Appendix A part 3

which identified cleanup target ranges of 5 ug/kg to 20 ug/kg dioxin TEQ for industrial facilities and 1 ug/kg dioxin TEQ for residential soils. The directive noted that these recommended levels are generally considered protective of human health and the environment. Ultimately, USEPA selected a sediment cleanup goal of 1.0 ppb of dioxin (I-TEQ). Given the distribution of contaminants in sediment, achieving a cleanup goal of 1 ppb for dioxin (I-TEQ) will likely result in a surface area weighted average concentration in the upstream reach approaching 0.41 ppb.

Application of this delineation number was applied to all three reaches of Welch Creek with the following results:

- Upstream Reach: This RGO defines an area in the upstream reach of Welch Creek from approximately MT-6 to MT-3 where surficial concentrations of dioxin I-TEQ exceed 1 ppb. This reach extends approximately 5,300 feet and consists of post-1970 wastewater solid deposits that contain elevated dioxin concentrations (Figure I-1).
- Midstream Reach: In the midstream reach of Welch Creek (extending from MT-7 to GT-15), the sediment dioxin concentration (maximum of 64 ppt I-TEQ) is below the delineation concentration.
- Downstream Reach: Surficial sediment concentrations in the downstream reach (area extending MT-10 to the mouth of Welch Creek) are below this concentration so this area is not given further consideration in the Welch Creek FS.

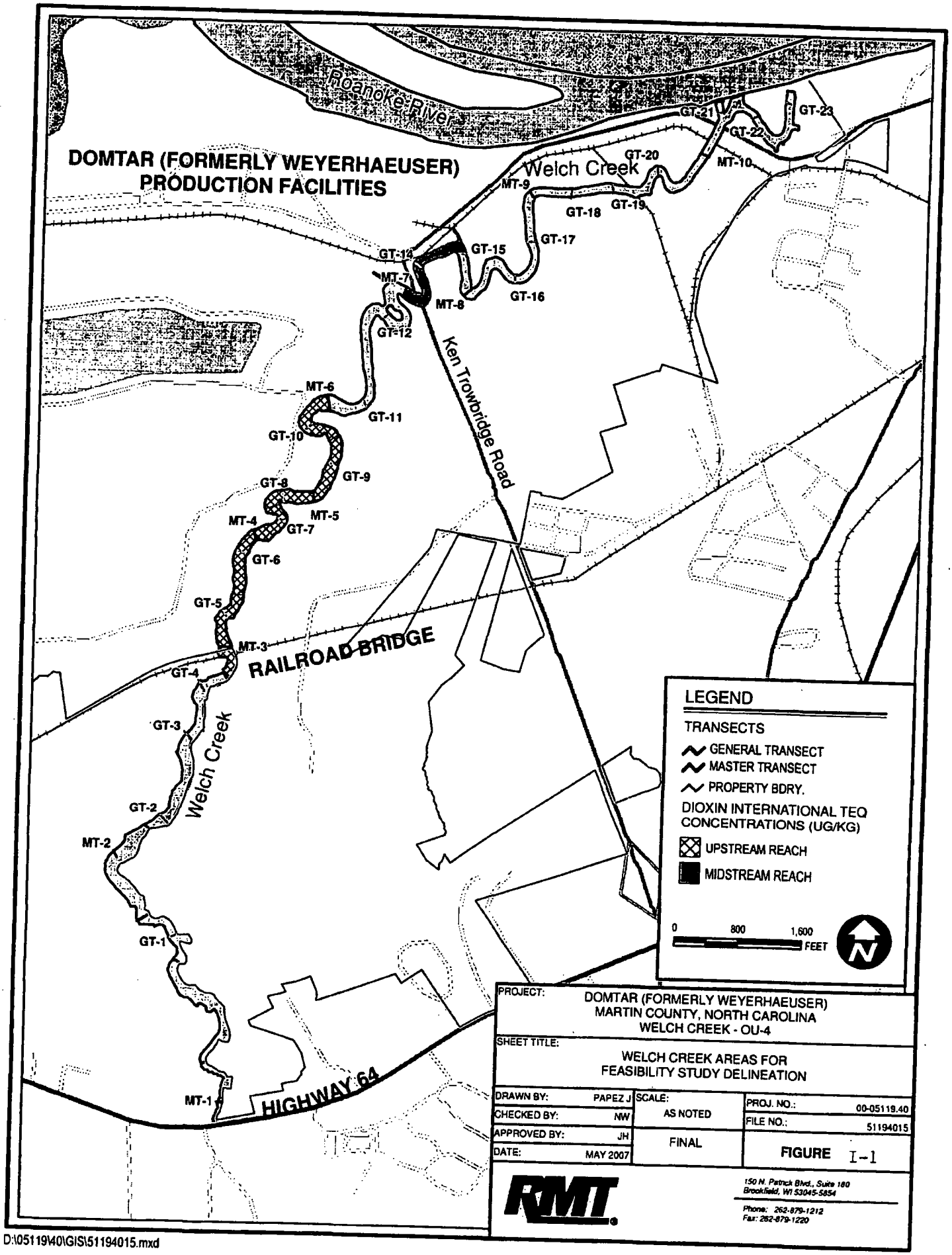
The USEPA also considered a mercury RGO and determined that establishing a RGO for mercury does not appear to be appropriate at this time due to the possibility of airborne deposition from other sources. However, mercury will be included in long term monitoring as part of the remedy.

Consideration of Sediment Mobility

An analysis of the sediment mobility during various flow events was performed on Welch Creek as part of the RI activities and then independently assessed by the USACE. The predicted conditions that would result in sediment migration were based upon different hydrodynamic models, but the same general approach of comparing predicted stream velocities with estimated sediment shear strength was used. The models are in agreement with regard to a number of key observations and conclusions.

- The upstream reach and downstream reaches of Welch Creek were predicted to be more stable under foreseeable conditions, and therefore, presented a low risk of sediment erosion and mobilization.
- The highest shear stresses exerted by the flowing water are generated in the "midstream reach" of Welch Creek bound by transects MT-7 and GT-15 (i.e., approximately 1,380 linear feet). This area presents the highest potential for sediment mobility.
- Based upon the mobility modeling conclusions, the only remaining area of potential concern for migration was a limited reach in the center of the Welch Creek OU. This midstream reach was defined by the USACE to extend from MT-7 to GT-15 (approximately 1,380 feet), as shown on Figure I-1. In response to the modeling, the midstream reach has been identified as an area of potential sediment migration and, thus, a possible contributor to exceeding the dioxin surface water standard (an ARAR).

The analysis by the USACE considered various events including a wind tide, Northeaster storm, Hurricane Dennis, and several return events (2 year, 5 year, 10 year, 25 year, 50 year, 100 year). Storm events will influence the water level in the lower Roanoke River which will in turn influence water levels and flows in Welch Creek. The USACE generally concluded that the midstream reach is the reach that had the highest potential for sediment mobilization due to either tidal or return flood events.



