COMMENTS TO APPENDIX I – LONGTERM MONITORING PLAN PRE-FINAL (95%) RD FOR OU1 LCP CHEMICALS GEORGIA SUPERFUND SITE BRUNSWICK, GEORGIA

GENERAL COMMENTS

1. USEPA's Guidance for Data Quality Objectives (DQOs) Process (USEPA 2006) should be used when designing the LTMP. The purpose of the DQO process is to develop "a plan for collecting data of sufficient quality and quantity to support the goals of the study" with an "efficient and effective expenditure of resources." Additionally, USEPA's Guidance for Monitoring at Hazardous Waste Sites is guidance for developing robust monitoring plans "that will support management decisions" (USEPA 2004). Use these two documents to ensure that data collected at the site during long-term monitoring will meet the needs of the monitoring plan in the most efficient and effective manner. For all sampling efforts, use appropriate statistical methods to determine sufficient sample size to detect changes. Note that USEPA's DQO Guidance is included as an applicable guidance document in Appendix B of the Consent Decree for OU1 (DOJ 2016b). Additionally, Appendix B of the Consent Decree outlines minimum requirements for the LTMP (Section 6.7e, Supporting Deliverables for the Remedial Design/Remedial Action).

2. Appendix A, Long-term Monitoring Framework, of the ROD indicated that, "Based upon the ROD RAOs, the LTMP will develop specific goals and data quality objectives (DQOs) which will define the data needed and upon which the plan for collection of data (e.g., the sampling design) will be based. However, DQOs were not presented in the RD to inform the design of the sampling plan. The number of fish tissue samples did not consider variability to achieve statistical power to verify that a result was less than a performance goal. In addition, the LTMP did not develop performance measures or triggers related to each RAO as EPA directed in the ROD Appendix A. Step 6 to identify performance measures and triggers is part of the DQO process that was not followed as conveyed in the ROD. Please see Figure 2 in USEPA (2006) for the steps in the DQO process. Develop DQOs for every RAO and data collection effort.

3. The LTMP quotes EPA as stating that it may take decades to achieve RAOs, but the plan only covers a 5-year period after the Remedial Action is completed. The proposed monitoring plan will document whether RAOs have been met within 5 years, and failing that, the plan will document whether performance metrics attached to the RAOs are trending toward meeting the RAOs. What will happen if RAOs are not met at 5 years? Will monitoring continue until RAOs are met? Later in the plan, there is a section on adaptive management that partially answers this question. However, the contingency/corrective actions included in the plan only include (1) assess the monitoring data and consider revisions to the monitoring approach at year 5, (2) EPA will consider the monitoring results after 5 years and weigh whether a technically infeasible waiver is warranted for surface water. Typically, an adaptive management plan identifies more possible corrective measures and possible adjustments including tweaks to the active remedy. Section 5 (RAO Attainment and Adaptive Management) should be expanded to include more potential contingency/corrective measures such as those specified in this comment and the specific monitoring results that would trigger them.

4. Since a large collection of site-specific data is available for this site, a power analyses could be conducted using variability reported from previous investigations for some of the

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monitoring categories like sediments and tissues to ensure adequate sample sizes are employed based on desired statistical power and effect sizes.

5. Spatial and temporal expansion of the proposed sediment monitoring plan could improve the evaluation of certain RAOs. For instance, the addition of sediment sampling locations conducted on an annual basis within Eastern Creek, LCP Ditch, and Purvis Creek above and below LCP Ditch could improve the evaluation of remediation's effectiveness of achieving RAO 1 and provide additional lines of evidence supporting RAOs 2-5.

6. Recommend including sediment samples at the same sites that tissue samples are also being collected from. It may be determined at a later date to evaluate how risk has changed for certain ecological receptors like piscivorous birds. Incidental ingestion of sediment is an additional exposure pathway for those receptors and having paired data, or samples collected within the same sampling unit, may improve that assessment.

7. Monitoring contaminant concentration trends can serve as a critical measure to evaluate remedial performance, but it is unclear how this performance measure will confirm achievement of RAO 2. For instance, a declining contaminant concentration trend may indicate effective remediation but does not necessarily indicate that concentrations have declined to acceptable levels. Could clarification be provided describing how it will be decided that RAO 2 has been met?

8. Clarify and clearly state exactly which data will be used for baseline for all of the monitoring activities. Since monitoring data will be compared to baseline data to assess progress towards meeting the RAOs, it must be clear what the new data will be compared to. Will new baseline data be collected prior to implementing the remedy? Collecting pre-construction data would be the best approach for establishing the current baseline and evaluating progress. If that's not going to occur, what data will be used? If existing data will be used as a baseline, ensure that any difference in sampling protocols and procedures won't prevent their use.

9. The performance standards should be more definitive and linked to the numerical goals. The LTMP states for several objectives that the performance standards are concentrations meeting or "trending toward" a goal (for example, see pages 9 and 12 of the LTMP). Progress towards a goal, although good, isn't an appropriate performance standard in and of itself. The monitoring is designed to determine if progress is being made toward an RAO. But the performance standard should be meeting the individual RAOs.

