables 2-5 and 2-6; 45, pp. 7, 8, 9). In addition, the HWQ receives a minimum factor value of 100 for the surface water migration pathway because Source No. 2 waste material is in direct contact with wetlands along the entire perimeter of the impoundment, thus targets subject to Level II concentrations have been documented for the surface water migration pathway (Refs. 1, Section 2.4.2.2; 37; 55, pp. 9, 16, 17).

HWQ Factor Value: 100
(Ref. 1, Table 2-6)

4.1.3.2.3 CALCULATION OF HUMAN FOOD CHAIN THREAT WASTE CHARACTERISTICS FACTOR CATEGORY VALUE

For the human food chain threat, cadmium, mercury, PCB, and benzo(a)pyrene are evaluated for waste characteristics. The waste characteristics factor category was obtained by multiplying toxicity, persistence, and HWQ factor values, subject to a maximum product of 1×10^8. Then, this product was multiplied by the human food chain bioaccumulation potential factor value, subject to a maximum product of 1×10^{12}. Based on this product, a value was assigned in accordance with Reference 1, Table 2-7.

Toxicity/Persistence Factor Value: 10,000.00
Hazardous Waste Quantity Factor Value: 100

Toxicity/Persistence Factor Value ×
Hazardous Waste Quantity Factor Value: 1×10^6

Toxicity/Persistence Factor Value ×
Hazardous Waste Quantity Factor Value × Bioaccumulation Factor Value (50,000): 5×10^{10}

Waste Characteristics Factor Category Value: 320
(Ref. 1, Table 2-7)

4.1.3.3 HUMAN FOOD CHAIN THREAT TARGETS

4.1.3.3.1 Food Chain Individual

As noted in Section 4.1.2.1.1, an observed release of hazardous substances having a bioaccumulation factor value of 500 or greater is documented in Source No. 2 waste samples, where palustrine forested wetlands surround the entire perimeter of the impoundment, with a fishery downstream—specifically, an observed release in palustrine forested wetlands with Little Horse Creek as a downstream fishery (Refs. 9, pp. 7, 49, 50, 52, 53, 55, 56, 192, 196; 10; 37; 55, pp. 4, 5, 9, 13, 16, 17) (see Table 7 and Figures 2 and 3 of this HRS documentation record).

According to South Carolina Department of Natural Resources personnel, Little Horse Creek and Horse Creek (downstream of Clearwater Lake) are fished for human consumption (Refs. 10; 37). These water bodies are mostly fished in the spring, and the predominant fish species is yellow perch. Fish caught in Little Horse Creek and Horse Creek are consumed (Refs. 10; 37).

Food Chain Individual Factor Value: 20
(Ref. 1, Section 4.1.3.3.1)

4.1.3.3.2 Population

4.1.3.3.2.1 Level I Concentrations

No Level I samples were collected.

4.1.3.3.2.2 Level II Concentrations

No Level II samples were collected.

4.1.3.3.2.3 Potential Human Food Chain Contamination

Little Horse Creek, downstream from CWF, and the entire portion of Horse Creek within the 15-mile surface water migration pathway TDL are fished (Refs. 3; 10). Information is not available on annual production of fish caught in Little Horse Creek or Horse Creek; therefore, annual production is assigned greater than 0 pounds per year.

TABLE 10: Potential Population Targets

Identity of Fishery	Annual Production (pounds)	Type of Surface Water Body	Average Annual Flow (cfs)	Population Value (P_i) (Ref. 1, Table 4-18)	Dilution Weight (D_i) (Ref. 1, Table 4-13)	$P_i \times D_i$	References
Little Horse Creek	>0	Small to moderate stream	33.81	0.03	0.1	0.003	1, Table 4-13, Table 4-18; 52
Horse Creek	>0	Moderate to large stream	171	0.03	0.01	0.0003	1, Table 4-13, Table 4-18; 53
					Total	**0.0033**	

Notes:

cfs Cubic feet per second

For the potential human food chain contamination factor value, the product of $P_i \times D_i$ is divided by 10.

Potential Human Food Chain Factor Value: 0.00033
(Ref. 1, Section 4.1.3.3.2.3)

4.1.4.2 ENVIRONMENTAL THREAT WASTE CHARACTERISTICS

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

Table 11 summarizes ecosystem toxicity, persistence, and bioaccumulation factor values for the hazardous substances detected in Source Nos. 1 and 2, with a containment factor value exceeding 0. Combined ecosystem toxicity, persistence, and bioaccumulation factor values are assigned in accordance with Reference 1, Section 4.1.4.2.1.