PROJECT:	DOMTAR (FORMERLY WEYERHAEUSER) MARTIN COUNTY, NORTH CAROLINA WELCH CREEK - OU-4		
SHEET TITLE:	WELCH CREEK AREAS FOR FEASIBILITY STUDY DELINEATION		
DRAWN BY: PAPEZ J	SCALE: AS NOTED	PROJ. NO.:	00-05119.40
CHECKED BY: NW		FILE NO.:	51194015
APPROVED BY: JH	FINAL	FIGURE	I-1
DATE: MAY 2007			

RMT
150 N. Patrick Blvd., Suite 180
Brookfield, WI 53045-5854
Phone: 262-879-1212
Fax: 262-879-1220

D:\05119\40\GIS\51194015.mxd

Other Media of Potential Concern

Other media of potential concern include the wetlands adjacent to the Welch Creek area. For exposure scenarios associated with these adjacent wetlands, the Welch Creek risk assessments did not identify an adverse risk posed by the COCs (see also additional discussion in Section M.4.2.). However, wetland soils and concentration trends (spatial and temporal) will be monitored immediately after remedy implementation to confirm that dioxin and mercury concentrations did not increase after remedy implementation.

Summary of Areas to be Addressed

- Upstream Reach: From MT-6 to MT-3 (approximately 5,300 feet). This area is of concern due to elevated dioxin concentrations found in surficial sediment. The upstream reach consists of post-1970 wastewater solid deposits. Applicable RAO: Limit biological uptake of COCs from the sediment in areas with excess potential risk, to the extent practicable.
- Midstream Reach: From MT-7 to GT-15 (approximately 1,380 feet). This area is of potential concern due to sediment migration predictions by the USACE for certain storm events. The midstream reach consists of pre-1970 wastewater solid deposits that contain higher percentages of sand. Applicable RAO: Minimize significant migration of COC-containing sediment in delineated areas of concern, to the extent practicable.

J. Description of Alternatives

As required in the NCP, remedial technologies were screened for effectiveness, implementability and cost. After screening, the following technologies were retained for assembly into alternatives:

- Upstream: No Action, Monitored Natural Recovery (MNR), Enhanced Monitored Natural Recovery (eMNR™), Engineered Cap, and Dredging with a thin layer cap to control residuals
- Midstream: No Action, Mobility Monitoring, Channel Rerouting, eMNR™, and Dredging

Ten alternatives were then assembled integrating all of the technologies to provide a range of effectiveness and cost.

Common Elements of Alternatives

With the exception of No Action, all of the remedial alternatives being evaluated for Welch Creek share some common components. Specifically, engineering and institutional controls, operations and maintenance, as well as short-term and long-term performance monitoring are included in each alternative. The following is a brief description of the shared components.

Engineering and Institutional Controls: There are two levels of engineering and institutional controls included in the Welch Creek alternatives. These are the existing fish consumption advisory which is controlled by the North Carolina Division of Public Health and other site related controls. The other on-site controls include routine inspection and repair or replacement of existing site fence and no trespassing signs to restrict access. Deed restrictions would also placed at the Site to limit land development that could impact the remedy on areas where the sediment would be contained by the eMNR™ remedy.

Operations and Maintenance Each remedial alternative includes up to 30 years of Operations and Maintenance (O&M) activities for actions that involve the inspection and on-going repair of in-water systems (engineered caps, thin-layer caps), on-shore material processing operations (dewatering and water treatment systems), and maintenance of monitoring equipment.

Short-Term Performance Monitoring: The short-term performance monitoring integrated into each alternative includes monitoring as well as sampling and analysis activities that are conducted before, during, and immediately after remedy implementation. Details will be developed during preparation of the Remedial Design/Remedial Action Work Plan. Possible components of pre-remedy sampling include:

- Collection of midstream reach samples for total mercury and AVS/SEM testing
- Supplemental bathymetric/debris surveys in mid and upstream reaches
- Selected confirmation of sediment characteristics in upstream and midstream reaches (sediment thickness across channel, water depths, sediment depth along side slopes and around debris, sediment grain size confirmation, initial SWAC, etc.)
- Pre-remedy fish sampling

Implementation monitoring is expected to include real time monitoring of turbidity, DO, velocity, and flow direction and recording of weather conditions and will be presented with the final design.

Long-Term Performance Monitoring: Each of the remedial alternatives includes long-term performance monitoring as a component of the remedy. Data from the final performance monitoring program will form the basis for updating the Welch Creek site conceptual models and adapting the selected remedy for greater success. Details of the performance monitoring plan will be developed during the remedial design as part of a performance standard verification plan.

Mercury Monitoring: Since mercury was identified as a site related COC in the Welch Creek BERA, mercury monitoring has also been included as part of long-term performance monitoring. Mercury concentrations in both wetland soil and in whole bluegills will be monitored before and after remedy implementation and compared to reference concentrations.

Multiple Lines of Evidence for Performance Monitoring Results: Multiple lines of evidence (physical, chemical, biological, and habitat indicators) will be used to evaluate progress toward and achievement of the RAOs for Welch Creek. Possible performance metrics will include both direct and indirect measures that can be used together to assess the remedy progress. Declining trends in fish tissue concentrations are the primary goal at Welch Creek. However, since there is no accurate method to predict exactly when these targeted tissue concentrations may be achieved, additional lines of evidence like benthic invertebrate dioxin concentrations and surface area weighted average concentrations may be used with the Site Conceptual Model to help assess overall remedy effectiveness.

Description of Individual Alternatives

Alternative 1: Upstream Reach – No Action; Midstream Reach – No Action

No Action provides a baseline alternatives for evaluation of the other alternatives.

Upstream Reach – In the upstream reach No Action will not be effective at reducing surficial sediment concentrations.

Midstream Reach – No Action may be appropriate in the midstream reach because concentration already meet the RAOs and the modeled erosion potential may overstate the mobility risk.

- No treatment or containment technologies (other than those already in place)
- The Welch Creek fish tissue consumption advisory will continue until tissue concentrations are below applicable thresholds.
- Operation and maintenance is not required as no remedy is implemented
- No ongoing long term monitoring

Capital Costs:	$ 0
O & M Costs (Present Worth):	$ 0
Contingency Costs:	$ 0
Total Present Worth Costs:	$ 0
Duration to Finish Construction:	Immediate

Alternative 2: Upstream Reach – Monitored Natural Recovery; Midstream Reach – Mobility Monitoring

Upstream Reach – Monitored natural recovery consists of monitoring sediment, benthic invertebrate, and fish tissue concentrations as the system naturally recovers. Currently Welch Creek experiences a low influx of total suspended solids significantly reducing the potential for MNR to be effective in meeting RAOs.

Midstream Reach – Mobility monitoring includes thorough monitoring of sediment for potential mobilization. . Additional hydrologic modeling may be appropriate to refine the mobilization potential.

- No treatment or containment technologies (others than those already in place).
- The Welch Creek fish tissue consumption advisory will continue until tissue concentrations are below applicable thresholds.
- Operation and maintenance is not required as no remedy is implemented.
- Long-term monitoring will be implemented in the upstream and midstream reaches. The upstream monitoring plan would focus on evaluating fish tissue trends, sediment concentrations, and monitoring benthic invertebrates. The midstream reach focus will be on sediment mobility trends.

Capital Costs:	$ 2,096,000
O & M Costs (Present Worth):	$ 2,963,000
Contingency Cost:	$ 1,012,000
Total Present Worth Costs:	$ 6,071,000
Duration to Finish Construction:	Immediate

Alternative 3: Upstream Reach – eMNR™; Midstream Reach – Mobility Monitoring

Upstream Reach – eMNR™ enhances natural burial and deposition processes by providing a thin granular cover material (5 to 10 cm) over the sediment. eMNR™ also includes active monitoring and adaptive management components to ensure remedy success. The thin layer sand cap would cover approximately 18 acres of creek bottom.