SPECIFIC COMMENTS

10. **Section 1.5.1 Sediment** – No monitoring or performance measures specific to RAO 1 were included in the LTMP. Appendix A, Long-term Monitoring Framework, of the ROD indicated that sediment monitoring was anticipated to be used in assessing attainment of cleanup levels, contaminant redistribution in the marsh, contaminant flux, incorporation of thin-layer cover (TLC) material into the marsh surface, as well as other data needs for RAO #1 in the ROD which is to "Prevent or minimize chemicals of concern (COCs) in contaminated in-stream sediment from entering Purvis Creek." Suspended sediments entering Purvis Creek from the site during the portion of the tidal cycle where water flows into Purvis Creek can be sampled for the concentrations of COCs in the suspended sediments compared to the CULs. The information can be used to assess whether the site is a continuing source of contamination to

Purvis Creek and whether dredged areas of Purvis Creek might become re-contaminated. No post-remedy monitoring of suspended sediments was planned for Purvis Creek to assess the potential for COCs to enter Purvis Creek on suspended sediments. The table in Section 2.2 on Page 9 of Appendix I referred to RAO 1 but did not pertain to minimizing contaminated sediment entering Purvis Creek. Please update the monitoring plan to include DQOs for RAO 1. Sediment traps are recommended.

11. **Section 1.5.1 Sediment** – The measure for achieving RAOs 2, 3, and 5 was reduction of the surface-area weighted average concentration (SWAC) to meet the SWAC cleanup levels (CULs) for mercury and Aroclor-1268. Section 8.1.1 of the ROD (Page 52) indicated that the SWAC CULs apply to the total creeks and the entire domain. Moreover, Page 54 stated that the following SWAC CULs will be applied to each exposure domain and the total creeks area to achieve the predicted post-remediation SWACs for the Selected Remedy:

    Mercury – 2 mg/kg
    Aroclor 1268 – 3 mg/kg.

    Table 4-7 in Appendix C of the RD provided predicted post-remedy SWACs for Domains and creeks. The pre-remedy SWACs from the ROD and the post remedy SWACs are estimated by calculations. They are presented without an expression of the error in the estimate or the uncertainty about the value. The changes to the SWACs in the 50% RD in response to redefinition of the creek boundaries highlight the uncertainty in the SWAC estimates, some of which are projected to be only slightly below the SWAC CULs post remedy. The SWAC estimates in Table 4-7 are averages and are not the 95% UCLs used for comparison to the SWAC CULs. A 95% UCL can be developed from Thiessen polygons, but this is not a straightforward task and requires bootstrap methods. This comment is recommending ISM approach to sample for conservative estimates of the average concentrations of the COCs to compare with SWAC CULs in the decision units in Table 4-7 post-remedy (ITRC 2020).

    The LTMP lacks post-remedy unbiased sampling of creek sediments to measure the average concentrations of mercury and Aroclor-1268 in the exposure domains and the total creek area to compare with the SWAC CULs. The thin-layer cover was intended to accelerate natural recovery processes that gradually reduce the SWAC in Domains 1 & 2. This comment recommends incremental sediment sampling to overcome the variability in the concentrations in the creeks and Domains 1 & 2 of the marsh. Incremental sampling can measure the average concentrations systematically to address whether the RAOs have been met. Since fish tissues and surface water are indirectly affected by the sediment remediation, the primary measure of remedy success is reduction in the SWACs to meet CULs. The purpose of the LTMP was to verify that the site met CULs. The fish tissue concentrations were not CULs but performance goals. The SWACs should be empirically measured instead of estimated or predicted from Thiessen polygons and interpolations. Note that the LCP Ditch and positions of the Eastern Creek were previously dredged and somehow became re-contaminated, that is, the concentrations in the previously dredged sediment were not equal to the detection limit, as is assumed in the model predicting SWAC reductions.

12. **Section 1.5.1 Sediment** – The LTMP currently lacks sediment sampling of the areas of Purvis Creek, LCP Ditch, Eastern Creek, and Domain 3 Creek that are planned for excavation and placement of backfill. The SWAC reductions assumed the backfilled areas would have negligible contamination. These comments recommend sampling of the biologically active

depth of the backfill to estimate a 95% UCL of the average concentration of mercury and Aroclor-1268 for the excavated areas. The creek areas that were not excavated can be sampled for mercury and Aroclor-1268 to provide a 95% UCL on the average concentrations for input to a new calculation of the SWACs post -remedy for comparison to the SWAC CULs. The ISM can sample the creeks over a grid to capture the banks as well as the centerline to provide a robust characterization of the conservative estimates of the average concentrations. None of the SWAC estimates in Table 4-7 of Appendix C are conservative estimates of the mean (i.e., 95% UCLs) for comparison to SWAC CULs.

