Table 2: Proposed Site Characterization/HHRA Data Collection Activities

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Problem Definition/Objective	SRI Findings (as interpreted by EarthCon)	Proposed Data Collection Activities	
		4th Quarter 2016	1st Quarter 2017
Data Gap #1: Source material has not been fully characterized			
Problem Definition: Previous soil and CPT/ROST investigations identified NAPL in the former Process Area, Wastewater Ponds, and Evaporation Pond. Tidal marsh sediments exhibit elevated total PAH concentrations with limited upgradient/terrestrial data. Objective: Assess the vertical and horizontal extent of NAPL to the extent practicable within and downgradient from potential source areas.	● 28 sonic borings completed to depths of 70 to 100 ft. bgs. ● 83 borings were advanced for the TarGOST investigation. Dense sandstone beds prevented advancement of the TarGOST probe, and required auger drilling to penetrate to deeper zones. One boring reached 100.5 ft. bgs. but majority of borings encountered refusal between 45 and 78 ft. bgs, prior to complete vertical characterization. ● Visible DNAPL observed in soil borings from ground surface to 30 feet below ground surface (bgs) in areas north of the fire pond, surrounding the evaporation pond and west of the wastewater pond. ● South of the process area, DNAPL was observed in borings greater than 20 ft. bgs to approximate depths of 80 ft. bgs downgradient of the wastewater pond and in the marsh near the bank. ● DNAPL not detected in deep soil borings installed south and east of the process area and along the marsh bank. ● TarGOST profiles completed in marsh indicate presence of NAPL only in marsh sediments (~0 to 15 ft. bgs) but not the underlying native sandy soils. ● With the exception of few selected areas, the lateral and vertical extent of DNAPL is defined.	● Obtain TarGOST evaluation report from Dakota Technologies. ● Obtain information and clearance on utility locations in the vicinity of Navassa Road. ● Prior to groundwater sampling, gauge all potential source-area monitoring wells using conductive probe to assess potential presence of DNAPL in bottom of well screen. ● Further identify areas with DNAPL for use in feasibility study and possible removal actions. ● Prior to finalizing SOW, compare CPT/ROST and TarGOST screening data and dissolved phase GW data with DNAPL map to confirm data gaps.	● Continue DNAPL assessment with the installation 10 deep (100 ft.) soil borings. - 5 borings west and southwest of Process Area along Navassa Road to assess the area where DNAPL was previously identified by NCDOT. - 2 borings in the wastewater pond to assess the depth of DNAPL at the source. - 2 borings downgradient of the evaporation pond and at the edge of the marsh to delineate the extent of DNAPL. -1 soil boring north of the Process Area in an area of the former product storage and positive CPT/ROST screening detection to confirm presence/depth of DNAPL. ● Install 3 shallow (20 ft.) soil borings in the fire pond and boiler ponds to assess the presence of DNAPL.
Data Gap #2: Additional soil data is necessary for the Northeastern Area to provide information sufficient to support risk assessments and future land use decisions			
Problem Definition: Contaminants released in the former wood treating areas may have been transported by storm water to drainage pathways that flow through the Northeastern area eastward to the Brunswick River. A disturbed area was identified west of the private residential property and east of the wood storage areas. Impacts from the adjacent former fertilizer manufacturer have not been assessed. Objective Assess the nature, extent, and potential risks to human health and the environment from contaminants in current and former drainage pathways and disturbed areas within the Northeastern Area. Assess the potential impacts from the adjacent former fertilizer plant.	● Results of 26 soil/sediment samples collected from drainage pathways indicate the presence of PAHs, arsenic aluminum, cobalt iron, manganese, thallium, and vanadium above residential RSLs. ● Results of 16 soil samples collected in the disturbed area indicate the presence of PAHs, arsenic, and hexavalent chromium (1 location only) in surface soil at concentrations above residential RSLs. ● Results of the 11 soil samples collected adjacent to the former fertilizer area indicate the presence of arsenic, hexavalent chromium and vanadium above residential RSLs. PAH concentrations in one sample, located nearest the road, near the former post office location were above the RSL, which may indicate fill. VOCs and pesticides are below RSLs. ● Concentrations of metals and PAHs appear to be indicative of general use rather than source material. ● The objective of assessing current and former drainage pathways, the disturbed area and the adjacent former fertilizer plant was achieved.	● Collect additional background samples for PAHs and metals to assess whether the detected concentrations are site related (see Data Gap #6). ● The results will be compared to background and included in the human health risk assessment.	

