United States Department of the Interior

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In Reply Refer To:

Ira Perry Katz
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FEB 12 2016

Dear Mr.Katz:

The U.S. Fish and Wildlife Service (Service) has completed its review of the Pompton Lake Study Area Corrective Measures Implementation Work Plan (CMI WP) (Arcadis *et al.* 2015) provided to us by the U.S. Environmental Protection Agency (EPA). The Service appreciates the opportunity to coordinate with EPA and EPA's efforts to address our concerns, and have prepared the following comments for your consideration in developing a final CMI WP.

GENERAL COMMENTS

Turbidity Curtains

The CMI WP indicates that a three-layer turbidity curtain will be used to enclose the Acid Brook Delta (ABD) during the dredging operations, while Lake Area A and the Island Area will be enclosed with a single turbidity curtain. The Service is concerned that there is insufficient information to evaluate whether these methods of containment are appropriate or adequate. The CMI WP indicates that use of sheetpile around the ABD to prevent migration of resuspended sediment is not feasible due to the depth of refusal along the eastern boundary of the removal area, but does not present data or an engineering analysis to support this conclusion. Additionally, the CMI WP does not indicate why a single turbidity curtain, as opposed to sheetpile or a triple curtain (as is proposed for the ABD), is sufficient to enclose Lake Area A and the Island Area.

Turbidity curtains are not as effective as sheetpile at containing sediment; material that has settled to the lake bed may still wash underneath. Additionally, while turbidity curtains contain sediment, they do not prevent the movement of water itself. Therefore, they are not effective at containing contamination in soluble form. There are numerous examples of dredging operations in which monitoring revealed elevated concentrations of dissolved contaminants outside of the turbidity curtains (see reviews in National Research Council 2007).

The Service recommends that sheet pile be used wherever possible to surround work areas during implementation of the corrective measures. In areas where sheet pile cannot be used, we

recommend that a triple curtain be used, unless information can be provided to indicate that a single turbidity curtain is sufficient.

Residuals and Best Management Practices

Residuals are contaminated sediments remaining within, or adjacent to, the dredging footprint after remediation (Palermo *et al.* 2008). They include contaminated sediments found at the post-dredge surface that have been uncovered but not fully removed during dredging, as well as sediments that are dislodged during dredging operations and that ultimately settle back to the bottom (Bridges *et al.* 2008). Sediment resuspension and the generation of residuals represent a nearly universal problem in the dredging of contaminated sites (National Research Council 2007). Resuspension is particularly an issue when debris or other conditions interfere with normal dredging operations. The CMI WP should provide additional details regarding how the removal of trees and shrubs (including stumps and roots) will be accomplished in the wetlands and uplands, and what impacts vegetation removal and the presence of any remaining stumps and roots may have on dredging operations and residuals. The Service also recommends that the remedial action incorporate Best Management Practices (BMPs) beyond those identified in the CMI WP to minimize undredged and generated residuals. Finally, the Service recommends that additional monitoring procedures be incorporated to better evaluate residuals and ensure remedial goals are achieved.

National Research Council (2007) lists a variety of BMPs that may help minimize residuals, as well as off-site transport of sediment and debris. The Service suggests that the following BMPs also be followed during the corrective action.

- Reducing the impact speed of the dredge bucket with the bottom, the rate of ascent of a filled bucket, and the swing rate of cutter-head dredge.
- Avoiding overfilling buckets through accurate and controlled bucket placement while also maximizing the bite of the bucket to avoid thin lifts.
- Allowing time for draining of a sediment-filled bucket before breaking the water's surface.
- Once the water's surface is broken, holding the buckets just above the water's surface to allow water to drain before swinging the bucket to the barges/scows.
- Protecting the overwater swing path of a filled bucket (*e.g.*, by placing an empty barge/scow or apron to catch lost material).
- Preventing water entrained with the dredged sediment from being released back to the water (*i.e.*, controlling sediment runoff from barges/scows and handling areas by filtering water through haybales or fabric, or using baffles to contain sediment).
- Overdredging into clean material, and where removal extends to native material, inspecting bucket materials to ensure that all fine-grained sediment has been removed before moving on to the next area.
- Incorporating a two-pass dredge approach to remove soft find-grained sediment that sloughs along the dredge cut face back on to previously dredged areas.
- Performing frequent inspection of the bedded baffle, silt curtain, and anchors to ensure the baffle is in contact with the lake bed.
- Creating incentives for contractors to reduce resuspension and residuals.
- Allowing sediment particles to settle a minimum of 6-12 hours prior to placement of the ecological layer.
- Providing sufficient time for the sand ("ecological") layer to settle prior to removal of the turbidity curtain.