13. **Section 1.5.3 Tissue, page 6** – Regarding target tissue concentrations, please state the metric that will be used to determine if/when progress toward meeting RAO 2 is achieved. Should tissue concentrations be declining each time they are measured, or by a certain total amount, or be compared to a particular benchmark?

14. **Section 1.5.3 Tissue, page 6** – "…target tissue concentrations were calculated from protective tissue concentrations using site-specific sediment to biota bioaccumulation factors." This statement appears to be incorrect. Protective tissue concentrations would be used with site-specific sediment to biota bioaccumulation factors to calculate sediment concentrations.

15. **Table 3 Summary of Long-Term Monitoring Program, Benthos, page 7** – For benthos, please provide additional detail in the text or table. Samples will be collected at 5 locations in the thin layer cover area. Will these be sediment cores to evaluate benthic infauna? Fiddler crab number and number of burrow surveys (described in Appendix F, Pilot Study Monitoring Report) were conducted to evaluate the macroinvertebrate community during the Thin Layer Cover (TLC) Pilot Study. Will any evaluation of fiddler crabs be included in the monitoring? Will reference area or pre-remedial samples be collected for comparison? Will this be 5 sample locations for all of the area in yellow on Figure 7-1 of the Remedial Design Plan? How will sample locations be selected? Sample locations should be as similar as possible in terms of particle size, detrital and organic carbon content, habitat, elevation, and tidal position within the system. Co-located samples should be collected for chemistry at the benthic sampling locations.

16. **Table 3 Summary of Long-Term Monitoring Program, Benthos and Vegetation, page 7** – Due to their sessile nature, plant and benthos samples should be collected at the same location every sampling event. Please state this in the text.

17. **Table 3 Summary of Long-Term Monitoring Program, Surface Water, page 8** – Please state whether a total of 6 samples will be collected, or will 6 samples be collected from each creek/ditch? Samples should also be collected from Domain 3 Creek.

18. **Figure 4 Surface Water Sampling Locations** – Figure 4 indicates a total of 6 surface water samples. A sample should also be collected from Domain 3 Creek. An additional surface water sample in Purvis Creek south of the confluence with the LCP Creek Ditch is also recommended.

19. **Table 3, Summary of Long-Term Monitoring, Page 7** – Table 3 in appendix I indicated that at least two reference locations would be used in the vegetation survey. Section 13, Page 64, however indicated that ten reference locations would be used in the survey. Please revise for consistency. Revise Appendix I to discuss the criteria used to select appropriate reference

locations for the vegetation survey.

20. **Table 3, Summary of Long-Term Monitoring, Page 7** – Table 3 indicated 24 samples of fiddler crabs, while Section 13, Page 65, and Table 5 of Appendix I indicated 21 samples of fiddler crabs. Please revise for consistency. Five fiddler crab composites and five mummichog composites are recommended instead of three to detect a minimum difference of 35 percent at 80% power from the left-most figure of Figure A-1 of USEPA (2008).

21. **Table 3 Summary of Long-Term Monitoring Program, Surface Water, Fish and Shellfish Monitoring, page 8** – Please state that fillets will be analyzed for the human health fish samples, and whole-body fish will be collected for ecological receptor evaluation. Total number of samples for fiddler crab should be 21. Add lipids and percent (%) moisture to the ecological tissue analyte list.

22. **Table 3 Summary of Long-Term Monitoring Program, Biota Monitoring** – The ROD indicated in Section 8.4 (Page 56) that "tissue monitoring for mercury and Aroclor 1268 in common prey (mummichog, fiddler crab and blue crab) will be included in the monitoring program (See Appendix A)." Blue crabs, however, are not included in the LTMP. The ROD further states that "If the resulting calculated hazard quotients for the receptors are less than one, then the goal of reducing exposures to these receptors (i.e., RAOs 2 and 5) would be achieved." Based on the ROD definition of successful achievement of RAOs 2 and 5, tissue concentrations of blue crabs, fiddler crabs, and mummichogs are needed to support food-chain models for piscivorous birds and mammals. No specific performance goals were included in the ROD for prey items. The 95% upper confidence levels on the mean concentrations detected in the prey items were intended to be entered into a food-chain model to estimate a hazard quotient. A hazard quotient less than 1 was the ROD performance goal. LOAEL risks to piscivorous birds and mammals will be reduced to an HI of 1 or less, according to ROD Page 79. The green heron was indicated to be the most sensitive ecological receptor on Page 76 of the ROD. Areas of OU1 with HQs over 1 included Eastern Creek, LCP Ditch, and Domains 1 & 3 (ROD Table 23). The diet of the green heron was assumed to be 90% mummichogs, 5% fiddler crabs, and 5% blue crabs. The diet of the raccoon was 45% blue crabs. Update the RD to include monitoring of mummichogs, fiddler crabs, and blue crabs in Eastern Creek, LCP Ditch, and Purvis Creek. RAO 2 specified that concentrations in prey items of piscivorous bird and mammal populations would be reduced to acceptable levels versus simply being reduced. Please revise text to refine the goal for prey tissue to reduce to acceptable levels as indicated by LOAEL HQs less than 1. A statistical approach is needed to determine the sampling sizes for ecological risk reduction in HQs and comparison to baseline conditions. Since 95% UCLs will be used in the FCM, at least 11 samples are needed. The FCM also include incidental sediment ingestion, which could employ the SWAC. Some receptors like the raccoon have a diet high in blue crabs, so blue crab data is needed for the performance evaluation to cover important prey species for ecological receptors of concern. Blue crabs are recommended to be collected from two stations in Purvis Creek, seven composites at each station.