TABLE 11: Ecosystem Toxicity/Persistence/Bioaccumulation

Hazardous Substances	Source No.	Ecosystem Toxicity Factor Value[1]	Persistence Factor Value[2]	Environmental Bioaccumulation Value[3]	Ecosystem Toxicity/ Bioaccumulation Factor Value (Ref. 1, Table 4-21)	Reference
Arsenic	1, 2	10	1	50,000	500,000	2, pp. 1, 2
Cadmium	1, 2	10,000	1	50,000	500,000,000	2, pp. 6, 7
Chromium	1, 2	10,000	1	500	5,000,000	2, pp. 7, 8
Hexavalent chromium	1, 2	100	1	5	500	2, pp. 8, 9
Copper	1, 2	1,000	1	50,000	50,000,000	2, p. 10
Lead	1, 2	1,000	1	50,000	50,000,000	2, p. 12
Mercury	1, 2	10,000	1	50,000	500,000,000	2, pp. 12, 13
Zinc	1, 2	10	1	50,000	500,000	2, pp. 15, 16
PCB (PCB-1254)	1, 2	10,000	1	50,000	500,000,000	2, pp. 14, 15
Benz(a)anthracene	1	10,000	1	50,000	500,000,000	2, pp. 2, 3
Benzo(a)pyrene	1	10,000	1	50,000	500,000,000	2, pp. 3, 4
Benzo(g,h,i)perylene	1	0	1	50,000	0	2, p. 4
Benzo(k)fluoranthene	1	0	1	50,000	0	2, p. 6
Chrysene	1	1,000	1	5,000	5,000,000	2, pp. 9, 10
Fluoranthene	1	10,000	1	5,000	50,000,000	2, p. 5
Indeno(1,2,3-cd)pyrene	1	0	1	50,000	0	2, p. 11
Phenanthrene	1	10,000	0.4	50,000	200,000,000	2, pp. 13, 14

Notes:

1 Ecotoxicity for fresh water
2 Persistence value for rivers
3 Bioaccumulation factor value for fresh water, environmental threat

Regarding the environmental threat, cadmium, mercury, PCB, benz(a)anthracene, and benzo(a)pyrene have the highest toxicity/persistence/ecosystem bioaccumulation factor value of 500,000,000 (Ref. 2, pp. 2, 3, 4, 6, 7, 12, 13).

Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value: 500,000,000
Reference 1, Section 4.1.4.2.1.4)

4.1.4.2.2 HAZARDOUS WASTE QUANTITY

TABLE 12: Hazardous Waste Quantity		
Source No.	**Source Type**	**Source Hazardous Waste Quantity**
1	Contaminated soil (Source No. 1)	>0
2	Abandoned surface impoundment (Source No. 2)	989.07

See Section 2.4.2.1.5, Source Hazardous Waste Quantity Value, of this HRS documentation record.

Total Source Hazardous Waste Quantity: 989.07

The hazardous constituent quantity for Source No. 1 is unknown but greater than zero. Source No. 2 HWQ is 989.07, which equates to a pathway HWQ factor value of 100 (Refs. 1, Tables 2-5 and 2-6; 45, pp. 7, 8, 9). In addition, the HWQ receives a minimum factor value of 100 for the surface water migration pathway because Source No. 2 waste material is in direct contact with wetlands along the entire perimeter of the impoundment, thus targets subject to Level II concentrations have been documented for the surface water migration pathway (Refs. 1, Section 2.4.2.2; 37; 55, pp. 9, 16, 17).

Hazardous Waste Quantity Factor Value: 100
(Ref. 1, Table 2-6)

4.1.4.2.3 CALCULATION OF ENVIRONMENTAL THREAT WASTE CHARACTERISTICS FACTOR CATEGORY VALUE

For the environmental threat, cadmium, mercury, PCB, benz(a)anthracene, and benzo(a)pyrene are evaluated for waste characteristics. The waste characteristics factor category was obtained by multiplying the ecosystem toxicity, persistence, and HWQ factor values, subject to a maximum product of 1×10^8. Then, this product was multiplied by the environmental bioaccumulation potential factor value, subject to a maximum product of 1×10^{12}. Based on this product, a value was assigned in accordance with Reference 1, Table 2-7.