The possibility of leaving consolidated sediments with elevated concentrations in place can be reduced by overdredging, and by verification sampling after dredging (see recommendations below) followed by re-dredging as needed (National Research Council 2007).

Monitoring and Verification Sampling

A number of guidance documents have been published to assist in designing monitoring programs for contaminated sediment sites undergoing remediation (e.g., Palermo *et al.* 1998; U.S. Environmental Protection Agency 1999, 2002, 2004, 2005; Palermo *et al.* 2008). These documents recommend incorporating three lines of evidence to document successful sediment remediation: sediment physical stability, sediment chemical stability (lack of movement of contaminants from the sediment to the water column), and biologic-ecologic integrity (National Research Council 2007).

The CMI WP indicates that sediment removal confirmation will be elevation-based. The Service recommends that monitoring and verification procedures be expanded to better evaluate the three recommended lines of evidence. This will help ensure that protective measures and BMPs are effective and provide quantitative evidence to indicate whether remedial goals are achieved. In addition, while the CMI WP states that a long-term monitoring (LTM) workplan (WP) will be submitted to EPA within 45 days of approval of the CMI WP, the Service recommends that the LTM WP be developed as soon as practicable. Evaluating the effectiveness of a corrective action requires a comparison of pre-and post-remedial data; without knowing what the LTM will consist of, it is impossible to ensure that the available baseline data will be adequate to perform that comparison. Hence, the LTM plan needs to be completed far enough in advance of the remedial action to allow time to collect additional baseline information, if necessary.

Our specific recommendations for monitoring and verification sampling are as follows.

<u>During Remediation</u>

1. Monitoring

The Service recommends that additional sampling and analyses beyond those proposed in the CMI WP be performed throughout remedial activities to increase the probability of identifying contaminant releases, should they occur. The CMI WP indicates that only turbidity will be routinely monitored outside of the silt curtains; additional sampling and chemical analyses will be incorporated only if turbidity action levels are exceeded. The additional sampling would consist of one water sample being collected adjacent to the relevant remedial area; one being collected from an upstream location; and one being collected from a downstream location. These samples would be analyzed for total suspended solids and mercury.

Turbidity is a measure of water clarity that is used to indirectly detect the presence of suspended sediment, which may carry sorbed contaminants. However, high turbidity readings are not necessarily indicative of contaminant releases, because turbidity can be affected by factors other than suspended sediment (*e.g.*, phytoplankton). Additionally, contaminants may be present in dissolved form, due to the release of sediment pore water during material handling or the movement of equipment (*e.g.*, dredges, boats, and barges) (Bridges *et al.* 2008). Contaminants may also desorb

directly from resuspended sediment or residuals dislodged during dredging operations. Turbidity monitoring will not be effective at detecting this contamination.

Contaminants dissolved in the water column may be more bioavailable than contaminants sorbed to sediment. They are also more mobile, since water can flow through the water-permeable silt curtain surrounding the dredging operations to locations further downstream. The Service recommends collecting surface water samples adjacent to each removal area on a regular basis during dredging activities and analyzing those samples for total and dissolved mercury. Rapid monitoring techniques should be employed to the extent possible to inform dredging operations in nearly real time regarding the degree of contaminant resuspension and release to the water column. This will help evaluate the effectiveness of BMPs and determine if corrective measures are needed to reduce resuspension and mobilization of contaminants. The Service also recommends that passive sampling devices and caged organisms be placed adjacent to each removal area while dredging is on-going to assess mercury bioaccumulation outside of the silt curtain or sheetpile. A variety of organisms (e.g., fish, cladocerans, amphipods, midges, bivalves, crabs, mayflies, and oligochaetes) have been used to evaluate contaminant releases during dredging (Bergen *et al.* 2005; Adams *et al.* 2005; Crane *et al.* 2007; Association of State and Territorial Solid Waste Management Officials 2009). Caged exposures of as little as 2-4 days have been shown to provide uptake and toxicity information that is comparable with that of standardized laboratory tests that take much longer (Greenberg *et al.* 2002; Burton, Greenberg, *et al.* 2005; Burton, Rosen, *et al.* 2012).