23. **Section 2.0, Thin Layer Cover/Disturbed Area Monitoring, Page 9** – The objectives for the TLC monitoring should include verification of the depth of the cover. Performance standards in the tables in Section 2.2 and Section 4.2 need to be more specific than "improving." Use language from the ROD for RAOs, such as "result in self-sustaining benthic communities with diversity and structure comparable to that in appropriate reference areas."

24. **Section 2 Thin Layer Cover/Disturbed Area Monitoring** – The sampling planned to meet RAO 1 are: 1) thin layer cover/sediment sampling (cores collected at the density of 5 cores/acre in the thin layer cover areas as shown in LTMP Figure 3) and 2) vegetation monitoring for species presence, percent cover, and plant height. It's not clear specifically how these data will be used to demonstrate that sediment bound COCs are not entering Purvis Creek. Other techniques and/or sediment transport studies may need to be employed to collect data for this RAO.

25. **Section 2 Thin Layer Cover/Disturbed Area Monitoring** – Take sediment samples in areas of domains and creeks that have not been dredged or covered as well as in areas that have, to confirm the predicted post-remedial SWAC (surface weighted average concentration) CULs (clean up levels) have been met in entire domain and creek areas. The sediment SWAC CULs are components of RAOs 2, 4, and 5. The proposed sediment sampling only includes sediments sampled from the newly placed thin cover in marsh in some areas of Domain 1 and Domain 2. The SWACs were calculated using sediment concentrations from entire creeks or domains (see Table 26 of the ROD, USEPA 2015). Marsh areas require sampling in covered and non-covered areas so the marsh SWAC CULs can be verified. The lack of any samples from any creeks is particularly concerning since the creeks had the highest Aroclor 1268 and mercury concentrations. The creeks collectively add up to 98.5 acres and there are no sediment samples planned under the current LTMP. For the Alternative 6 scenario presented in the ROD, the SWAC Aroclor 1268 for Eastern Creek was predicted to drop from 43.5 ppm to 0.2 ppm and the SWAC for the LCP ditch was predicted to drop from 25.4 ppm to 0.3 ppm. Sampling over time needs to be conducted to confirm whether these creek SWAC CULs are attained. Additionally, the ROD specifically mentions sampling Domain 3 creek and the Western Creek Complex stating in Section 13.1 "Although the Selected Remedy will leave elevated concentrations of mercury and Aroclor 1268 in isolated portions of Domain 3 Creek and in the Western Creek Complex that exceed benthic CULs, the SWAC CULs are met. Long-term monitoring in these two creeks should confirm that residual contamination does not pose an adverse risk to fish, wildlife, and humans."

26. **Section 2 Thin Layer Cover/Disturbed Area Monitoring** – Alternative 6, the selected alternative in the ROD, combined sediment removal, sediment capping and thin-layer placement to accelerate natural recovery. The phrase "accelerate natural recovery" indicated an expectation that natural recovery was part of the remedy and hence monitoring should include measuring the average concentrations of sediment over the domains and creeks in Appendix C Table 4-7 to assess the progress in meeting RAOs 2, 3, & 5. Average concentrations in a decision unit are typically measured by incremental sampling to handle variability and to produce the most reliable estimate. This comment is providing additional rationale for the recommendation for incremental sampling of sediment concentrations in Domains 1 & 2 and the creeks. The ROD included an expectation that concentrations of COCs would experience a decline throughout the decision units, including in areas of the domain or creek outside of the remedy footprint to result in a reduction in the overall average concentration if not by constructing the remedy by waiting for concentrations to naturally reduce over time. Therefore, the LTMP should include a contingency for monitoring beyond the first five years, such as in ten years, if average concentrations have not achieved the SWAC CULs in the total creek area or Domains 1 & 2.