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Data Gap #3: Vertical and lateral extent of groundwater contamination is not defined			
Problem Definition: Assessment of the vertical and lateral extent of contamination in Surficial and Peedee aquifer groundwater in offsite areas to the southwest of the former Process Area is incomplete. The permanent monitoring well network does not reflect surficial contamination identified in shallow groundwater from temporary monitoring wells. Assessment of vertical and horizontal extent of naphthalene in the Peedee aquifer in the southern area of the Site is incomplete. Objective: Define the horizontal extent of contamination concentrations exceeding screening levels in Surficial aquifer groundwater within the former Process Area and in offsite areas to the southwest of the former Process Area. Define the vertical and horizontal extent of contamination concentrations exceeding screening levels within the Peedee Aquifer in the southern portion of the Site.	● The offsite monitoring wells were not installed due to access issues. ● 10 shallow monitoring wells were installed to screen across the water table and 11 monitoring wells were installed within the upper portion of the Peedee aquifer. ● The planned 150 ft. deep monitoring well was not installed due to the presence of a low permeability (10^{-6} to 10^{-7}) zone beginning at a depth of ~100 ft. bgs. This layer is anticipated to retard downward migration of contaminants. ● Lateral delineation to the north and northeast of the process area is complete. ● Delineation to the south is complete using the EPA residential sampling data.	● Obtain access to sample off-site wells RIMW-18 and RIMW-19 and evaluate access to potential additional offsite-downgradient locations. ● Conduct a full round of water level measurements and DNAPL measurements. ● Collect groundwater samples from each of the monitoring wells and analyze for VOCs, SVOCs, total and dissolved arsenic, TDS, and chloride. Analyze samples from background wells for total and dissolved cobalt and from well MW-25S for total and dissolved selenium. ● Evaluate the need for additional monitoring wells in areas off-site to the west/southwest. ● Evaluate the need for additional monitoring wells north and east of the dissolved phase plume to refine the plume boundaries.	● Install up to 10 additional groundwater monitoring wells at select locations ● Collect groundwater samples for chemical analysis and DNAPL measurements quarterly for use in a plume stability analysis.
Data Gap #4: Pentachlorophenol was reported in incremental soil samples and one groundwater sample; site historical operations do not indicate the use of pentachlorophenol and the presence/absence should be confirmed			
Problem Definition: Pentachlorophenol (PCP) was detected in groundwater from MW06 exceeding the tap water RSL and maximum contaminant level (MCL). Objective: Confirm the presence of PCP in site media.	● PCP was detected in groundwater samples collected from MW-06 and MW-25S at concentrations below the PQL but above the RSL. The detections correspond with high PAH detections. ● PCP was analyzed by EPA Method 8151A. Sample results for this method can be impacted by matrix interferences from contaminants co-extracted from sample including organic acids and phenols. ● Based on the low frequency of detections and coincidence of PCP detections with high PAH levels, pentachlorophenol is not expected to significantly impact the site.	● Collect groundwater samples from wells MW-06 and MW-25 and confirm the presence of PCP by 8270C SIM analysis. ● Incorporate results in the human health risk assessment, if presence is confirmed.	
Data Gap #5: Location of background groundwater monitoring wells may not be representative of background conditions			
Problem Definition: The existing background monitoring well is located in proximity to a former boat manufacturing operation and may not be representative of background conditions. Objective: Assess conditions in the surficial and Peedee aquifers from locations that are more likely to represent background concentrations.	Four monitoring wells were installed as background wells (MW-22, MW-22D, MW-23, and MW-23D). Installation of background monitoring wells is complete.	No further work is required.	

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Data Gap #6: Background and onsite metals concentrations are not adequately characterized for risk assessment purposes			
Problem Definition: Background soil, groundwater, surface water, and sediment data is limited for metals that were identified as COCs in the HHRA (arsenic, thallium, and chromium). Objective: Assess background concentrations of metals identified as COCs in site media.	● The background soil samples were not collected due to access issues. ● Background groundwater samples were collected from 6 monitoring wells. ● 5 collocated surface water/sediment samples were collected within the tidal marsh area – 2 in Sturgeon Creek and 3 east of the Site. Surface water background sample collection is complete.	Select additional background soil sample locations and obtain access. ● Up to 10 background soil samples will be collected and analyzed for TAL metals and PAHs. ● Collect 3 additional sediment samples from background marsh locations and analyze for PAHs.	
Problem Definition: Speciated chromium data has not been collected for any site media so all detections of chromium were conservatively treated as the more toxic hexavalent form in risk assessment. Objective: Assess speciated chromium concentrations in site media to support more accurate assessment of risks.	● Only one of the ten soil samples collected from the process area was analyzed for hexavalent chromium. Hexavalent chromium was detected at an estimated concentration below the reporting limit. ● Hexavalent chromium was analyzed in nine sediment samples in the tidal marsh and five sediment samples in the process area. Hexavalent chromium was detected in three samples in the tidal marsh and 1 sample in the Process area at concentrations below the reporting limit. ● Hexavalent chromium was analyzed in 13 groundwater samples. The only detection was in the groundwater sample from upgradient monitoring well MW-01; therefore, hexavalent chromium in groundwater will not be assessed in the future. ● Hexavalent chromium was not detected in the surface water samples; therefore, hexavalent chromium in surface water will not be assessed in the future.	● Analyze the background soil and sediment samples described above for hexavalent chromium to assess whether the detected concentrations are site related. ● Results of the hexavalent chromium analysis in soil and sediment will be compared to background concentrations and included in the risk assessment.	