2. Verification of Removal

The CMI WP identifies quantitative remedial action objectives (RAOs) for upland soils outside of the wetland and wetland transition zones. However, the CMI WP does not indicate that chemical analysis will be performed to verify that remedial objectives have been achieved. The Service recommends that sediment cores be collected post removal and prior to backfilling in areas where quantitative RAOs are being applied to verify that those RAOs have been met. A statistical approach should be used to determine the sampling density required to have a minimum of 90% confidence that concentrations of copper, mercury, lead, and zinc are below the identified target concentrations across the entire removal area.

The Revised Permit Module (U.S. Environmental Protection Agency 2015) indicates that removal in the ABD, Lake Area A, and Island Area will "...focus on the mercury-impacted sediments including sediments down to the native cobble or gravel," and include "...select areas of the peat layer which have elevated mercury concentrations." The Revised Permit Module further states that "Confirmation of sediment dredging/removal completion shall be conducted...to verify that dredging down to the peat layer has been achieved." However, the CMI WP does not include information regarding methods that will be used to confirm that removal of material down to (or in some cases, including) the native substrate has been achieved. Because native materials, generated residuals, and undredged residuals are likely to have different geochemical characteristics (e.g., grain size, bulk density, and contaminant concentrations), the Service recommends sediment sampling to examine these characteristics during and after dredging to evaluate whether dredging operations need to be modified, and to ensure complete removal of targeted material prior to placement of the ecological layer.

3. Verification of Ecological Layer Depth

The CMI WP indicates that cores confirming the ecological layer thickness will be collected at a spacing of one per acre, with no justification as to whether this will be adequate to ensure that the ecological layer is consistently a minimum of six inches thick across the placement area. The Service previously recommended that the ecological layer be at least 12 inches thick (U.S. Fish and Wildlife Service 2014); at a permitted thickness of six inches, it is all the more critical that this thickness, at a minimum, be achieved. Therefore, we are recommending that a statistically-based analysis be used to determine the number and density of core samples that are needed to assure that the ecological layer is a minimum of six inches thick across the entire covered area. In addition, allowances should be made for mixing of the underlying sediment with the ecological layer and ecological layer settlement over time. Sediment profile cameras can also be used to evaluate placement and mixing of sediment and sand (Palermo *et al.* 1998).

4. Adaptive Management

The EPA encourages using an adaptive management approach to improve remedial outcomes (U.S. Environmental Protection Agency 2005). The Service also recommends the CMI WP incorporate an adaptive management approach to ensure the effective use of information obtained through monitoring. The CMI WP should also identify indicator values that will trigger a change in management actions.

Post-Dredging (Short-Term) Monitoring

The Service recommends that sampling be performed within each removal area, once the ecological layer has been placed and the curtains removed, to help document the shift to recovery. Monitoring contaminants in the water column and assessing bioaccumulation immediately after the completion of dredging activities will help to determine whether any increases that might occur are the result of sediment resuspension and pore water release, or due to residuals. Residual contamination can lead to longer term exposure and ecological risk than resuspended sediments and pore water releases, which typically have a more transitory effect (National Research Council 2007). The Service suggests using passive sampling devices and placing caged organisms within and adjacent to each removal area to assess mercury bioaccumulation immediately after dredging and track changes in bioaccumulation over time. Upstream and downstream sampling should be performed concurrently to evaluate the areal extent of any impacts and provide context for evaluating the recovery rate.