27. **Section 2 Thin Layer Cover/Disturbed Area Monitoring** – Long-term monitoring of mercury and Aroclor 1268 concentrations in the total creek area should include in the sampling design monitoring of the western creek complex and isolated portions of the Domain 3 complex because Section 13.1 (Page 75) of the ROD indicated "Although the Selected Remedy will leave elevated concentrations of mercury and Aroclor 1268 in isolated portions of Domain 3 Creek and in the WCC that exceed benthic CULs, the SWAC CULs are met. Long-term monitoring in these two creeks should confirm that residual contamination does not pose an adverse risk to fish, wildlife, and humans." The ROD anticipated that the LTMP would include sampling of the western creek complex and the Domain 3 complex, including the isolated portions that are not planned for excavation. The boundaries of the decision unit for the total creek SWAC include the WCC and the portions of Purvis Creek, Eastern Creek, and the Domain 3 Creeks that were not excavated as well as areas that were excavated. An unbiased estimate of the total creek area average sediment concentration in the biologically relevant depth interval is needed to answer the question of whether the remedy has achieved the SWAC CULs, thereby addressing RAOs 2, 3, & 5.

28. **Section 2 Thin Layer Cover/Disturbed Area Monitoring** – The LTMP included sixty samples over the 12.2-acre thin-layer cover of sediments from the 0-6-inch and 6-12-inch intervals for COCs. The purpose of sampling the cover was not explained in the LTMP. A purpose of the thin-layer cover was to dilute the concentrations to accelerate natural recovery to reach the SWAC goal. Performance standards and triggers for the TLC area were not defined. The sampling of the TLC should compare the concentrations detected in the 6- to12-inch interval with the CULs for the benthos. The TLC sampling will collect discrete samples for comparison to not-to-exceed sediment CULs. The thickness of the cover should be at least 6 inches over sediments that exceed the CULs for benthos. Measurements of the depth of the sand cover over sediment with concentrations above the benthic CULs can be used to ensure exposures are reduced. If the sand cover is not thick enough, additional material can be added. Expand discussion of how the depth of the sand cover will be measured at the locations of the cover sampled at the two depths. Photographs of cores are recommended. Finely sectioned cores through the TLC are recommended to examine the mixing by burrowing organisms and deposition of materials potentially containing COCs on top of the cover. The finely sectioned cores can be used to decide whether sampling of the TLC should take place beyond the first five years. See Appendix A of the ROD for explanation of what the EPA was looking for in the LTMP.

29. **Section 2 Thin Layer Cover/Disturbed Area Monitoring** – The ROD indicated the focus of the LTMP is to verify:

    - Risk reduction to acceptable levels;
    - Meet RAOs and clean-up levels; and
    - The physical integrity of remedy construction elements, specifically the caps; and the assumptions used in remedy selection, such as the sediment concentrations in thin-layer areas affected by burrowing organisms.

    Risk reduction to acceptable levels refers to RAO 2 and requires tissue monitoring of prey items that make up the food-chain model to the green heron (most sensitive ecological receptor). The RD discussed a decision criterion of whether fish tissue concentrations were trending downward. Several measurements over time are needed to detect a downward trend. Please enhance the discussion of the number of sampling events needed to detect a trend. More

than three events (zero, three years, and five years) will likely be needed to detect a downward trend in finfish tissue concentrations. Moreover, the term "trending" was not in the ROD. The decision rules should copy language from the ROD such as "to levels that are protective."

30. **Section 2 Thin Layer Cover/Disturbed Area Monitoring** – ROD Section 13.2.3, Long-Term Monitoring Program, Page 78, indicated the LTMP would include:

    - Sediment monitoring;
    - Water column monitoring;
    - Fish and shellfish monitoring;
    - Cap and thin-layer cover monitoring; and
    - Benthic community assessment and re-vegetation of disturbed areas.

    Appendix A of the ROD clarifies the role of sediment monitoring within the LTMP:

    "Within the LTMP sediment sampling and analysis is anticipated to be a component of multiple evaluations of the overall remedy performance. Sediment monitoring is anticipated to be used in assessing attainment of cleanup levels, contaminant redistribution in the marsh, contaminant flux, incorporation of TLC material into the marsh surface, as well as other data needs. The specific sediment monitoring parameters will be established during design and in the LTMP and linked to ROD RAOs as will all monitoring efforts. For example: sediment monitoring is needed to meet RAO #1 in the ROD which is to "Prevent or minimize chemicals of concern (COCs) in contaminated in-stream sediment from entering Purvis Creek."

    The ROD anticipated sediment sampling to be used to assess the attainment of CULs. The main CULs are SWAC CULs for mercury and Aroclor-1268. The RD should incorporate sediment sampling to verify attainment of SWAC CULs as reinforced by comments recommending ISM.

31. **Section 2 Thin Layer Cover/Disturbed Area Monitoring** – Take sediment samples in the dredge/backfill areas not only for confirmation of the post-remedial SWACs, but for integrity of the backfill too. As mentioned above, the current LTMP has no samples planned for the dredge/backfill areas. Sediment sampling is planned for the thin cover areas which will be helpful to determine if the cover is being revegetated, examining cover integrity and COC concentrations in the cores. This sampling is also important to monitor the thin cover to see if it's being re-contaminated or if sediment mixing, bioturbation, advection, and/or diffusion is occurring in the cover. Sample the dredge and fill areas, like the thin layer areas, to collect data on the effectiveness of the remedial action.