Midstream Reach – Mobility monitoring includes monitoring the sediment for potential mobilization and additional hydrologic modeling, if appropriate.

- eMNR™ in the upstream reach is a containment remedy that reduces bioavailability and exposure to contaminants.
- The Welch Creek fish tissue consumption advisory will continue until tissue concentrations are below applicable thresholds.
- eMNR™ in the upstream reach would contain a detailed maintenance plan to ensure long term remedy integrity.
- Long-term monitoring in the upstream reach will focus on evaluating fish tissue trends, sediment concentrations, and monitoring benthic invertebrates. The midstream reach monitoring plan would focus on the continued evaluation of water depth and sediment mobility to ensure risks are minimized.
- Institutional controls and deed restrictions would be placed and/or maintained at the site including continuance of the existing fish consumption advisories, maintenance of the existing fencing which limits access to the Welch Creek area, maintenance of signs in Welch Creek noting fish advisories and the presence of the sand cover, and deed restrictions to limit land development that could impact the remedy on areas where the sediment would be contained by the eMNR™ remedy. Fish consumption advisories would continue until State of North Carolina guidelines have been met.

Capital Costs:	$ 5,088,000
O & M Costs (Present Worth):	$ 2,887,000
Contingency Costs:	$ 1,595,000
Total Present Worth Costs:	$ 9,570,000
Duration to Finish Construction:	1 Year

Alternative 4: Upstream Reach – eMNR™; Midstream Reach – eMNR™

Upstream Reach – eMNR™ enhances natural burial and deposition processes by provided a thin cover material (5 to 10 cm) over the sediment. eMNR™ also includes active monitoring and adaptive management components to ensure remedy success.

Midstream Reach – eMNR™ provides a thin cover material (5 to 10 cm) over the sediment to improve resistance to erosion and to serve as a sacrificial layer, if sediment mobility occurs. In this alternative, the thin layer sand cap would cover approximately 22 acres of creek bottom considering both the upstream and midstream reaches.

- eMNR™ in the upstream reach is a containment remedy that reduces bioavailability and exposure to contaminants. While, the application of eMNR™ in the midstream is a sacrificial layer designed to reduce potential mobilization of low levels of contaminants.
- The Welch Creek fish tissue consumption advisory will continue until tissue concentrations are below applicable thresholds.
- eMNR™ in the upstream and midstream reach would each contain a detailed maintenance plan to ensure long term remedy integrity.
- Long term monitoring will focus on evaluating fish tissue trends, sediment concentrations, and monitoring benthic invertebrates.
- Institutional controls and deed restrictions would be placed and/or maintained at the site including continuance of the existing fish consumption advisories, maintenance of the existing fencing which limits access to the Welch Creek area, maintenance of signs in Welch Creek noting fish advisories and the presence of the sand cover, and deed restrictions to limit land development that could impact the remedy on areas where the sediment would be contained by the eMNR™ remedy. Fish consumption advisories would continue until State of North Carolina guidelines have been met.

Capital Costs:	$ 5,513,000
O & M Costs (Present Worth):	$ 3,117,000
Contingency Costs:	$ 1,726,000
Total Present Worth Costs:	$ 10,356,000
Duration to Finish Construction:	1 Year

Alternative 5: Upstream Reach – eMNR™; Midstream Reach – Channel Rerouting

Upstream Reach – eMNR™ enhances natural burial and deposition processes by provided a thin cover material (5 to 10 cm) over the sediment. eMNR™ also includes active monitoring and adaptive management components to ensure remedy success. The thin layer sand cap would cover approximately 18 acres of creek bottom.

Midstream Reach – Creating a new channel and redirecting the flow will reduce the risk for COC mobilization in this reach.

- eMNR™ in the upstream reach is a containment remedy that reduces bioavailability and exposure to contaminants.
- The Welch Creek fish tissue consumption advisory will continue until tissue concentrations are below applicable thresholds.
- eMNR™ in the upstream reach would contain a detailed maintenance plan to ensure long term remedy integrity.
- Long-term monitoring will focus on evaluating fish tissue trends, sediment concentrations, and monitoring benthic invertebrates. The midstream reach will also require an evaluation of water depth, sediment mobility, and channel stability to ensure risks are minimized after completion of channel rerouting.
- Institutional controls and deed restrictions would be placed and/or maintained at the site including continuance of the existing fish consumption advisories, maintenance of the existing fencing which limits access to the Welch Creek area, maintenance of signs in Welch Creek noting fish advisories and the presence of the sand cover, and deed restrictions to limit land development that could impact the remedy on areas where the sediment would be contained by the eMNR™ remedy. Fish consumption advisories would continue until State of North Carolina guidelines have been met.

Capital Costs:	$ 8,072,000
O & M Costs (Present Worth):	$ 2,887,000
Contingency Costs:	$ 2,192,000
Total Present Worth Costs:	$ 13,151,000
Duration to Finish Construction:	1 Year

Alternative 6: Upstream Reach – Engineered Cap; Midstream Reach – eMNR™

Upstream Reach – An engineered cap provides containment and focuses on isolating the sediment contaminants from the surface water and benthic invertebrates.

Midstream Reach – eMNR™ provides a thin cover material (5 to 10 cm) over the sediment to improve resistance to erosion and to serve as a sacrificial layer, if sediment mobility occurs. In this alternative, capping would cover approximately 22 acres of creek bottom considering both the upstream and midstream reaches.

- An Engineered Cap in the upstream reach is a containment remedy that reduces bioavailability and exposure to contaminants. The application of eMNR™ in the midstream is a containment option that also acts as a sacrificial layer designed to reduce potential mobilization of low levels of contaminants.
- The Welch Creek fish tissue consumption advisory will continue until tissue concentrations are below applicable thresholds.
- An Engineered Cap in the upstream and eMNR™ in the midstream would each contain a detailed maintenance plan to ensure long term remedy integrity.
- The monitoring plan for dioxin would focus on evaluating fish tissue trends, sediment concentrations, and monitoring benthic invertebrates. The midstream reach monitoring plan would also focus on the continue evaluation of water depth and sediment mobility to ensure risks are minimized.
- Institutional controls and deed restrictions would be placed and/or maintained at the site including continuance of the existing fish consumption advisories, maintenance of the existing fencing which limits access to the Welch Creek area, maintenance of signs in Welch Creek noting fish advisories and the presence of the engineered cover, and deed restrictions to limit land development that could impact the remedy on areas where the sediment would be contained by the eMNR™ remedy. Fish consumption advisories would continue until State of North Carolina guidelines have been met.

Capital Costs:	$ 8,609,000
O & M Costs (Present Worth):	$ 3,297,000
Contingency Costs:	$ 2,382,000
Total Present Worth Costs:	$ 14,288,000
Duration to Finish Construction:	2 Years

Alternative 7: Upstream Reach – eMNR™; Midstream Reach – Dredging

Upstream Reach – eMNR™ enhances natural burial and deposition processes by provided a thin cover material (5 to 10 cm) over the sediment. eMNR™ also includes active monitoring and adaptive management components to ensure remedy success. The thin layer sand cap would cover approximately 18 acres of creek bottom.

Midstream Reach – Dredging the midstream reach will reduce the potential for sediment mobility by increasing cross sectional area and thereby reducing stream velocity. It is estimated that about 53,000 cubic yards of sediment would be removed.

