Appendix F
Technical Case for the Sustainable Remedy

to the Comments on behalf of the Lower Passaic River Study Area Site Cooperating Parties Group on the Proposed Plan for the Lower Eight Miles of the Lower Passaic River Study Area Portion of the Diamond Alkali Superfund Site

Overview

The Lower Passaic River Study Area (LPRSA) Cooperating Parties Group (CPG)[1] is nearing completion of a more than $100 million Remedial Investigation/Feasibility Study (RI/FS) study designed to determine the most effective method(s) to reduce the risk to human health and the environment from the contaminants found in the Lower Passaic River (LPR) sediment, water and ecology following applicable CERCLA guidance and regulation. Significant elements of the RI/FS have already been completed and submitted to Region 2 for review, and are referenced throughout this document. The current conclusion from the ongoing RI/FS is that the optimal solution for the river is a program that includes the removal and capping of the most highly contaminated sediment in the river, as well as ecological restoration. This approach – the "Sustainable Remedy" – is part of a comprehensive vision for the entire 17 miles of the lower river, where risks to human health and the environment are reduced, water quality is improved and communities can again value and enjoy the river.

The Sustainable Remedy provides a superior alternative to the bank to bank dredging approach selected by Region 2 in its Focused Feasibility Study and Proposed Plan (April 2014). Specifically, the Sustainable Remedy is designed to address the entire 17 miles of the LPR, achieve equivalent - or better - risk reduction, be accomplished much more quickly (with less negative impact on the river and adjacent communities), and includes river restoration and interim risk management provisions that are not part of EPA's Proposed Plan. Based on a detailed evaluation of the Sustainable Remedy and the bank to bank alternatives merely conceptualized by Region 2 in the FFS, the CPG has concluded that the Sustainable Remedy better meets the nine CERCLA remedy selection criteria and is more consistent with EPA's Sediment Management Guidance than any of the bank to bank dredging alternatives.

[1] The CPG includes more than 60 cooperating members. Many other parties who have been identified as potentially responsible are not members of the CPG. Most notably, Tierra Solutions/Maxus/Occidental Chemical, considered the most significant responsible party due to significant contribution of 2,3,7,8-TCDD, is no longer part of the CPG and no longer funding the RI/FS effort. In 2012, EPA issued a Unilateral Administrative Order (UAO) against Occidental for its failure to contribute toward the CPG's removal of 2,3,7,8 TCDD contaminated sediment at RM 10.9.

The Sustainable Remedy is currently well advanced within the RI/FS process and is scientifically sound. It has been developed through extensive technical evaluation of all the sediment, surface water and ecological data collected by the CPG (with Region 2 oversight) during the RI and by Region 2 and others in previous investigations. The numerical modeling developed by the CPG used to predict the future levels of contaminants in sediment and fish provides assurance that the remedy will be protective of human health and the environment. However, safeguards are built into the Sustainable Remedy consistent with EPA's sediment principles, including adaptive management. This is an iterative process whereby continued monitoring will be conducted after the sediment cleanup is completed and if progress towards the remedial goals is not achieved, the need for additional remediation will be evaluated.

Components of the Sustainable Remedy

The Sustainable Remedy consists of two integrated programs that will rapidly remediate contaminated sediment and help to restore the ecology along the entire 17 miles of the LPR:

1. Targeted removal and capping of approximately 150 acres of sediments in the LPR that contain the highest levels of near-surface contamination. The removal targets surface sediments in areas where elevated concentrations are observed at or near the sediment surface due to limited burial and areas of recent erosion into historic, contaminated sediments. Analyses performed as part of the ongoing Feasibility Study indicate this remediation can be constructed in approximately five to seven years and will reduce the average 2,3,7,8-TCDD surficial sediment concentration by approximately 80 percent, with other contaminants of potential concern (COPCs) approaching regional background concentrations. After the cleanup, the risk to human health during swimming, wading and boating will meet EPA target levels (10^{-4} to 10^{-6}), and the risks from fish consumption will approach EPA target levels and be equivalent to those achieved by Region 2's bank to bank FFS alternative.
2. Restoration programs that will improve water quality, reduce the impacts of invasive species, and create and enhance habitat that will ultimately encourage a healthy watershed ecology. These programs are expected to include components such as bank softening, riverfront park improvements that create habitat and provide greater river access, and projects such as creating wetlands and riparian habitat, planting shade trees, and constructing rain gardens, that will improve the watershed. Several of these projects are currently in the development stage within communities along the river.

The Sustainable Remedy's holistic approach to the Passaic River cleanup, where natural resource restoration efforts are combined with sediment remediation, is precisely

the program envisioned by the Urban Water Federal Partnership which the Passaic River was added to in May 2013.

Although the best science available supports the conclusion that the Sustainable Remedy will be protective of human health and the environment, within such a complex environment there are uncertainties that must be recognized and managed to ensure a successful conclusion. The Sustainable Remedy has incorporated two features that allow these uncertainties to be evaluated and addressed to ensure a successful outcome:

- First, the Sustainable Remedy will use "adaptive management", an iterative decision-making process designed to monitor and address uncertainties, as outlined in EPA's own sediment management guidance (EPA 2005[2]). Using adaptive management, the performance of the remediation will be evaluated to verify that the goals are being met. If the cleanup is not meeting the predicted outcome, the CPG will work with Region 2 to determine what additional remedial actions are needed.