32. **Section 2 Thin Layer Cover/Disturbed Area Monitoring** – Proposed sediment sampling will not sufficiently inform managers if RAO 4 is being met. RAO 4 is: "Reduce risks to benthic organisms exposed to COC-contaminated sediment to the levels that will result in self-sustaining benthic communities with diversity and structure comparable to that in appropriate reference areas." See previous comment regarding sediment sampling.

33. **Section 2.1 Objectives (Thin Layer Cover/Disturbed Area Monitoring), page 9** – Add an additional objective, "Evaluation of the stability/loss of the thin cap material," and identify

performance standards for this objective.

34. **Section 2.1 Objectives (Thin Layer Cover/Disturbed Area Monitoring), page 9** – Please identify monitoring components that may need to be evaluated outside of the schedule defined in Table 3, e.g., in the event of severe storm events that may impact the marsh.

35. **Section 2.1 Objectives (Thin Layer Cover/Disturbed Area Monitoring), page 9** – For objective "Confirm recovery and stability of marsh plants (minimum of 80 percent [%] coverage) … Confirm marsh plant species remain consistent with restoration targets." The restoration target plant species should be defined here.

36. **Section 2.3.2 Benthic Community Assessment, page 10** – The remedial action objective pertaining to the benthic community was:

    RAO 4: Reduce risks to benthic organisms exposed to COC-contaminated sediment to levels that will result in self-sustaining benthic communities with diversity and structure comparable to that in appropriate reference areas.

    The LTMP proposed a benthic community assessment to document the composition and reestablishment of the benthic community following placement of the thin layer cover. These comments recommend that the RD discuss the biological mixing zone in relationship to the proposed sampling of the TLC in the 0- to 6-inch interval and the 6- to 12-inch interval. Revise the RD to include measurements taken to assess reduction in risks to the benthic invertebrate community by comparing the concentrations to the CULs for benthic organisms. The benthic community sampling is currently planned to be conducted in year one and year five at five locations within the cover area. The progress in year five is to be compared to year one. Given RAO 4's specification of comparing to a reference location, benthic community results should compare to one or more suitable reference locations. The goal is to ensure the benthic community has recovered from placement of the TLC and that the TLC is effective in reducing exposures to the benthic community. Appendix A of the ROD clarified the purpose of the benthic community monitoring as:

    Establishing baseline benthic community conditions both before and after remediation is important. Benthic community assessments may be targeted at locations in TLC areas to assess impacts of the cover on reestablishment of the benthic community. In addition, benthic assessments may be targeted in selected un-remediated portions of the marsh and compared to an appropriate reference envelope so that monitoring results (various biological integrity metrics appropriate to the habitat) are evaluated within a range of background marsh conditions. This is because community assessments have many confounding factors such as particle size distribution, detrital and organic carbon contents, sediment stratification, and variable tidal positions within the marsh.

    Characterization of the benthic community prior to remediation is important to have something to compare with the data collected after one and five years to assess the reestablishment of the benthic community. The ROD stated that benthic monitoring will require baseline surveys in the affected areas and in the reference envelope prior to remedial action. There ROD anticipated in RAO 4 that the remedy would do more than allow the benthic community to recolonize but that the community that recolonized would be similar to a reference location, i.e., not impacted by contamination from the site. Please revise the RD to

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include baseline sampling of the benthic community and sampling of suitable reference locations not impacted by the site.

33. **Section 2.3.2 Benthic Community Assessment, page 10** – The benthic community assessment is proposed for five locations within the TLC area. As the composition of the benthic community is affected by many factors such as elevation and tidal position the sampling design should be stratified to account for the important variables with five locations for each group. As the variability is great in terms of the densities of fiddler crabs present, a sampling plan is needed to obtain sufficient samples to characterize both the site and reference areas. Enhance the discussion of the characteristics of the benthic macroinvertebrate community. Discuss literature on the rates of recolonization. Include some replication of benthic community samples in the design. Consider mud flats and small creeks separately.

37. **Section 2.3.2 Benthic Community Assessment, page 10** – The Responsible Party (RP) states that comparison to reference locations poses considerable challenges, and reference locations will not be sampled. However, RAO 4 indicates risks to benthic organisms should result in benthic communities with diversity and structure comparable to that in appropriate reference areas. How will RAO 4 be met?

38. **Section 2.3.2 Benthic Community Assessment, second paragraph** – This section includes the statement, "As USEPA recognizes, multiple factors beyond contaminant concentrations impact benthic communities. These factors include particle size, organic carbon content, habitat, elevation, and tidal position within the system. Therefore, reference locations will not be sampled." While recovery of benthic communities is affected by the factors listed, that fact does not preclude the value of reference location data. The effects of those factors may be controlled by careful site selection of the reference locations. Reference location data provides valuable context for evaluating unexpected trends in ecological recovery. Other components of the monitoring plan include reference locations. Reference locations should be included in areas unaffected by COCs to provide context for interpreting recovery trends within remediated areas. Alternately, a more robust justification should be included for excluding reference areas beyond the statement quoted above.