- eMNR™ in the upstream reach is a containment remedy that reduces bioavailability and exposure to contaminants. Dredging in the midstream reach is a removal option.
- The Welch Creek fish tissue consumption advisory will continue until tissue concentrations are below applicable thresholds.
- eMNR™ in the upstream would contain a detailed maintenance plan to ensure long term remedy integrity.
- The monitoring plan for dioxin would focus on evaluating fish tissue trends, sediment concentrations, and monitoring benthic invertebrates. The midstream reach monitoring plan would also focus on an initial evaluation of water depth and sediment mobility to ensure risks are minimized after completion of dredging.
- Institutional controls and deed restrictions would be placed and/or maintained at the site including continuance of the existing fish consumption advisories, maintenance of the existing fencing which limits access to the Welch Creek area, maintenance of signs in Welch Creek noting fish advisories and the presence of the sand cover, and deed restrictions to limit land development that could impact the remedy on areas where the sediment would be contained by the eMNR™ remedy. Fish consumption advisories would continue until State of North Carolina guidelines have been met.

Capital Costs:	$ 8,527,000 – 9,405,000
O & M Costs (Present Worth):	$ 3,285,000
Contingency Costs:	$ 2,363,000
Total Present Worth Costs:	$ 14,175,000 – 15,053,000
Duration to Finish Construction:	1 Year

Alternative 8: Upstream Reach – Engineered Cap; Midstream Reach – Dredging

Upstream Reach – An engineered cap provides containment and focuses on isolating the sediment contaminants from the surface water and benthic invertebrates. The thin layer sand cap would cover approximately 18 acres of creek bottom.

Midstream Reach – Dredging the midstream reach will reduce the potential for sediment mobility by increasing cross sectional area and thereby reducing stream velocity. It is estimated that about 53,000 cubic yards of sediment would be removed.

- An Engineered Cap in the upstream reach is a containment remedy that reduces bioavailability and exposure to contaminants. Dredging in the midstream reach removal and also performs containment by reducing potential mobility.
- The Welch Creek fish tissue consumption advisory will continue until tissue concentrations are below applicable thresholds.
- An Engineered Cap in the upstream reach would require a detailed maintenance plan to ensure long-term remedy integrity.
- The monitoring plan for dioxin would focus on evaluating fish tissue trends, sediment concentrations, and monitoring benthic invertebrates.
- Institutional controls and deed restrictions would be placed and/or maintained at the site including continuance of the existing fish consumption advisories, maintenance of the existing fencing which limits access to the Welch Creek area, maintenance of signs in Welch Creek noting fish advisories and the presence of the engineered cover, and deed restrictions to limit land development that could impact the remedy on areas where the sediment would be contained by the eMNR™ remedy. Fish consumption advisories would continue until State of North Carolina guidelines have been met.

Capital Costs:	$ 11,513,000 – 12,391,000
O & M Costs (Present Worth):	$ 3,235,000
Contingency Costs:	$ 2,950,000
Total Present Worth Costs:	$ 17,698,000 – 18.576,000
Duration to Finish Construction:	2 Years

Alternative 9: Upstream Reach – Dredging and Thin-Layer Cap; Midstream Reach – Mobility Monitoring

Upstream Reach – Dredging will target removal of contaminant mass and volume, but residual concentrations of COCs may present a risk to the environment. To diminish these risks, dredging will be followed by placement of a thin-layer cap. About 64,000 cubic yards of sediment would be excavated. The thin layer sand cap would then cover approximately 18 acres of creek bottom.

Midstream Reach – Mobility monitoring includes monitoring the sediment for potential mobilization including detailed surveys and additional hydrologic modeling if appropriate.

- Dredging in the upstream reach removes contaminant volume from Welch Creek, the thin-layer cap acts as a containment layer over the dredging residuals..
- The Welch Creek fish tissue consumption advisory will continue until tissue concentrations are below applicable thresholds.
- The thin-layer cap over the dredging residuals in the upstream reach would require a detailed maintenance plan to ensure long term remedy integrity.
- Long term monitoring will focus on evaluating fish tissue trends, sediment concentrations, and monitoring benthic invertebrates. The midstream reach monitoring plan will also focus on the continue evaluation of water depth and sediment mobility to ensure risks are minimized.
- Institutional controls and deed restrictions would be placed and/or maintained at the site including continuance of the existing fish consumption advisories, maintenance of the existing fencing which limits access to the Welch Creek area, maintenance of signs in Welch Creek noting fish advisories and the presence of the sand cover, and deed restrictions to limit land development that could impact the remedy on areas where the sediment would be contained by the eMNR™ remedy. Fish consumption advisories would continue until State of North Carolina guidelines have been met.

Capital Costs:	$ 15,529,000 – 15,893,000
O & M Costs (Present Worth):	$ 3,285,000
Contingency Costs:	$ 3,763,000
Total Present Worth Costs:	$ 22,577,000 – 22,941,000
Duration to Finish Construction:	3 Years

Alternative 10: Upstream Reach – Dredging and Thin-Layer Cap; Midstream Reach – Dredging

Upstream Reach – Dredging will target removal of contaminant mass and volume, but residual concentrations of COCs may present a risk to the environment. To diminish these risks, dredging will be followed by placement of a thin-layer cap.

Midstream Reach – Dredging the midstream reach will reduce the potential for sediment mobility by increasing cross sectional area and thereby reducing stream velocity. It is estimated that approximately 117,000 cubic yards of sediment would be excavated from both reaches under this alternative.

- Dredging is a removal option with the thin-layer cap in the upstream reach acting as containment for the dredging residuals.
- The Welch Creek fish tissue consumption advisory will continue until tissue concentrations are below applicable thresholds.
- A detailed maintenance plan for the thin-layer cap will be required to ensure long term remedy integrity.
- The monitoring plan for dioxin would focus on evaluating fish tissue trends, sediment concentrations, and monitoring benthic invertebrates.
- Institutional controls and deed restrictions would be placed and/or maintained at the site including continuance of the existing fish consumption advisories, maintenance of the existing fencing which limits access to the Welch Creek area, maintenance of signs in Welch Creek noting fish advisories and the presence of the sand cover, and deed restrictions to limit land development that could impact the remedy on areas where the sediment would be contained by the eMNR™ remedy. Fish consumption advisories would continue until State of North Carolina guidelines have been met.

Capital Costs:	$ 18,008,000 – 19,136,000
O & M Costs (Present Worth):	$ 3,285,000
Contingency Costs:	$ 4,259,000
Total Present Worth Costs:	$ 25,552,000 – 26,680,000
Duration to Finish Construction:	3 Years

K. Summary of Comparative Analysis of Alternatives

In this section, each alternative is assessed using nine evaluation criteria required under the NCP (NCP§300.430 (f)(5)(i)). Comparison of the alternatives with respect to these evaluation criteria are presented in summary form in the text of this section and is summarized on Figure K-1. In addition to this comparison, consistency of the remedial alternatives to principles defined in two applicable OSWER directives was considered along with a Relative Environmental Benefit Evaluation (REBE). The REBE reflects Section 7.4 of the Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (USEPA, 2005) which encourages comparison of net risk reduction between alternatives as part of the decision making process. The REBE approach combined this concept with direction from the stakeholders to qualitatively consider relative risk. A summary of these comparisons are also included in this section of the ROD. This multi-pronged approach is designed to provide sufficient information to adequately compare the alternatives, aid in the selection of an appropriate remedy for the Site, and demonstrate satisfaction of the statutory requirements.