Ecosystem Toxicity/Persistence Factor Value: 10,000.00
Hazardous Waste Quantity Factor Value: 100

Ecosystem Toxicity/Persistence Factor Value ×
Hazardous Waste Quantity Factor Value: 1×10^6

Ecosystem Toxicity/Persistence Factor Value ×
Hazardous Waste Quantity Factor Value × Bioaccumulation Factor Value (50,000): 5×10^{10}

Waste Characteristics Factor Category Value: 320
(Ref. 1, Table 2-7)

4.1.4.3 Environmental Threat Targets

Level I Concentrations

No Level I concentrations have been documented.

Level II Concentrations

Actual contamination by direct observation has been documented in Section 4.1.2.1.1 of this HRS documentation record. The sampling locations are depicted on Figure 3 of this HRS documentation record.

During the October 2017 wetland field verification event, Oneida Total Integrated Enterprises (OTIE) evaluated sample locations from the SCDHEC 2016 ESI to assess presence or absence of wetlands. Wetland boundaries were determined by applying the following criteria: (1) a prevalence of hydrophytic vegetation, (2) presence of hydric soils, and (3) wetland hydrology (Ref. 55, p. 2). The wetland field verification event confirmed the presence of palustrine forested wetlands surrounding the entire perimeter of Source No. 2 (Ref. 55, pp. 9, 13) (see Figure 3 of this HRS documentation record).

The zone of actual contamination is the perimeter of Source No. 2. The wetland frontage along the perimeter of Source No. 2 is approximately 640 feet as calculated using Geographic Information System (GIS) software. A detailed description of the calculation is provided in Reference 64 (see Figure 3 of this HRS documentation record).

4.1.4.3.1 Sensitive Environments

4.1.4.3.1.1 Level I Concentrations

Sensitive Environments

Sensitive environments other than wetlands have not been identified within the 15-mile TDL.

Wetlands

Level I wetlands were not scored in this HRS documentation record.

4.1.4.3.1.2 Level II Concentrations

Sensitive Environments

Sensitive environments other than wetlands have not been identified within the 15-mile TDL.

Wetlands

The wetlands were identified from Reference 55, Clearwater Wetland Investigation, Revision 2. Reference 55 presents the NWI mapped wetlands, as well as field-verified wetlands. The wetlands evaluated are palustrine forested. Source No. 2 contains wastes resulting from facility operations as documented by hazardous substances contained in samples CWF-004-SD, CWF-005-SD, and CWF-006-SD (Refs. 9, p. 7; 37) (see Sections 2.2.1 and 2.2.2, Source No. 2, and Figure 3 of this HRS documentation record). The waste material is in direct contact with palustrine forested wetlands that surround the entire perimeter of the surface impoundment (Refs. 37; 55, pp. 9, 16, 17) (see Figure 3 of this HRS documentation record). Therefore, an observed release by direct observation has been documented. The wetland frontage along the perimeter of the surface impoundment is approximately 640 feet as calculated using GIS software. A detailed description of the calculation is provided in Reference 64 (see Figure 3 of this HRS documentation record).

TABLE 13: Level II Wetland Frontage

Wetland	Water Body	Wetland Frontage	References
Palustrine forested	Little Horse Creek	640 feet	55, pp. 9, 10, 11, 13; 64
Total Wetland Frontage		640 feet or 0.121 mile	

Total Wetland Frontage: 640 feet (0.121 mile)

The wetland ratings value for 0.121 mile is obtained from Reference 1, Table 4-24 and is 25.

Wetland Value: 25
(Ref. 1, Table 4-24)

For wetlands subject to Level II concentrations, the wetland value (25) is multiplied by 1 (Ref. 1, Section 4.1.4.3.1.2).

Wetland Value: 25 × 1
Level II Concentrations Factor Value: 25
(Ref. 1, Section 4.1.4.3.1.2)

4.1.4.3.1.3 Potential Contamination

Sensitive Environments

Potential sensitive environments were not scored because presence of sensitive environments other than wetlands has not been confirmed.

Wetlands

Potential contamination of wetlands was not scored because potential contamination does not contribute significantly to the site score.