39. **Section 2.3.2 Benthic Community Assessment, page 10** – Sediment samples collected for benthic community assessment should also be evaluated for contaminant concentrations. Please add analysis of mercury, Aroclor 1268, lead and polycyclic aromatic hydrocarbons (PAHs) to the list of analyses on Table 3.

40. **Section 2.3.2 Benthic Community Assessment, page 10** – Because the stated objective is to "document the reestablishment and composition of the benthic community," pre-remedial samples should be collected to document the existing benthic community. Define the performance standards for numeric abundance and diversity that will indicate that RAO 4 has been met.

41. **Section 2.3.2 Benthic Community Assessment, page 11** – For the statement "Changes in species type or abundance over time will be tracked and compared to the performance standards," define the performance standards.

42. **Sections 2.3.2.2, 3.3.1.2, and 4.3.4 Sample Analysis** – The qualification/certification requirements for the laboratories providing chemical/biological/tissue analyses should be

added to the BODR or the LTMP.

43. **Section 3.3.1: Water Sampling** – Water quality monitoring will be conducted to measure contaminant concentrations in surface water over time to assess whether concentrations are meeting or trending toward State of Georgia water quality criteria. Surface water samples will be collected at six locations within Purvis Creek, LCP Ditch, and Eastern Creek and one reference location in Troup Creek. The surface water samples will be submitted for total mercury, PCBs, and lead on a filtered and unfiltered basis and total suspended solids. Surface water sampling will be conducted in the fall during two tidal events: one at approximately ebb tide conditions and one during flood tide conditions. Because of RAO 1 the surface water entering and exiting Purvis Creek at the LCP Ditch should receive special attention. Surface water samples should be collected from fish sampling areas to assess the reductions in exposures to fish from reduced contamination in surface water, which means that surface water should be monitored at the locations proposed for finfish collection in Zones D, and H/I. Zone H/I contains Purvis Creek, which is planned for surface water sampling, but Zone D, Turtle River, should add surface water sampling.

44. **Section 3.3.1: Water Sampling** – Because one of the fish tissue goals is for methylmercury in tissue, consider analyzing surface water samples for methylmercury as well as total mercury to better understand the bioavailable fraction. Surface water samples should be analyzed for dissolved organic carbon and total organic carbon to assess bioavailability.

45. **Section 3.3.1: Water Sampling** – The aquatic life criteria represent continuous exposure or annual average concentrations. To best represent long-term concentrations an understanding is needed of the variability in the surface water concentrations seasonally or over the tidal cycle. Some measurements of surface water concentrations over a range of conditions may be necessary for the first monitoring year to select the most representative time to sample. For Aroclor-1268 surface water samples could be collected over two months or more with passive samplers to integrate the sample over a longer exposure time and to reach the lower detection limits for human health criteria. Reductions in Aroclor-1268 concentrations detected by a passive sampler would provide a near-term estimate of reduction in exposure to fish and would have less variability than trying to estimate exposure reduction by sampling fish tissue alone. The average concentration of Aroclor-1268 over a longer period is more relevant to exposures to fish. Grab samples can be subject to variability with the tidal cycle as mentioned in the RD, a passive sampler could provide better representativeness of average conditions and eliminate some of the factors related to temporal variability. There is not an adopted method of using a passive sampler for mercury. This comment is recommending surface water sampling to characterize temporal variability or the use of passive samplers for Aroclor-1268 in surface water.

46. **Section 3.3.1: Water Sampling** – It is recommended that a minimum of 12 surface water samples at appropriate sampling locations (the same locations used in 2012 Remedial Investigation Report Operable Unit One - Estuary is appropriate) should be collected according to the most current Surface Water Sampling protocol of EPA Region 4's Field Branches Quality System and Technical Procedures. Both filtered (dissolved) and unfiltered (total) samples should be collected. It is recommended that samples be taken every 6 months following remedy completion to account for temporal variability.

47. **Section 4 Fish and Shellfish Monitoring** – The sampling currently outlined in the LTMP is likely insufficient to determine if RAO 5 is being met. RAO 5 is "Reduce, to acceptable levels, finfish exposures to COCs from ingestion of prey and contaminated sediment in the LCP marsh." Prey sampling is appropriate here. Include blue crabs as they are an important prey species and the ROD stated that in addition to mummichogs and fiddler crabs, blue crabs would be sampled (USEPA 2015). However, collecting and analyzing finfish is the most direct way to determine if remedial efforts have reduced finfish exposures and whole-body concentrations. Finfish should be collected and analyzed for COCs following the recommendations established in USEPA's Using Fish Tissue Data to Monitor Remedy Effectiveness (USEPA 2008) and recommended by the NRRB during their review of the remedy for this site (NRRB 2014). Since the site contains COCs known for their bioaccumulative potential, finfish sampling should target a range of species representative of the range of bioaccumulative potential. It is recommended to collect finfish species that have been sampled in previous monitoring efforts at the site (e.g., striped mullet, red drum, black drum). Additionally, any fish samples collected for human health should be analyzed for COCs in both the filet and whole body to support evaluations of human health and environmental goals. The whole-body samples will already be in hand, so money and effort can be saved by processing samples concurrently.