- Second, a fish exchange program will be established in parallel with the sediment remediation. Studies conducted by the CPG have found that some anglers are consuming fish from the river, despite the state-mandated fish and crab consumption ban. By exchanging clean fish for fish caught in the LPR (or providing suitable alternatives such as vouchers), the risks from eating contaminated fish will be directly reduced while the Sustainable Remedy is completed and its effectiveness subsequently proven. The fish exchange will provide a supply of safe, high quality protein to community members who currently consume their catch as well as provide other benefits to the community. The feasibility of this approach is currently being evaluated through a veterans training and pilot program in association with Rutgers University.

Compliance with NCP Criteria and EPA Guidance

Remedies under consideration for the LPRSA must meet nine evaluation criteria specified in the National Contingency Plan (NCP). The Sustainable Remedy will meet these criteria and provide equivalent or better risk reduction and protectiveness than the EPA FFS remedial options. The Sustainable Remedy will be protective of human health and the environment by quickly removing surface sediments with the highest 2,3,7,8-TCDD concentrations (as well as other co-located COPCs) and, in the interim, by managing potential fish consumption risk through the fish exchange program. Consistent with the alternative in the Proposed Plan, it achieves long-term protectiveness by isolating buried contamination and enhancing natural recovery,

[2] EPA. 2005. *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites*. EPA-540-R-05-012.

however, it minimizes short-term impacts and community/economic disruptions by a shorter implementation period and less resuspension of contaminants than the Proposed Plan. [Note: Extensive engineering, including the evaluation by dredging contractors and transportation experts refutes the duration estimates for the implementation of the Proposed Plan presented by Region 2, and have been previously presented in these comments.] Further, the potential for recontamination following implementation of the Sustainable Remedy is reduced by addressing potential ongoing sources from the entire river.

The Sustainable Remedy is also more consistent with the 11 principles of EPA's "Guidance for Contaminated Sediment Sites" than the bank to bank dredging alternative in the FFS and Proposed Plan, including the use of phased actions that quickly reduce risk followed by monitoring to determine if any additional actions need to be implemented This results in a scientifically-sound approach that provides meaningful risk reduction in a more timely and responsive manner, enhances the ecology and value for local communities, and can offer the opportunity to learn from implementation and adapt to handle inherent uncertainties associated with large-scale sediment remediation projects.

Conceptual Site Model

As previously discussed, a Conceptual Site Model (CSM) Report, presenting the current understanding of the sources, fate and transport, and bioaccumulation of contaminants in the LPRSA has been submitted to Region 2 (December 2013), and is currently under review. This CSM was developed from the interpretation of all the extensive data collected to investigate the river. The data collected to understand the LPRSA conditions can generally be grouped into: (1) multiple rounds of sediment sampling (with analyses for physical, chemical and radiochemical parameters); (2) several bathymetric surveys; (3) physical and chemical water column monitoring; (4) analysis of benthic invertebrate and fish tissue; and (5) avian, fish, benthic and habitat surveys. Data have been collected throughout the LPRSA, from above Dundee Dam in the upper Passaic River, and in Newark Bay., This information has been supplemented with an extensive design-level data collection program at RM 10.9 Removal Area, where the CPG has completed a Removal Action of over 16.000 cubic yards in June 2014.

The efforts of the CPG have focused on the interpretation of these data and application of the numerical models that use all the available data to simulate and predict sediment and contaminant transport. These analyses provide a thorough understanding of the physical characteristics, hydrology, nature and extent of contaminants, and contaminant impact upon human health and the ecology in the LPRSA.

The CPG's understanding of the LPRSA is based on a number of detailed scientific evaluations, including:

(1) characterizing the behavior of freshwater and estuarine flows and associated sediment transport patterns;

(2) determining the extent of chemical contamination in LPR sediment and comparing the contamination within the LPRSA with the upper Passaic River and Newark Bay;

(3) analyzing radiochemistry data to evaluate depositional history and assess the stability of sediment throughout the LPRSA;

(4) characterizing changes in the elevation and morphology of the river bed over time, including conditions following extreme flows during Hurricane Irene (2011);

(5) modeling the structure of the food web and the pathways by which contaminants are transferred from sediment to fish;

(6) conducting human health risk evaluations to understand what contaminants and pathways are driving the risk; and

(7) characterizing potential risks to populations and communities of LPR ecological receptors to understand what contaminants, pathways and other stressors are most pertinent to the ecological health and recovery of the LPR.

These, and other studies that comprise the RI for the LPRSA, are used to develop a remedy focused on effectively addressing elevated risks to human health and ecological receptors from contamination in the LPRSA.

The following summary of the system understanding of the LPRSA highlights the important features of the LPRSA that support the implementation of a targeted remedial action to reduce risk and accelerate recovery:

Human Health and Ecological Risk

- The human health risk from contamination in the Passaic River is driven predominantly by the bioaccumulation of 2,3,7,8 TCDD and ingesting of these fish.

- Human health and ecological risk are driven by surface sediment concentrations. People (waders, boaters and swimmers) and fish and wildlife are exposed to surface sediment resulting in a direct contact risk. Finally, the data that has been collected show that the levels of contaminants in surface water are connected to the concentrations in surface sediment.