Long Term Monitoring

The CMI WP incorporates the following qualitative RAOs for sediment, wetland, and wetland transition zone soils in the ABD, Lake Area A, and Island Area of Pompton Lake:

- reduce ecological exposure to elevated concentrations of mercury in sediments;
- reduce the potential for mercury methylation in sediment; and
- eliminate or reduce the potential for ecological exposure by limiting the potential for mercury methylation, bioaccumulation, and translocation.

The EPA has promulgated principles for contaminated sediment management that include selecting remedial approaches that achieve risk-based goals and ensuring that sediment cleanup levels are clearly tied to risk management (U.S. Environmental Protection Agency 2002). The Service also

supports the development of remedial objectives that focus on risk reduction. While the Service does not object to RAOs to minimize ecological exposure, bioaccumulation, and translocation, there is no mention of risk reduction being a remedial objective *per se*. Given that the CMI WP does not yet incorporate a detailed LTM plan, it is not possible to evaluate whether LTM will be adequate to demonstrate the effectiveness of the action either to achieve the stated RAOs or to document reductions in human or ecological risk.

Demonstrating the success of a remedial action in achieving risk reduction requires having pre- and post-remedial datasets that evaluate the same contaminant pathways and exposures. Thus, the Service recommends that an approved LTM plan be in place far enough in advance of the removal to ensure that the pre-remedial, or "baseline", data are adequate and appropriate for making robust pre- and post-remedial comparisons (*e.g.,* through a repeated measures approach). Further, a clear definition of dredging effectiveness should be identified so that appropriate statistical hypotheses can be formulated and tested (National Research Council 2007). The available datasets must be sufficient to develop both pre- and post-removal trend estimates to demonstrate that any risk reduction observed after the remedial action is related to the removal, rather than an already-occurring trend (National Research Council 2007). If baseline data are not sufficient to identify current (pre-remedial) risk trends, the Service recommends that additional sampling be undertaken as needed prior to implementing the corrective measures.

Although a complete list of specific recommendations for LTM is outside the scope of this review, the Service recommends that the LTM plan incorporate biological measures of exposure, accumulation, and toxicity. While sediment contaminant concentrations reflect the potential for exposure, reductions in sediment contamination do not necessarily translate to reductions in biological uptake or risk and therefore are not adequate to demonstrate risk reduction. Resuspension of sediment during dredging can cause physical (decreased consolidation) and chemical (redox) changes in generated residuals, with the result that contaminants may become more bioavailable for a time after dredging is completed (National Research Council 2007; Bocchetti *et al.* 2008). Although the placement of the ecological layer will likely provide a measure of protection against bioaccumulation after dredging, the low sorptivity of sand and the proximity of residual contamination to re-colonizing benthic invertebrates, combined with the fact that bioaccumulation in benthic organisms is often closely tied to pore water contaminant concentrations, may allow the benthic invertebrate community, and the organisms that feed upon it, to continue to bioaccumulate mercury. Therefore, the Service suggests that the LTM plan incorporate tissue residue analyses, toxicity testing, and biological community indices. The analyses should focus on organisms that are likely to solely or primarily use the area within or adjacent to the remedial footprint (*e.g.*, benthic invertebrates; fish with small foraging ranges; spiders). Caged accumulation studies could also be incorporated to ensure that organisms are present to be evaluated (it may take some time for the benthic community to recover following remediation) and to ensure that exposure occurs within the remedial footprint. The LTM plan could also include passive sampling techniques that mimic biological exposure and uptake; however, actual biological tissue samples would be needed to evaluate risk to upper trophic level receptors.

For effective pre- and post-remedial comparisons, data on contaminant concentrations and effects should be collected consistently over time (*i.e.*, from the same organisms and locations), both before and after remediation. Sample sizes should be sufficiently robust to account for natural heterogeneity (estimates of variability from remedial investigations can be used to determine the sample sizes necessary during LTM to complete a statistical evaluation of remedial

effectiveness).The time spans of both pre- and post-remedial sampling need to be long enough to capture the time scale of recovery processes, and reference locations should be evaluated concurrently to help interpret spatial and temporal trends. Finally, LTM should continue until it can be determined whether risk reduction has been achieved, which may take longer than the five years proposed in the CMI WP. Additional controls should be implemented if sufficient risk reductions are not achieved in an acceptable time frame.