48. **Section 4 Fish and Shellfish Monitoring** – RAO 5 was "Reduce, to acceptable levels, finfish exposures to COCs from ingestion of prey and contaminated sediment in the LCP Chemicals marsh." The LTMP should be revised to include whole body fish tissue sample or the analysis of the carcass in addition to the filet to reconstruct the whole-body fish concentration to assess the exposures to finfish to assess whether exposures to finfish are declining. The finfish species proposed to monitor were southern kingfish (whiting) and spotted seatrout. The fishes historically monitored for the ecological risk assessment were the black drum, red drum, silver perch, spotted seatrout, and striped mullet. Please enhance the discussion of rationale for selecting the two species by including size, lipid contents, feeding habits and movement patterns Please include measurement of whole-body concentrations as these are more relevant to exposures to the fish themselves.

49. **Section 4 Fish and Shellfish Monitoring** – It is recommended to collect at least five composites of the two finfish species from each sampling location per guidance in USEPA (2008). A site-specific statistical evaluation of the number of samples to achieve at least 80% power to detect a 20% decrease should be sought. A statistical evaluation should be performed to guide the number of fish tissue composites.

50. **Section 4.2 Performance Standards, page 14** – In the Performance Standards Table, "Concentrations meeting or trending toward target tissue concentrations for human health (0.099 and 0.11 milligrams per kilogram [mg/kg] for mercury and Aroclor 1286, respectively) and the national recommended and state criterion for human health (0.3 mg/kg for mercury)," 1) Please specify whether the cited fish tissue concentrations are on a dry or wet weight basis; 2) The national criterion is for methylmercury in tissue (EPA, 2001); specify analysis for methylmercury; and 3) Editorial: it is Aroclor 1268, not 1286.

51. **Section 4.3.1 Tissue Sampling for Human Health Exposure, page 16** – Is the preparation method for spotted seatrout and southern kingfish (skin-on fillets with belly flap) consistent with how both recreational users and "high quantity fish consumers" prepare and consume fish? Please document. If there is a subsistence fishery, it is likely that other parts of the fish

are consumed as well. Analysis of both fillets and carcass portions should be considered if appropriate.

52. **Section 4.3.1 Tissue Sampling for Human Health Exposure, second paragraph** – The paragraph indicates that Gibson Creek is Zone I. However, Figure 5 is referenced, which does not show Gibson Creek in Zone I. This difference in Section 4.3.1 and Figure 5 should be resolved.

53. **Section 4.3.2 Tissue Sampling for Ecological Exposure, page 16** – The footnote to the table states "The number of fish and crab per composite, the range of lengths, and total weight per composite will be specified in the Field Sampling Plan (FSP)." The EPA needs to review and approve the QAPP and FSP before sampling is conducted.

54. **Section 4.3.2 Tissue Sampling for Ecological Exposure, page 16** – In describing Figure 6, please describe how the mummichog and fiddler crab sampling locations were selected. Based on comparison with Figures 2-1a to e and 2-2a to e of the Remedial Design Report, many of the locations are where existing mercury and Aroclor 1268 concentrations are below the benthic community CULs.

55. **Section 4.3.2 Tissue Sampling for Ecological Exposure, page 16** - Tissue mass requirements needed for mercury, Aroclor 1268 and lipid analysis should be determined by consultation with the analytical laboratory. The average weight of fiddler crabs and mummichogs should be available from the Remedial Investigation (RI) studies. The number of individuals per composite should be estimated based on those parameters. It should also be stated that composite samples will be whole body fish.

56. **Section 4.3.3 Sampling Frequency, page 16** – Mummichog and fiddler crab tissue samples should also be collected in Year 1. If there is a spike in tissue concentrations after remediation (Year 1), having that data may help interpret Year 3 data if tissue samples are higher than or similar to the concentrations before remediation data.

57. **Section 5 RAO Attainment and Adaptive Management, page 18** – Given that mummichog and crab, and the benthic community, do not have specific target concentrations or community indices that must be met, it is unclear at what point the monitoring program would be considered "complete" for these 2 endpoints. More clarity is needed on what constitutes "success" for these endpoints.

58. **Section 5 RAO Attainment and Adaptive Management, page 18** – Text indicated that "Mummichog and fiddler crab tissue data will be compared to historical data. . ." However, Appendix I, Section 4.2, Page 14, indicated that mummichog and fiddler crab data will be assessed for concentrations declining compared to baseline data. Please revise Section 5 to reflect the table in Section 4.2.