- The mudflats and shoals, which are the locations where the highest concentrations of contaminants in surficial sediment are typically found, represent areas of greatest potential exposure, both for humans where these sediments are accessible to recreational users, and for the ecological community as habitat for forage fish and wading birds.

- Invasive species contribute to the degradation of the LPRSA. For example, the common carp present in the river can degrade water quality, benthic habitat, and populations of valued fish and wildlife. Because of their comparatively higher body burden of bioaccumulative contaminants, consumption of carp also contributes significantly to potential human health risk.

- There are ongoing sources of non-COPC stressors such as nutrients, organic carbon and pathogens to the LPR that degrade water quality and damage the ecology.

Contaminant Distribution

- The data that have been collected and the analysis of the behavior of the river show that there are specific, predictable locations in the river, such as mudflats and point bars, where sediment containing high concentrations of 2,3,7,8- TCDD has accumulated. There are also areas with elevated surficial concentration of 2,3,7,8-TCDD that have experienced recent erosion. These areas, totaling approximately 150 acres, represent sources of human and ecological exposure, as well as ongoing sources of contamination to the rest of the river, inhibiting natural recovery. These areas also contain several other COPCs, including PCBs, DDX and mercury.

- The areas where the highest concentrations of surface sediment are found are located in the lower 14 to 15 miles of the river. This is a function of both the sediment type (more fine-grained sediment) and the limit of upstream tidally-induced contaminant transport.

- The sediment bed throughout the river is generally stable, and, in many locations, particularly within the navigation channel, the highest COPC concentrations have been buried since their release several decades ago. This is supported by several lines of evidence including vertical contaminant profiles and radiodating. These stable, buried sediments do not pose a risk to human or ecological receptors and are not mobilizing COPCs into the system. In contrast, there are a number of locations, primarily mud flats and point bars, throughout the lower 12 miles of the river where steady state conditions were reached many

years ago, and elevated concentrations of contaminants are found in surface sediment.

Natural Recovery

- Natural recovery (the reduction in surface sediment concentrations) is seen throughout much of the LPR as surficial sediments are buried by and mix with incoming cleaner sediments from upriver. This natural recovery process is ongoing. Although burial has slowed as infilling has slowed, some areas remain highly depositional and mixing of clean sediment in the upper several inches of the sediment bed is occurring. Fish tissue concentrations have declined in response to recovery of the surficial sediments. Future recovery of surficial sediments can be expected to result in a continued decline in fish tissue concentrations.

- The recovery is most apparent in those locations where the net sedimentation rates are greatest. Recovery is not observed in locations such as the mudflats above RM 7 where there is no significant burial or erosion, and in these locations surficial sediment COPC concentrations remain elevated.

- COPCs enter the LPRSA from Newark Bay and over Dundee Dam. The importance of these ongoing sources, with the exception of 2,3,7,8-TCDD, is evident by the similar average surficial sediment concentrations of contaminants other than 2,3,7,8-TCDD within and outside of the LPR. To the extent that COPCs enter the LPRSA from Newark Bay and over Dundee Dam, sediments with elevated COPCs concentrations act as sources to the LPRSA. The extent that recovery can occur in the LPR is controlled by these ongoing sources; remedial actions performed within the LPR cannot reduce COPC concentrations below those of any ongoing sources due to recontamination.

- High flows of the recent past[3] have uncovered previously buried sediments and exposed relatively high COPC concentrations at the surface. These areas now provide a source of contaminated sediments to the rest of the LPR and likely slow natural recovery.

Basis for the Targeted Removal

The first component of the Sustainable Remedy is a targeted removal of approximately 150 acres of LPR sediments with the highest levels of near-surface contamination that

[3] Daily average flow at Little Falls exceeded 13,000 cfs [the 10-year flood] twice in the 47 years from 1949 to 1995 and six times in the 16 years from 1996 to 2011

present the majority of the risk and inhibit recovery. The data demonstrate that there is clear structure to the distribution of concentrations of 2,3,7,8-TCDD and other COPCs in the LPR sediments and that these patterns are explainable based on our understanding of historical sources and how the river functions. Although the deeper sediments in the LPR are stable, there are areas of the river where surficial sediments with elevated COPC concentrations are contributing to potential risk and slowing recovery. These areas are the focus of the targeted removal and isolation of contaminated sediments because management of these areas will provide an appropriate and effective remedy.

These targeted areas are responsible for much of the potential human and ecological risk because they not only contain high levels of 2,3,7,8-TCDD and other persistent COPCs that are significantly above the concentrations in other areas in the LPR and significantly above urban background levels Also, because most of the targeted areas are found in shallow parts of the river with easier access for humans and with more productive ecologies than the channels. These areas are ongoing sources of 2,3,7,8-TCDD to other locations of the LPR through erosion and diffusion to the water column. Therefore, these sediments should be the focus of any remedial activities as they have a disproportionately higher impact on human health and the environment than the rest of the LPRSA.

The stable sediments in the lower seven miles with generally lower surficial COPC concentrations do not present such risks and will recover more quickly after the source areas are addressed. The sediments in the channels show lower concentrations of COPCs due to net deposition and mixing of sediments with lower concentrations. These areas where the surface concentrations are lower should not be disturbed as doing so will unnecessarily introduce more contaminant mass into the system and slow the ongoing natural recovery.