Comparison to NCP Criteria

Each alternative is evaluated in terms of its ability to:

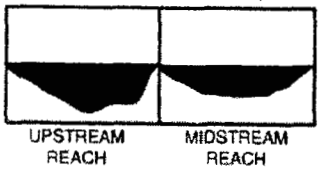
- Provide overall protection of human health and the environment.
- Attain ARARs or provide grounds for invoking a waiver.
- Use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.
- Satisfy the preference for treatment that reduces toxicity, mobility, or volume of the hazardous substances, pollutants and contaminants as a principal element.
- Be completed in a timely manner and provide for short-term effectiveness to ensure that the remedy addresses any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy.
- Be implementable with the least amount of negative effects and provide a feasible remedy from design through construction and operation.
- Be cost-effective.
- Be acceptable to the State.
- Be acceptable to the Public.

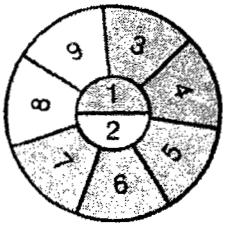
The nine evaluation criteria required to address the above CERCLA requirements serve as the basis for conducting the detailed analysis. A comparison to the evaluation criteria is included in Table K-1. The comparison is summarized by evaluation criteria in the next paragraphs.

Overall Protection of Human Health and the Environment

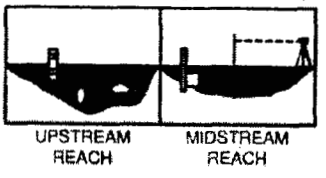
The criteria of overall protection of human health and the environment considers whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment. Alternatives 1 and 2 have limited or no action which minimizes any reduction in risk to human health and the environment. Alternatives 3 and 4 will provide both long- and short-term protection to human health. Long-term environmental impacts from

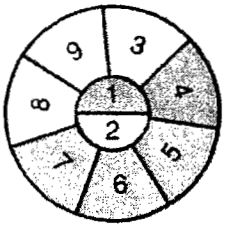
Alternative No. 1
No Action (Upstream)
No Action (Midstream)



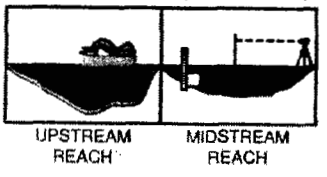


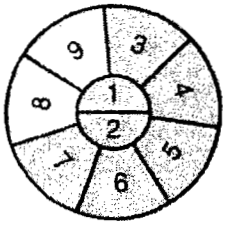
Alternative No. 2
MNR (Upstream)
Mobility Monitoring (Midstream)



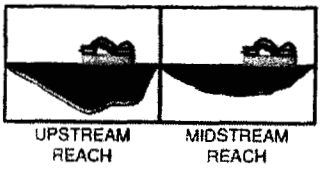


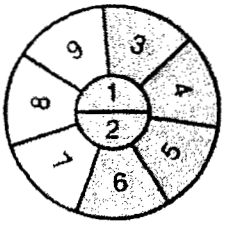
Alternative No. 3
eMNR (Upstream)
Mobility Monitoring (Midstream)



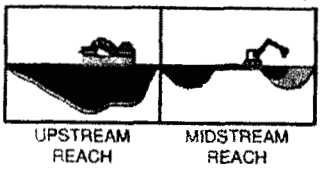


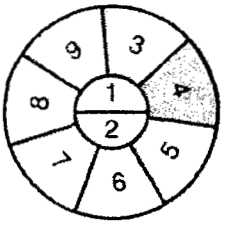
Alternative No. 4
eMNR (Upstream)
eMNR (Midstream)



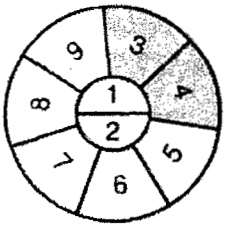


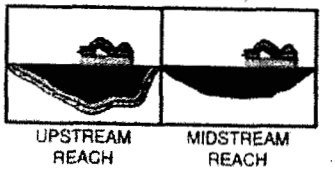
Alternative No. 5
eMNR (Upstream)
Channel Rerouting (Midstream)



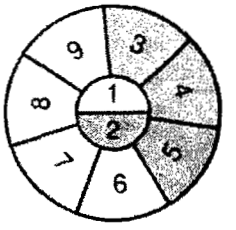


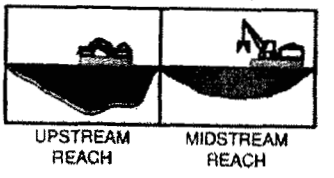
Alternative No. 6
Engineered Cap (Upstream)
eMNR (Midstream)



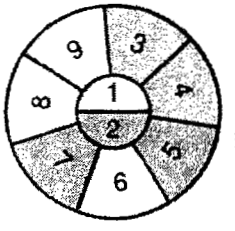


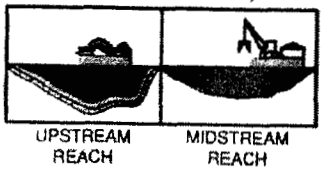
Alternative No. 7
eMNR (Upstream)
Dredge (Midstream)



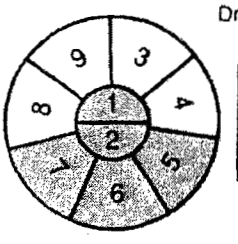


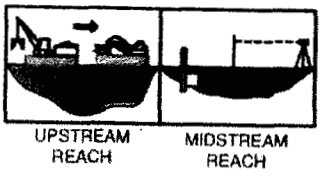
Alternative No. 8
Engineered Cap (Upstream)
Dredge (Midstream)



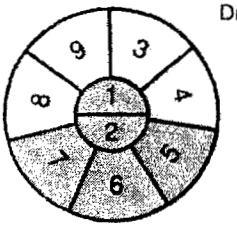


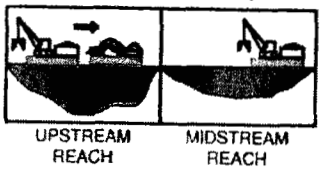
Alternative No. 9
Dredge & Thin Layer Cap (Upstream)
Mobility Monitoring (Midstream)





Alternative No. 10
Dredge & Thin Layer Cap (Upstream)
Dredge (Midstream)





NINE NCP CRITERIA (Refer to Table 6-3)

1. Overall Protection of Human Health and Environment
2. Compliance with Applicable or Relevant and Appropriate Requirements.
3. Long Term Effectiveness and Permanence
4. Reduce Toxicity, Mobility, or Volume Through Treatment
5. Short-Term Effectiveness
6. Implementability
7. Cost
8. State Agency Acceptance
9. Community Acceptance

Unknown	Negative	Neutral	Positive

PROJECT: DOMTAR (FORMERLY WEYERHAEUSER)
MARTIN COUNTY, NORTH CAROLINA
WELCH CREEK - OU-4

SHEET TITLE:
COMPARISON OF THE NINE NCP CRITERIA FOR EACH ALTERNATIVE

DATE: MAY 2007 FINAL

DRAWN BY: NCW

FIGURE K-1

RMT

P:\DATA\PROJECTS\00-05174.01\Figures\Figure 7 all 0207.vsd

rerouting the channel in Alternative 5 are unknown at this time. Possible side slope failures for the engineered cap reduce the potential long-term protectiveness of Alternatives 6 and 8. Alternative 7 provides long-term protection, but due to the potential resuspension of sediments during midstream dredging, short-term impacts are unknown. These four alternatives therefore were determined to have neutral impacts. Alternatives 9 and 10 were depicted with negative impacts to human health and the environment due to the increased area and concentrations with the potential for resuspension and short-term impacts during construction. Some of the potential exposure from these two alternatives (Alternatives 9 and 10) could be reduced by limiting access to Welch Creek or additional fish advisories during and after construction.