Problem Definition: Groundwater data for metals is limited to only two onsite samples Objective: Assess metals concentrations in groundwater.	5 samples were analyzed for TAL metals and 13 samples were analyzed for arsenic, chromium, and thallium, only. ● Concentrations of arsenic, aluminum, cobalt, hexavalent chromium, iron, manganese, and selenium exceed residential RSL values. ● Background samples were not collected for cobalt, iron, manganese or selenium. ● Thallium was not detected in the groundwater samples. ● Aluminum, iron, and manganese will not be carried forward as they are essential nutrients. Thallium will not be carried forward as it was not detected.	● Analyze cobalt in the samples to be collected from the background wells (see Data Gap #3). ● The dissolved selenium result in monitoring well MW-25S will be confirmed during the groundwater sampling event (see Data Gap #3). ● Arsenic concentrations will be confirmed during the groundwater sampling event (see Data Gap # 3) and addressed through the human health risk assessment.	
Data Gap #7: Additional study is required to refine characterization of site hydrogeology			
Problem Definition: Site hydrogeologic data is limited, additional study is necessary. Objective: Complete characterization the site geology and hydrogeology to allow refinement of the CSM	● Soil borings completed to 100 ft. bgs along marsh shoreline, and one boring advanced to 150 ft. bgs. Silty sands and clay are encountered in soil borings to approximate depths of 10 ft. bgs. These soils transition to a poorly graded sand to approximate depths of 40 ft. bgs that transition to silty sands with some to trace clay to depths greater than 100 ft. bgs. Thin beds of sandy limestone encountered between 40 and 120 ft. bgs. ● Results of geotechnical laboratory tests on soils collected from 80 to 130 ft. bgs range from 1.1×10^{-6} to 6.5×10^{-7} cm/sec defining a low permeability soil zone at depth.	● Conduct up to 10 additional slug tests in selected monitoring wells to confirm historical data. ● Calculate groundwater flow rates in the Surficial and Peedee aquifers using slug test results.	● Collect depth to GW measurements in MWs on a quarterly basis to evaluate seasonal fluctuations and variations, if any, in vertical gradients.

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	● Peedee aquifer confining unit was not encountered, and therefore the Surficial and Peedee aquifers are in direct hydraulic communication. ● Preliminary evaluations of vertical gradients suggest a slight upward gradient from the Peedee to the Surficial aquifer. ● Potentiometric surface maps developed from GW elevations measured in MWs installed in these aquifers show groundwater flow towards Sturgeon Creek. ● In-situ hydraulic conductivity tests (i.e. slug tests) were performed on 25 MWs screened in the Surficial and Peedee Aquifers. ● The site hydrogeologic data collection activities are generally complete.		
Data Gap #8: The groundwater/surface water interaction in the tidal marsh is not well understood			
Problem Definition: Assessment of the groundwater discharge to surface water pathway is incomplete. Objective: Identify potential groundwater to surface water discharge zones, and quantify	Paired piezometers were installed and data collected in March 2016. Data collected from the paired piezometers study will be used in conjunction with the assessment performed by ENSR to further evaluate the interaction in the tidal marsh between the groundwater and surface water.	● Collect up to 3 surface water samples from the marsh and analyze for TDS and chloride. Analytical results will be compared to results from groundwater samples collected from site-wide Surficial Aquifer wells to further define the salt water/fresh water interface.	
Data Gap #9: The onsite and offsite vapor intrusion potential has not been evaluated			
Problem Definition: An offsite building is located within 100 feet of the estimated extent of the naphthalene plume in the Surficial aquifer. However, the vapor intrusion (VI) pathway has not been evaluated. Assessment of the onsite VI pathway is incomplete because it was solely based on groundwater concentrations whereas vadose zone sources are also present on and possibly offsite. The future planned use of the former operations area and treated and untreated wood storage area is commercial. Objective: Conduct a VI investigation at the Cumulus Broadcasting, LLC property located on Highway 1435 (Navassa Road) immediately adjacent to surficial aquifer monitoring well RIMW-18 and for the on-site area planned for commercial use to assess if/where potential risks are present requiring mitigation or land use restrictions. .	The VI investigation at the Cumulus Broadcasting building was not performed due to access issues. Shallow groundwater was encountered which prevented soil gas sampling on-site.	● Model the vapor intrusion pathway using site-specific geotechnical data. ● Collect 4 shallow soil samples from 2 off-site locations and analyze for porosity, permeability, moisture content, total organic carbon and grain size. ● Collect 6 shallow soil samples from 3 on-site locations and analyze for porosity, permeability, moisture content, total organic carbon and grain size.	