Delineation of Target Areas

The CSM defines two characteristic areas that contribute the greatest potential for human and ecological risk, and/or may be providing ongoing sources of contaminants to the LPRSA. These areas were delineated to identify the target areas for remediation:

1. Areas where episodic erosion exposes buried historic sediments with elevated concentrations that provide a source of COPCs for the rest of the LPR, and are inhibiting recovery. These areas were observed primarily below RM 7.

2. Areas where elevated concentrations of 2,3,7,8-TCDD are observed at or near the surface, and where ongoing recovery has slowed or ceased (e.g., RM 10.9). These areas have the highest impact on potential risk because they tend to be shallow and near shore, where people are more likely come in

direct contact with these sediments. In addition, these areas tend to be the most productive ecological areas because they are shallow, so more light reaches the bottom, and the water does not move as quickly. Therefore these areas have the highest population of smaller prey fish, vegetation and benthic organisms. This combined with the higher concentration of COPCs in these areas results in a very significant impact to the contaminant load in the food chain. These areas are primarily located above RM 7.

The targeted removal balances the need to clean up the areas subject to erosion and the near shore areas where high concentrations of 2,3,7,8-TCDD are found in sediment with the objectives of quickly conducting the sediment remediation and minimizing the disruption and impacts on the river and the river front communities. A detailed evaluation of the distribution of contaminants in surface sediment shows that cleaning up additional areas beyond those included in the Sustainable Remedy will provide little additional benefit relative to reducing risk, but will dramatically increase the time needed to complete the cleanup and the disruption and impacts of the cleanup.

Based on the distribution of contaminants throughout the river, it has been concluded that targeting surface sediment containing approximately 500-1,000 ppt of 2,3,7,8-TCDD optimizes the efficiency of the cleanup. Targeting lower concentrations of TCDD increases the area and volume of sediment (and increases the time of cleanup and the resuspension of contaminants) but does not provide commensurate reductions in surface concentrations.

Target removal areas have been developed to address surficial sediments with 2,3,7,8-TCDD concentrations above 500 ppt. The target area boundaries were delineated based on 2,3,7,8-TCDD concentrations and other criteria including surficial sediment texture (i.e., the location of silt deposits), bathymetric gradients, geomorphic regions, and dredging history. Other considerations for the delineation of the target areas included surficial sediment total PCB concentrations, and areas with surficial sediment 2,3,7,8-TCDD concentrations below 500 ppt, but identified as erosional, slowly recovering, and/or potential human health exposure areas. These criteria are subject to further evaluation and are all a function of river dynamics. Therefore evaluation of these properties also allows for the prediction of the extent of the highly contaminated areas. The ~30 proposed target areas are located between the mouth of the LPR and RM 14.6 and comprise approximately 150 acres, or ~16% of the lower 14.6 miles of the sediment bed on an area basis (Figure 1). The target area boundaries will be further refined as part of the Remedial Design process. During the Remedial Design additional data will be collected in and around the targets, as implemented at RM 10.9, to develop the specific details necessary to perform the remediation in each area.

Recovery Projections

Evaluation of the immediate impact of the removal of the targeted areas using numerical models shows that the effects on the river will be remarkable. The CPG has been working under the oversight of the EPA to develop these models, and the report for the sediment transport model has been submitted to Region 2 in August 2014. Additional reports documenting the framework and calibration of the bioaccumulation and fate and transport models are under development and will be submitted to Region 2 by the end of 2014.

Evaluating the long term effects of a proposed remediation is supported by the use of these mathematical models that have been developed and calibrated to simulate the river dynamics and predict how the surficial sediments change over time. The models simulate the hydrodynamic conditions in the river, the movement of sediments and how contaminants behave in the system. These results are then used to predict how much of the contamination will move in the food chain and how that will in turn impact human health and the environment. When the Sustainable Remedy is entered into the CPG's current version of the model, the result shows that the risks are effectively managed. When the Sustainable Remedy is compared with the remedial alternatives presented in the FFS and Proposed Plan, the model predicts that the surface sediment concentrations over the 17-mile study area are better than or equal to those expected following the implementation of the Proposed Plan. These ongoing modeling efforts represent an integration of the CSM and all of the applicable RI data to provide a useful representation of the important processes in the system and the best possible projection of post-remedy surface concentrations. As part of the ongoing RI/FS, the model is still under development and the results presented below are preliminary; however these results provide a useful means for a comparative analysis. The predictions from these models are helpful in comparing remediation alternatives and developing a strategy for evaluating how well the remediation is meeting the goals set for the river. It is important to note that model is able to simulate all the activities in a river, and therefore it is important to monitor the results of the remediation in the river and adapt the remediation as needed to reach these goals.

The targeted removal, as described above, is compared with remedies proposed by Region 2 in the FFS. The following remedial alternatives are evaluated:

- Monitored Natural Recovery (MNR)
- Cap and Dredge of the Lower 8 miles (~15 years implementation period, without the navigational dredging presented in the Proposed Plan)
- Full Dredge of the Lower 8 miles (~45 years implementation period)
- Targeted Removal (currently estimated with 5-7 year implementation period)

Two graphs that show the model results are provided. They show the predictions of 2,3,7,8-TCDD concentrations in surficial sediment (top six inches) over time for the four remediation alternatives currently being discussed (natural recovery, the Sustainable Remedy, and the two FFS alternatives developed by Region 2). Figure 2 shows the results for river miles (RM) 0-8 and Figure 3 show the predictions for the entire 17-mile of the LPRSA. Evaluation of these graphs indicates the following:

- The targeted removal achieves lower surficial concentrations more quickly than the FFS alternatives, due to the removal of the areas with the highest surficial COPC concentrations, the significantly shorter implementation time and the lower amount of resuspension and recontamination.
- The concentrations achieved by the targeted removal at the end of the projection are within a factor of two of the FFS alternatives for the lower 8 miles, suggesting similar predicted concentrations for the alternatives, given that the difference between the results are within the range of uncertainty for the long-term projections.
- The targeted removal achieves lower surficial concentrations over the entire river during and following implementation, as it addresses the entire 17-mile LPRSA.