Compliance with ARARs

The criteria of compliance with ARARs evaluates whether the alternative meets Federal and State environmental statutes, regulations, and other requirements that pertain to the site.

Section 121(d) of CERCLA and NCP §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitations, which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA Section 121(d)(4).

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

To-Be-Considered Requirements (TBCs) are federal and state environmental and public health agency criteria, advisories, guidance, and proposed standards that are not legally enforceable but contain information that is useful in carrying out, or in determining the level of protectiveness of, selected remedies. TBCs are meant to compliment the use of ARARs, not to compete with or replace them. Because TBCs are not ARARS, their identification and use are not mandatory. Where no ARARs address a particular situation at a CERCLA site, or the existing ARARs do not ensure sufficient protectiveness, the TBC advisory, criteria or guidelines should be used to evaluate alternative remedial actions.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of federal and state environmental statutes, or provides a basis for invoking a waiver. There are a variety of action-specific and location-specific ARARs associated with each alternative which are further described in the FS. It is expected that the alternatives are capable of meeting the location and action specific ARARS. There is one chemical-specific applicable requirement, the Surface Water Quality Standard for 2,3,7,8-TCDD, which apply to each of the alternatives. None of the alternatives can guarantee elimination of the periodic exceedance of this regulated congener of dioxin into the water column. Alternatives 7, 8, 9, and 10 however, have the potential based on pilot studies to exacerbate the resuspension at least during construction. Regulatory agency representatives from the State of North Carolina, have had concerns regarding the potential adverse impact of sediment resuspension during any construction activity on water quality and the fisheries in Welch Creek and the Lower Roanoke River.

Long-Term Effectiveness

The criteria of long-term effectiveness and permanence considers the ability of an alternative to maintain protection of human health and the environment over time. Based on initial modeling of the system, Alternative 1 (No Action) would not be able to achieve RAOs for up to 100 years, and therefore, was deemed to be not effective. Alternative 2 (MNR and monitoring) is neutral since monitoring allows adaptation, if needed. Uncertainty in the ability to maintain a re-routed channel in Alternative 5 (eMNR and Channel re-routing) makes this approach neutral as well. Alternative 3 (eMNR and mobility monitoring) is considered effective with a proper monitoring and active operations and maintenance program and has the least amount of uncertainty. Alternatives 4, 6, 7, and 8 are expected to be effective but have a higher level of uncertainty. For example, there is greater uncertainty as to whether the sand layer in the midstream reach (Alternative 4) will remain in place long enough to improve conditions, or whether side slope failures for the engineered cap (Alternatives 6 and 8) will significantly impact overall SWAC reduction. However, all four alternatives may be effective with a proper monitoring and active operations and maintenance program and thus were coded as neutral. While Alternatives 9 and 10 would be effective in removing a majority of the contaminated sediments from the upstream reach, the resuspension impacts and the ability of the resettled solids to support a thin-layer cap is unknown at this time and therefore effectiveness was also deemed to be neutral.

Reduce Toxicity, Mobility or Volume

This criteria considers an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

None of the alternatives have a treatment component, and therefore, do not reduce the toxicity of the sediments through that mechanism. Some reduction in volume and/or mobility is achieved in all of the alternatives except Alternatives 1 and 2. Volumes will be reduced by removal and dewatering for Alternatives 7, 8, 9, and 10 and by settlement of the wastewater solids under the weight of a cap for Alternatives 3 through 8. Alternatives 9 and 10 reduce volume overall but actually increase mobility of sediment during the construction activities, thus are coded with neutral impacts. Reduction in mobility

is achieved for Alternatives 3 through 7 by covering the contaminated sediment layer with a cap material. Alternative 5 also reduces mobility of the potential contaminated sediment by rerouting the flow around the potential mobile reach of the creek.

Short Term Effectiveness

This criteria considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation. There are no adverse effects from Alternatives 1 and 2, so these alternatives are coded positive. Alternatives 3 and 4 are effective in the short term. They have minimal adverse impacts since the pilot study indicated that eMNR™ construction did not affect water quality and did not disturb the debris related benthic community. Alternative 5 has neutral coding due to adverse impacts on the wetlands during channel rerouting. Alternative 6 is also neutral with some adverse impacts from expected steep side slope failures during construction of the engineered cap. Alternatives 7 to 10 each have a dredging component in at least one reach, causing negative short term impacts due to the removal of woody debris and resuspension of contaminants into the water column among other considerations.

Implementability

This criteria considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services. There are no adverse implementation issues for either Alternatives 1 or 2. The pilot studies have shown that implementation of an eMNR™ layer is feasible (Alternatives 3 and 4). Alternative 5 has potential issues associated with implementation of rerouting the channel both administratively due to wetland disturbances and technically due to potential issues dewatering the area and unknown conditions encountered during excavation activities. Alternative 7 has similar issues associated with dredging activities in wetlands near the midstream reach and approvals of work near a bridge. Pilot studies indicated that, while placement of a heavier engineered cap is implementable, there are issues associated with failure along steep side slopes (Alternatives 6 and 8). Alternatives 9 and 10 are technically implementable but may not be administratively implementable due to concerns expressed by water quality and wetlands officials. Furthermore, dewatering of the highly organic material from the upstream reach is difficult and water treatment is needed. Pilot tests have demonstrated a thin layer of sand placement is implementable over the existing wastewater solids which have been stabilized by biofilms. The ability of the freshly disturbed dredging residuals to support a thin layer of sand is unknown at this time.

Cost

Detailed cost estimates for each alternative were prepared based on the conceptual designs described in the Feasibility Study report. The detailed cost estimates include total capital cost (both direct and indirect), and O&M costs for implementing each alternative. Cost estimates for the alternatives were prepared primarily based on professional experience, pilot study costs and information supplied by potential suppliers, vendors, and other external sources. The estimated present worth of the remedial

alternatives was based on a discount rate of 7 percent, which is typical per current USEPA guidance on cost estimation (USEPA, 2000).

Total capital costs are those expenditures required to initiate and implement a remedial action. Both direct and indirect costs are considered in the development of capital costs. Direct costs include construction costs or expenditures for equipment, labor, and materials required to implement the remedial action. Indirect costs consist of engineering, permitting, supervising, and other outside services required to implement the remedial action. Certain contingencies have also been included in the cost estimates to account for unknowns, since the FS contains only conceptual designs.

Performance monitoring and O&M cost estimates were converted to present worth values using a discount rate of 7 percent and a 30-year post-closure period. Therefore, the total present worth of an alternative was the sum of the total capital cost and the present worth of the performance monitoring and O&M costs.

Typically, the "study estimates" made during the FS are expected to provide an accuracy of +50 percent to -30 percent (USEPA, 2000). Final costs would depend on actual labor and material costs, actual site conditions, market conditions, final project scope, engineering between the FS and final design, final project schedule, productivity, and other variable factors. As a result, the final costs could vary from the estimates presented in this report. However, most of these factors should not affect the relative cost differences between alternatives.

Alternative 1 has the lowest costs since no action is taken. Alternative 2 consists of monitoring only and has the next lowest cost. Alternative 10 (dredging of both reaches) has the highest total capital cost, as well as total present worth. The remaining alternatives all have comparable costs within the -30 to +50 percent accuracy assumed for this level of remediation cost development.