SPECIFIC COMMENTS

Main Report

Page 18: Backfill: The discussion of the backfilling procedures in the uplands is confusing. The CMI WP indicates that after removal operations and backfilling, a geotextile liner will be placed on top of the backfill. The ecological layer will be spread on top of that, and then another geo-textile liner will be laid down to form a barrier between the work surface and the ecological layer. The CMI WP goes on to say, "Following dredging and demobilization of the solidification equipment, the additional fill material under the liner will then be reused for the ecological-layer. Finally, the uplands will be restored by establishing design elevations and installing the final surface layer or restoration features." The Service's interpretation of this description is that the second (upper) liner will be removed after dredging and demobilization and the ecological layer laid underneath will remain in place, upon which additional backfill material (presumably soil) will be placed until the design elevations are reached. We would appreciate clarification if this interpretation is not correct.

Page 20: Fish capture: Estimates of fish species composition and relative abundance differ greatly depending on level of sampling effort and types of sample gears used (see, for example, Arreguin-Sanchez 1996; Jackson and Harvey 1997; Portt *et al.* 2006). By logical extension, fish capture and removal efforts will vary greatly depending on the level of sampling effort and types of sample gear used. In addition to the sampling gear listed in the CMI WP, the Service requests the use of short-set gill nets and trap nets incorporating a variety of designs, including fyke nets. Additionally, the Service recommends that a sufficient level of effort be exerted per gear type to demonstrate asymptotic depletion of fish. Captured fish should be held in large oxygenated tanks for a minimal amount of time prior to their release. Release locations should be distributed throughout the lake, in areas with appropriate habitat and at appropriate distances from the dredging area. In addition, the Service recommends that rotenone be used within the sheetpiled area (after the sheetpile is installed) to euthanize any fish that may have avoided capture. Any dead fish must be disposed of expeditiously and appropriately to prevent them from being fed upon by predatory or scavenging species. The Service would like to provide oversight with respect to capture and depletion efforts. Finally, if any species are captured that were not analyzed for contaminants during the Remedial Investigation, the Service requests that tissue plugs be collected and tested for mercury.

Page 30: The CMI WP indicates that discharge permit requirements are currently being discussed with the New Jersey Department of Environmental Protection. Regardless of permit requirements, the Service recommends periodic testing of contact water for total and dissolved mercury concentrations to ensure that water is handled and disposed of in an appropriate manner.

Page 33: The CMI WP should document the rationale underlying the selected warning and action thresholds for nephelometric turbidity units (25 and 50 NTU, respectively). It is important to note that turbidity is not a surrogate measure for contamination, and that contaminant concentrations and

turbidity do not necessarily correlate. Turbidity only provides a relative index of water clarity; exceedances, or a lack of exceedances, of turbidity thresholds do not predict toxicity. Additionally, although turbidity may indicate that contaminated sediment is being resuspended, the identified action thresholds for turbidity may have no relationship to harmful levels of contamination. Therefore, it is not necessarily an environmentally relevant measure unless it is calibrated against a water quality parameter with direct associations to biological impacts (Henley *et al.,* 2000; Clarke and Wilber 200; Davies-Colley and Smith 2001).

Page 35: A contingency plan should be developed to indicate how water will be handled and disposed of in the event that water discharge monitoring shows exceedances of the New Jersey Discharge Elimination System permit.

Pages 45-46: The Service recommends that the suspended sediment levels considered "acceptable" for proceeding with placement of the initial two inches of ecological layer be identified in the CMI WP. Additionally, the initial two inches of ecological layer (as opposed to just the final four inches) should not be placed until all dredging activities within a work area are completed.

Page 50: Given that some locations in wetland and wetland transition zones may have only one foot of backfill material placed on top of undredged soil / sediment, the Service recommends that an evaluation be performed of the root depth of plant species to be used for the restoration. Plants with root systems likely to be more than a foot in depth should not be planted where they may come into contact with the contaminated soil underlying the backfill material.