Risk reduction associated with the proposed remedies was evaluated using fish tissue concentrations predicted by a food web model. Risk was calculated for an adult angler using Reasonable Maximum Exposure (RME) assumptions provided by Region 2 for the LPRSA Baseline Human Health Risk Assessment (Figure 4). This Baseline Risk Assessment was submitted to Region 2 in June 2014. The evaluation shows that risk from fish consumption is more rapidly reduced by removal of mudflats and shoals with elevated COPC concentrations (the Sustainable Remedy) than by the cap and dredge or full dredge in the lower 8 miles (FFS alternatives) or by a combined remedy (not evaluated in the FFS), assuming cap and dredge for the lower 8 miles and the targeted removal above RM 8.

The risk evaluations (which are informed by the CPG's ongoing Creel Angler Survey[4]) suggest that a meaningful option for reducing human health risk is to reduce or eliminate the consumption of carp. Some of the anglers interviewed along the LPR report catching and eating carp, which generally have the highest concentrations of 2,3,7,8-TCDD measured in LPR fillet samples. The results of the preliminary risk evaluations have shown that by replacing carp in a person's diet with native fish species found in the river, the risk from fish consumption can be lowered by approximately 30%. One of the ways in which a change in diet can be accomplished is by managing the invasive carp

[4] See *Analysis of Catch Preferences of Lower Passaic River Study Area Anglers,* Draft Report, June 2013

population in the river[5]. Carp were introduced in the Passaic River in the late 1800s and have since become a dominant species in the LPR. Because of their abundance, carp are easy to catch. With a reduction in the population of LPR carp, anglers will target other native species they prefer (e.g., striped bass, largemouth and smallmouth bass, pike, catfish, perch) which have lower concentrations of 2,3,7,8-TCDD than carp.

Reduction of the number of carp in the river will also have the added benefit of restoring river ecology. Carp are omnivorous, eating aquatic plants, other fish species eggs, and benthic invertebrates. Carp feeding behaviors adversely impact the ecology of the LPR by removing subaqueous vegetation and increasing turbidity and contaminant load to the water. Reduction in the carp population will promote restoration of habitat that favors native fish species.

The CPG is currently working with Region 2 to evaluate how to manage the carp in the river.

Reducing the carp population will have the combined benefit of reducing human health and ecological risks associated with food chain exposures, reducing the ecological damage caused by this invasive species, and promoting the growth of native species of fish and vegetation. When carp management is combined with sediment remediation, the risk from fish consumption can be brought into EPA's target risk range.

Summary

The Sustainable Remedy is a comprehensive approach to the entire seventeen miles of the Lower Passaic River. It focuses remediation on areas that, when addressed, are expected to have the greatest impact on recovery in a more timely manner. The Sustainable Remedy:

- Addresses the entire LPRSA as an interim remedy with an ongoing adaptive and iterative approach;
- Is protective of human health and the environment;
- Reduces the duration of the disturbance of the LPRSA;
- Addresses areas with elevated surficial concentrations of COPCs that pose the greatest potential risk;
- Addresses erosional areas which could expose high concentration sediments;
- Enhances the ongoing natural recovery;
- Provides a scientifically-sound, credible and implementable alternative to the remedies proposed under the FFS;

[5] Windward. 2013. Common carp (*Cyprinus carpio*) as an environmental stressor and methods for its management in the Lower Passaic River, technical memorandum. Draft. Prepared for Cooperating Parties Group, Newark, New Jersey. June 8, 2013. Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Windward Environmental LLC, Seattle, WA.

- Addresses the most ecologically valuable areas first;
- Brings value back to the communities quickly; and
- Manages the uncertainty inherent in any remediation through on-going monitoring, adaptive management and the fish exchange program.

The Sustainable Remedy protects the ecological community and human health, minimizes resuspension and manages uncertainty. It is consistent with the EPA guidance, which encourages adaptive management approaches at complex sites and periodic reviews of remedy performance.

The Sustainable Remedy is an integrated, watershed approach to the management of the river. The out-of-river projects will be selected with input from communities within the LPRSA to address ecological improvements, facilitate human use and enjoyment of the river, and demonstrate the benefits of watershed improvements as part of the solution for managing urban water quality issues. The out-of-river projects will also include support for community education programs and will provide opportunities to support the local economy.

Given the extent of the LPRSA and the unprecedented scope of EPA's Proposed Plan, there is necessarily uncertainty associated with estimates of the response and future behavior of the system. Following implementation of the targeted removal, continued monitoring will be performed to measure the effectiveness of the remedy. Monitoring will include periodic data collection of fish tissue, ecological receptors, and bathymetry to evaluate the success of the remedy. During the implementation and evaluation period, a fish exchange program will be introduced to manage human health risk from fish consumption. If the remedy does not meet the goals, additional remedial actions will be considered, adaptively managing the recovery of the LPRSA.