State Acceptance

The State of North Carolina, as represented by the NCDENR, has been the support agency during the Remedial Investigation and Focused Feasibility Study (RI/FFS) process for the Site. In accordance with 40 C.F.R. § 300.430, NCDENR as the support agency, has provided input during this process by reviewing major documents in the Administrative Record. The NCDENR Division of Waste Management ("the State") concurs with the selected remedy, but notes comments from The NCDENR Division of Waste Management and the NC Wildlife Resources Commission that expressed a preference for dredging.

Community Acceptance

EPA held a public meeting to discuss the proposed remedy on August 16, 2007. During the public comment period, the community expressed a range of comments – some thought the selected remedy was not necessary, some supported the selected remedy, and some preferred dredging. Specific responses to issues raised by the community can be found in the attached Responsiveness Summary.

Consistency with Sediment and Ecological Risk Management Principles

The second comparison completed for the ten alternatives was consideration of how consistent these remedial approaches were to the eleven sediment management and the six ecological risk management principles. Figures K-2 and K-3 identify the various principles, summarize the implications of each of the principles on Welch Creek, and then provide a summary of how the eleven sediment management principles and six risk management principles were considered during evaluation and comparison of the ten remedial alternatives identified for Welch Creek.

Relative Environmental Benefit Evaluation

Figure K-4 expands on the short and long term effectiveness criteria by presenting a ranking by seventeen site-specific factors which represent a relative environmental benefit evaluation. Seventeen site-specific factors were developed to assess the potential relative risks and benefits associated with implementing each technology within the Welch Creek operable unit. The individual factors were specifically focused on issues related to protection of human exposure, risk and habitat use, ecological exposure, risk and habitat impacts, and ARAR compliance. This comparative assessment provides a method to contrast the secondary environmental effects of the different remedial technologies. Other questions and factors could also be identified and compared as well, as long as each technology is ranked using similar criteria. These comparisons provide a simplified method for ranking and comparing the identified effects. Each of the questions is ranked based upon relative benefit or adverse effect using five rankings as follows:

0 = Neutral effect

+ = Beneficial effect

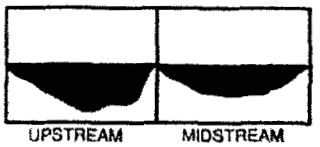
++ = Greater beneficial effect

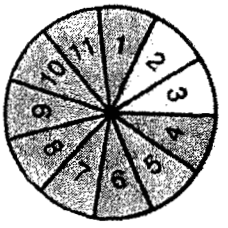
- = Adverse effect

-- = Greater adverse effect

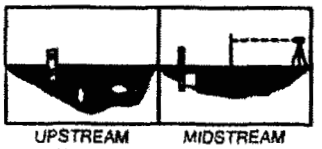
To compare technologies over all factors, the total number of beneficial or positive scores (*i.e.*, "+") and adverse or negative scores (*i.e.*, "-") are summed. Greater detail on these beneficial and adverse effects totals are presented in the FS.

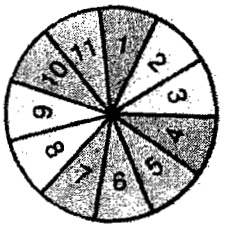
Alternative No. 1
No Action (Upstream)
No Action (Midstream)



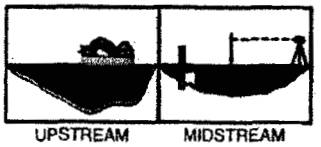


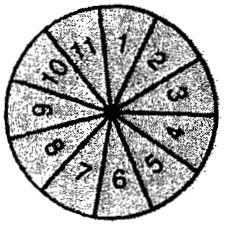
Alternative No. 2
MNR (Upstream)
Mobility Monitoring (Midstream)



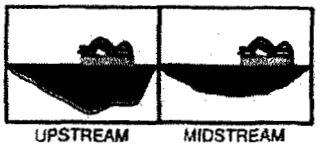


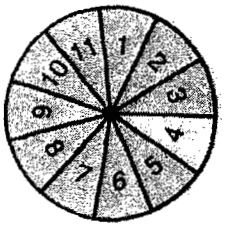
Alternative No. 3
eMNR (Upstream)
Mobility Monitoring (Midstream)



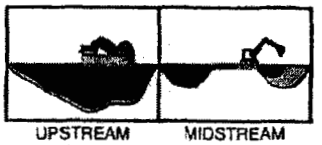


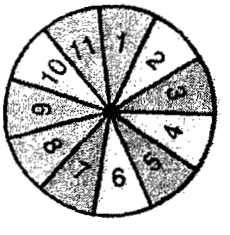
Alternative No. 4
eMNR (Upstream)
eMNR (Midstream)



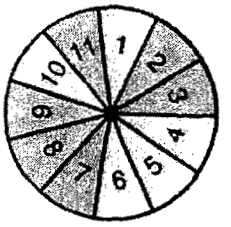


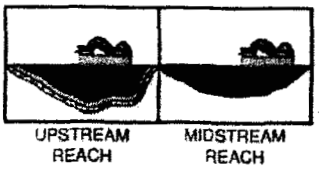
Alternative No. 5
eMNR (Upstream)
Channel Rerouting (Midstream)



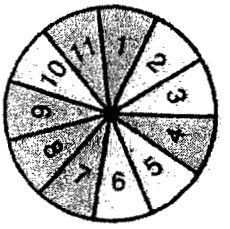


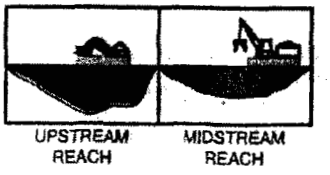
Alternative No. 6
Engineered Cap (Upstream)
eMNR (Midstream)



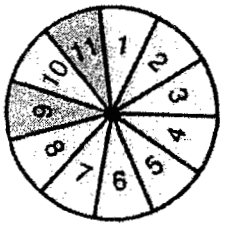


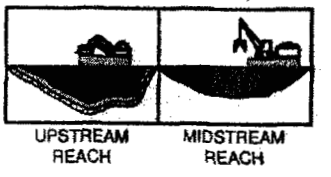
Alternative No. 7
eMNR (Upstream)
Dredge (Midstream)



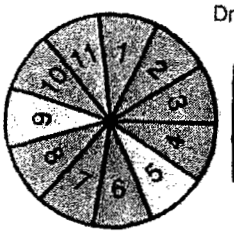


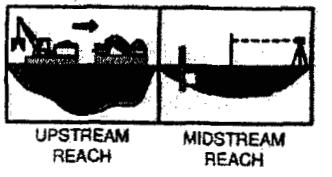
Alternative No. 8
Engineered Cap (Upstream)
Dredge (Midstream)



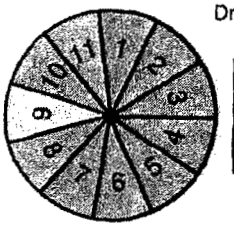


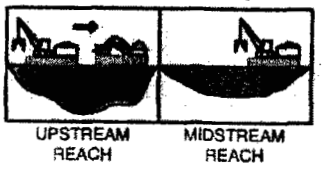
Alternative No. 9
Dredge & Thin Layer Cap (Upstream)
Mobility Monitoring (Midstream)





Alternative No. 10
Dredge & Thin Layer Cap (Upstream)
Dredge (Midstream)