Pages 58 and 63: Please note that while informal consultation with the Service regarding potential impacts to federally listed species was undertaken in advance of the removal initially proposed in 2012, the project has since changed. Therefore, we request that Section 7 consultation be re-initiated with the Service's New Jersey Field Office, in accordance with the Endangered Species Act (87 Stat. 884 as amended; 16 U.S.C. 1531 et seq.).

Page 62: The sheet pile barrier and turbidity curtains should be installed before the Pompton Lake fish stocking activities take place.

Page 62: The last paragraph on this page first indicates that work hours will be Monday to Saturday, but later states that the work hours will be Monday to Friday, with make-up work hours being considered for Saturday. This discrepancy should be corrected.

Appendix A

Page 12: The CMI WP states, "The areas that are cleared will only be grubbed if the rooting systems and stumps of the cleared vegetation will interfere with the temporary infrastructure and restoration design." However, roots and stumps will likely interfere with the effective removal of contaminated soil and are often associated with the presence of both undredged and generated residuals (National Research Council 2007). The Service recommends grubbing of root systems and stumps to the maximum extent possible within the proposed horizontal and vertical dredging footprint.

Page 16 (first paragraph): The text states, "Removal [of sheetpile] will occur from land and then the areas will be backfilled. Following backfill placement, the sheeting will be removed." This does not

make sense. Please provide clarification regarding the sequence of sheetpile removal and backfilling.

Page 16: The Service would like to be present during the 5-day fish collection period to oversee collection and transfer methods. If species are captured that have not been tested for mercury during the remedial investigation, the Service requests that tissue plugs be collected for analytical testing. See also our comments on Page 7, above, related to fish capture.

Pages 22-23: The discussion regarding backfilling, placement of the ecological layer, and geotextile liners is not clear. In particular, it is unclear whether the "additional material" that is going to be re-used as part of the ecological layer (page 23, first sentence, second paragraph) will be separated from work activities by a geotextile liner. The Service recommends that any material that is not overlain by a geotextile liner to separate it from work activities not be used as part of the ecological layer.

Pages 24 and 27-30: The text on page 24 states, "Any water collected from the pad will be pumped to the water treatment system for treatment prior to discharge." No information is presented regarding what that treatment will consist of, other than to say it will be in accordance with regulatory permits. While the section on sediment and water treatment (pages 27-30) goes into some detail regarding the treatment process, it does not include information regarding what water testing will consist of, or whether treatment will address contaminants of concern. Water from the sediment slurry pumped to the treatment area may have elevated concentrations of dissolved contaminants due to desorption or the release of pore water during sediment resuspension; the Service recommends that contact water collected during sediment processing be tested and treated as necessary to remove contaminants prior to discharge. Water with elevated contaminant concentrations should not be discharged back into the Pompton Lake system.

Page 32: The text states, "Note that placement of the first lift of the ecological-layer may be performed at the same time as the dredging. The two areas will be separated by a turbidity curtain to eliminate cross contamination. This curtain will be installed prior to capping in order to provide sufficient time for solids settling." The Service strongly recommends that placement of the ecological layer not begin within a dredging area until dredging is completed across the entire area and sufficient time has been allowed for resuspended sediment to settle (as confirmed by water quality testing within the turbidity curtain circumscribing the dredged area). In addition, no curtain should have to "be installed prior to capping," as the curtains should already have been in place prior to dredging. The Service recommends that curtains be placed only once, prior to dredging operations begin in an area, and removed only once, after placement of the ecological layer. The more times a curtain is installed or removed, the more sediments will be dislodged and resuspended.

Thank you for your consideration of these comments and recommendations. The Service looks forward to continued coordination with EPA in addressing contamination originating from the Pompton Lakes Works Site. Should you have questions on the above, please contact Melissa Foster at 609-382-5262, or by email at Melissa_foster@fws.gov.

Sincerely,

Eric Schrading
Field Supervisor

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