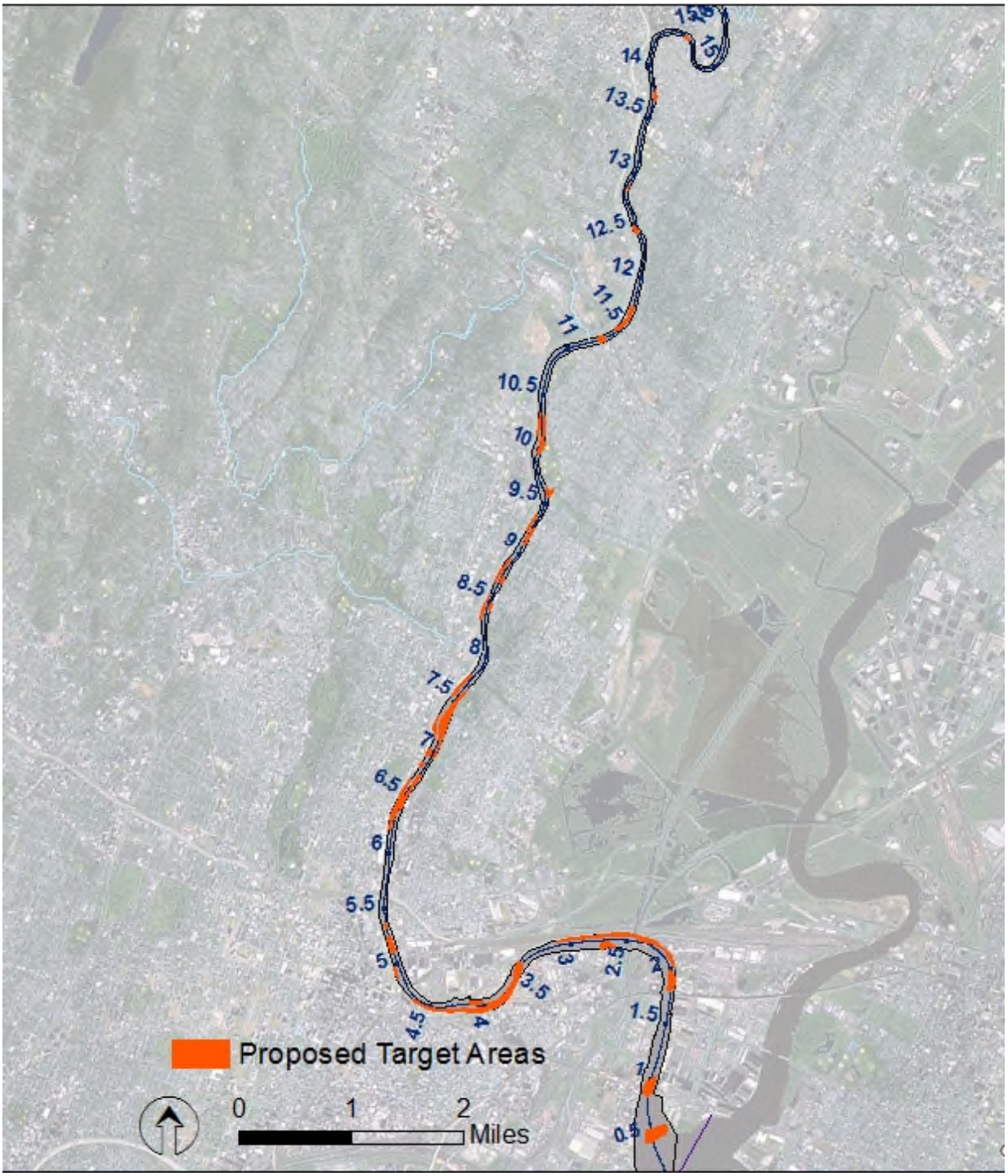

Figure 1 Proposed Target Areas

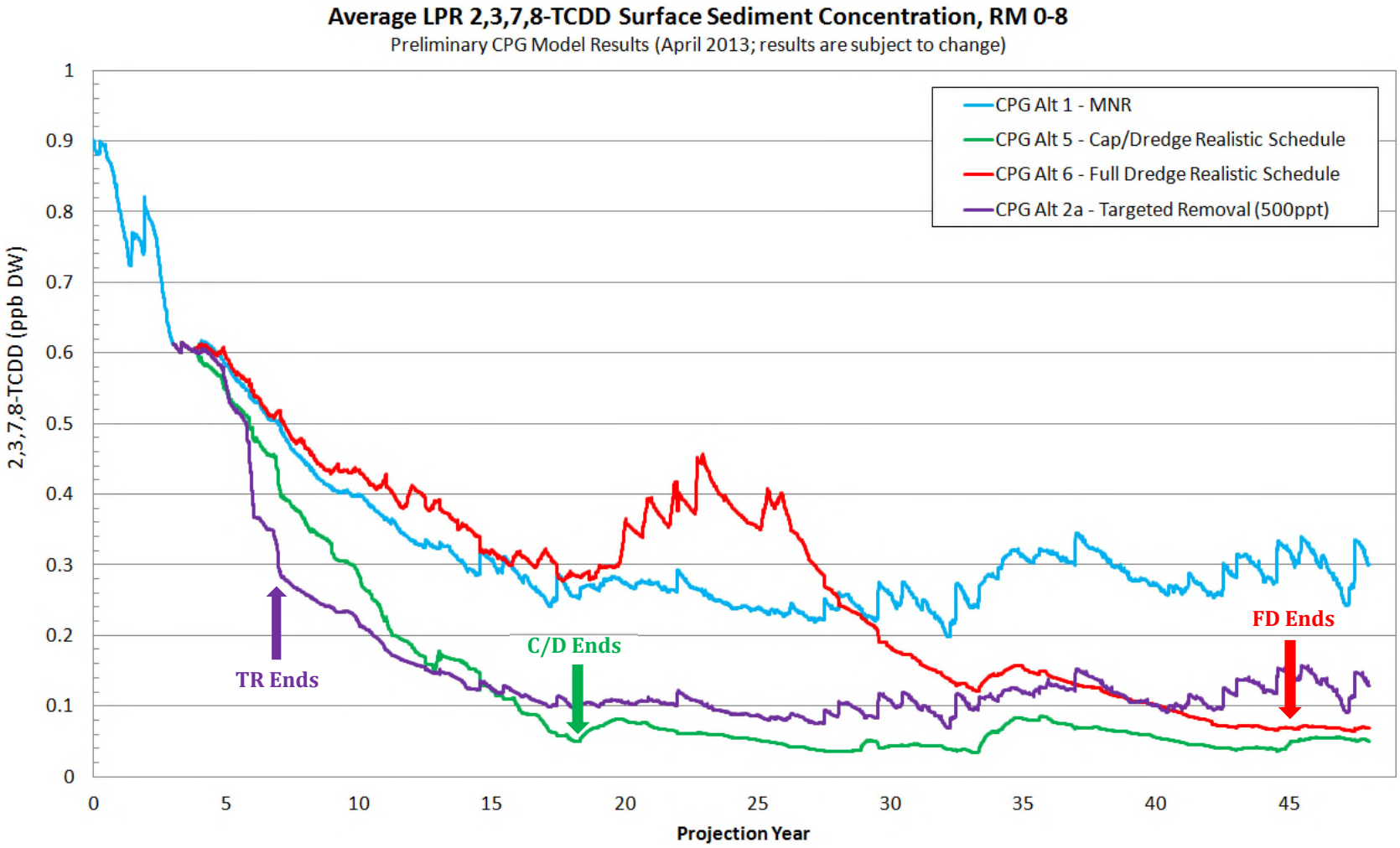

Figure 2 Comparison of Predicted Sediment Recovery Curves, RM 0-8

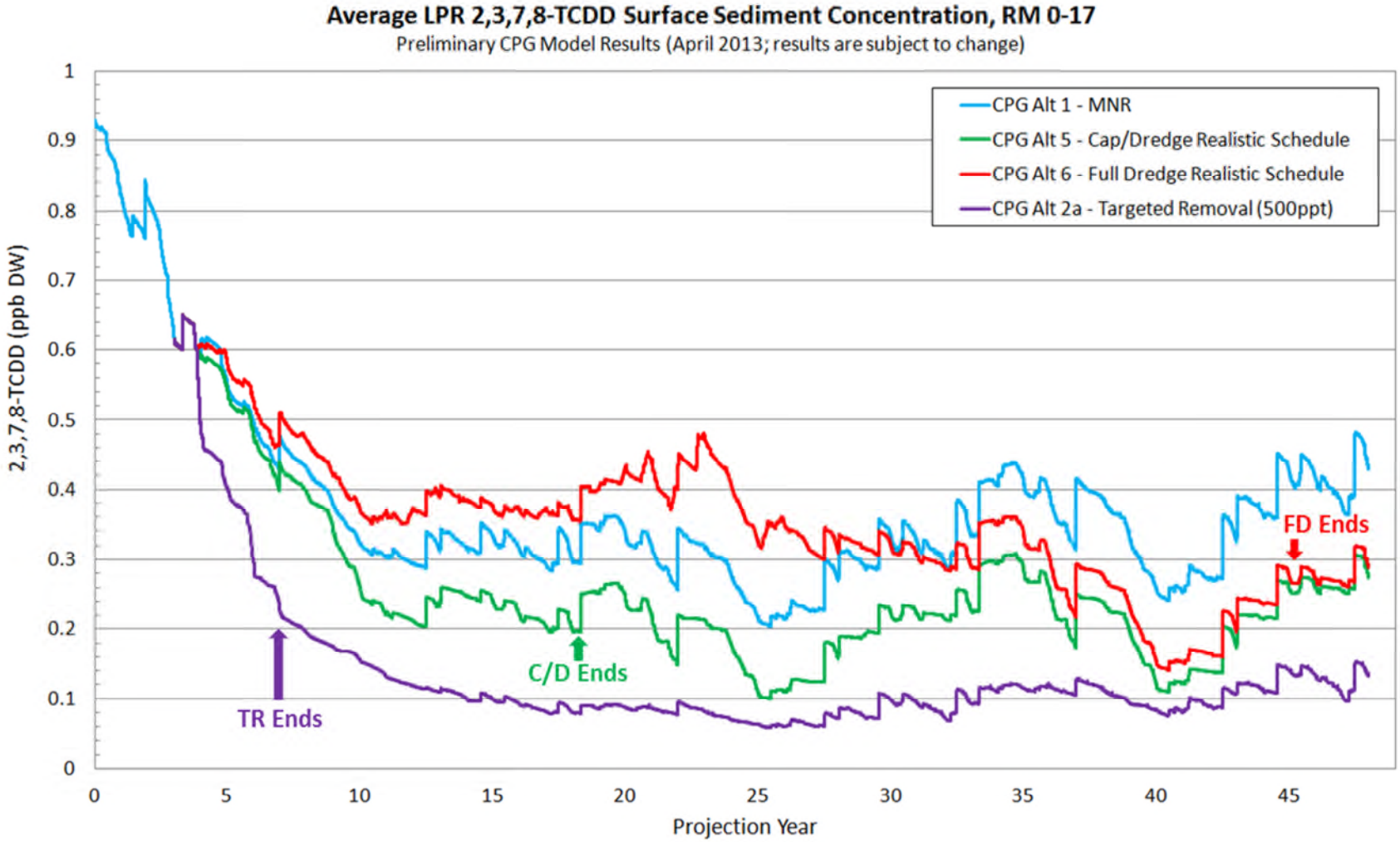

Figure 3 Comparison of Predicted Sediment Recovery Curves, RM 0-17

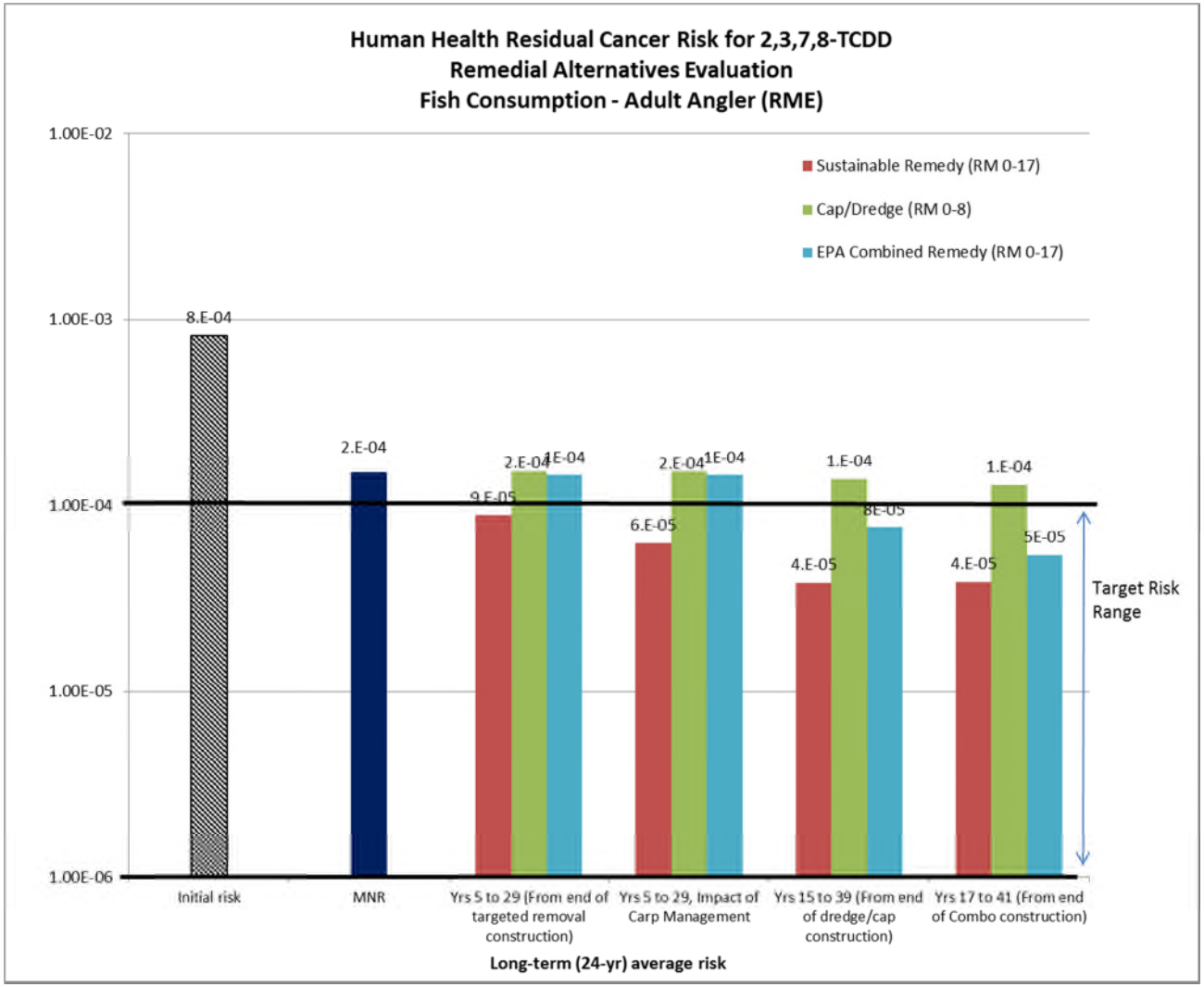

Figure 4 Comparison of Predicted Human Health Cancer Risk