SEDIMENT RISK MANAGEMENT PRINCIPLES (Refer to Table 7-2)

1. Control Sources Early
2. Involve the Community Early and Often
3. Coordinated with States, Local Governments, Tribes, and Natural Resource Trustees (Including Stakeholder Discussions)
4. Develop and Refine a Conceptual Model that Considers Sediment Stability
5. Use an Iterative Approach in a Risk-Based Framework
6. Carefully Evaluate the Assumptions and Uncertainties Associated with Site Characterization Data and Site Models
7. Select Site-specific, Project-specific, and Sediment-specific Risk Management Approaches that will Achieve Risk-based Goals.
8. Ensure that Sediment Cleanup Levels are Clearly Tied to Risk Management Goals
9. Maximize the Effectiveness of Institutional Controls and Recognize their Limitations
10. Design Remedies to Minimize Short-term Risks while Achieving Long-term Protection
11. Monitor During and After Sediment Remediation to Assess and Document Remedy Effectiveness

Negative	Neutral	Positive

PROJECT: DOMTAR (FORMERLY WEYERHAEUSER)
MARTIN COUNTY, NORTH CAROLINA
WELCH CREEK - OU-4

SHEET TITLE:
COMPARISON OF THE RISK MANAGEMENT PRINCIPLES FOR EACH ALTERNATIVE

DATE: MAY 2007 FINAL

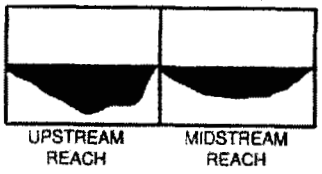
DRAWN BY: NCW

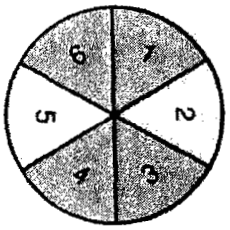
FIGURE K-2

RMT

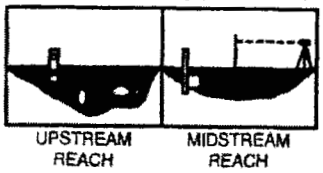
P:\DATA\PROJECTS\00-05174.01\Figures\Figure 7 all 0207.vsd

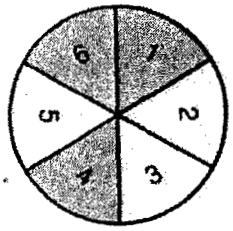
Alternative No. 1
No Action (Upstream)
No Action (Midstream)



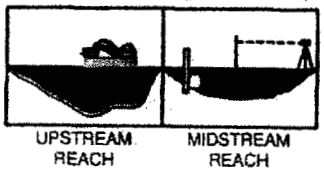


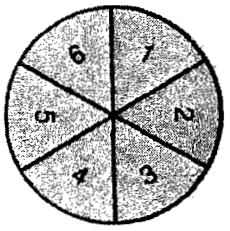
Alternative No. 2
MNR (Upstream)
Mobility Monitoring (Midstream)



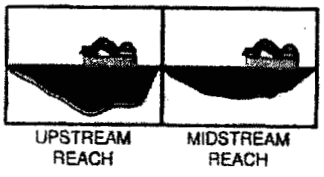


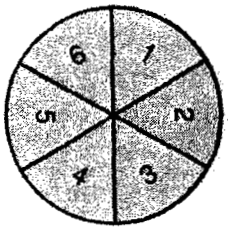
Alternative No. 3
eMNR (Upstream)
Mobility Monitoring (Midstream)



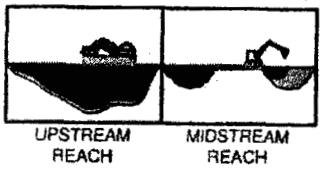


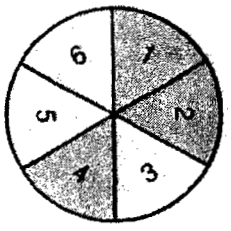
Alternative No. 4
eMNR (Upstream)
eMNR (Midstream)



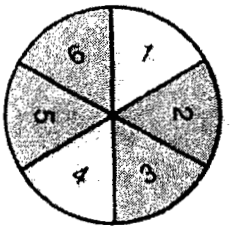


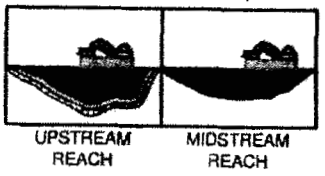
Alternative No. 5
eMNR (Upstream)
Channel Rerouting (Midstream)



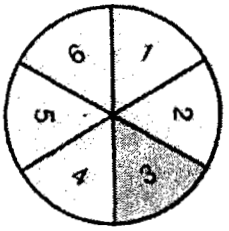


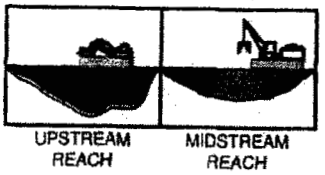
Alternative No. 6
Engineered Cap (Upstream)
eMNR (Midstream)



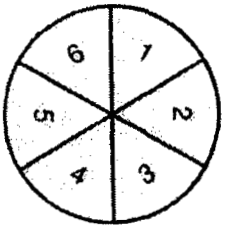


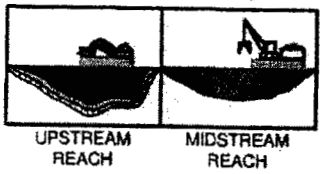
Alternative No. 7
eMNR (Upstream)
Dredge (Midstream)



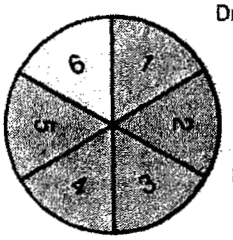


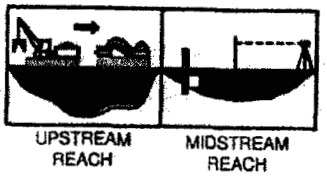
Alternative No. 8
Engineered Cap (Upstream)
Dredge (Midstream)



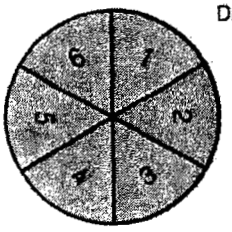


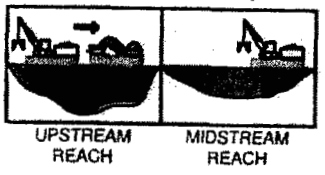
Alternative No. 9
Dredge & Thin Layer Cap (Upstream)
Mobility Monitoring (Midstream)





Alternative No. 10
Dredge & Thin Layer Cap (Upstream)
Dredge (Midstream)





Negative	Neutral	Positive

ECOLOGICAL RISK PRINCIPLES (Refer to Table 7-3)

1. Superfund's Goal is to reduce ecological risks to levels that will result in the recovery and maintenance of healthy local populations and communities of biota
2. Coordinate with Federal, Tribal, and State Natural Resource Trustees
3. Use site-specific ecological risk data to support cleanup
4. Characterize site risks
5. Communicate risks to public
6. Remediate unacceptable ecological risks

PROJECT: DOMTAR (FORMERLY WEYERHAEUSER)
MARTIN COUNTY, NORTH CAROLINA
WELCH CREEK - OU-4

SHEET TITLE:
COMPARISON OF THE ECOLOGICAL RISK PRINCIPLES FOR EACH ALTERNATIVE

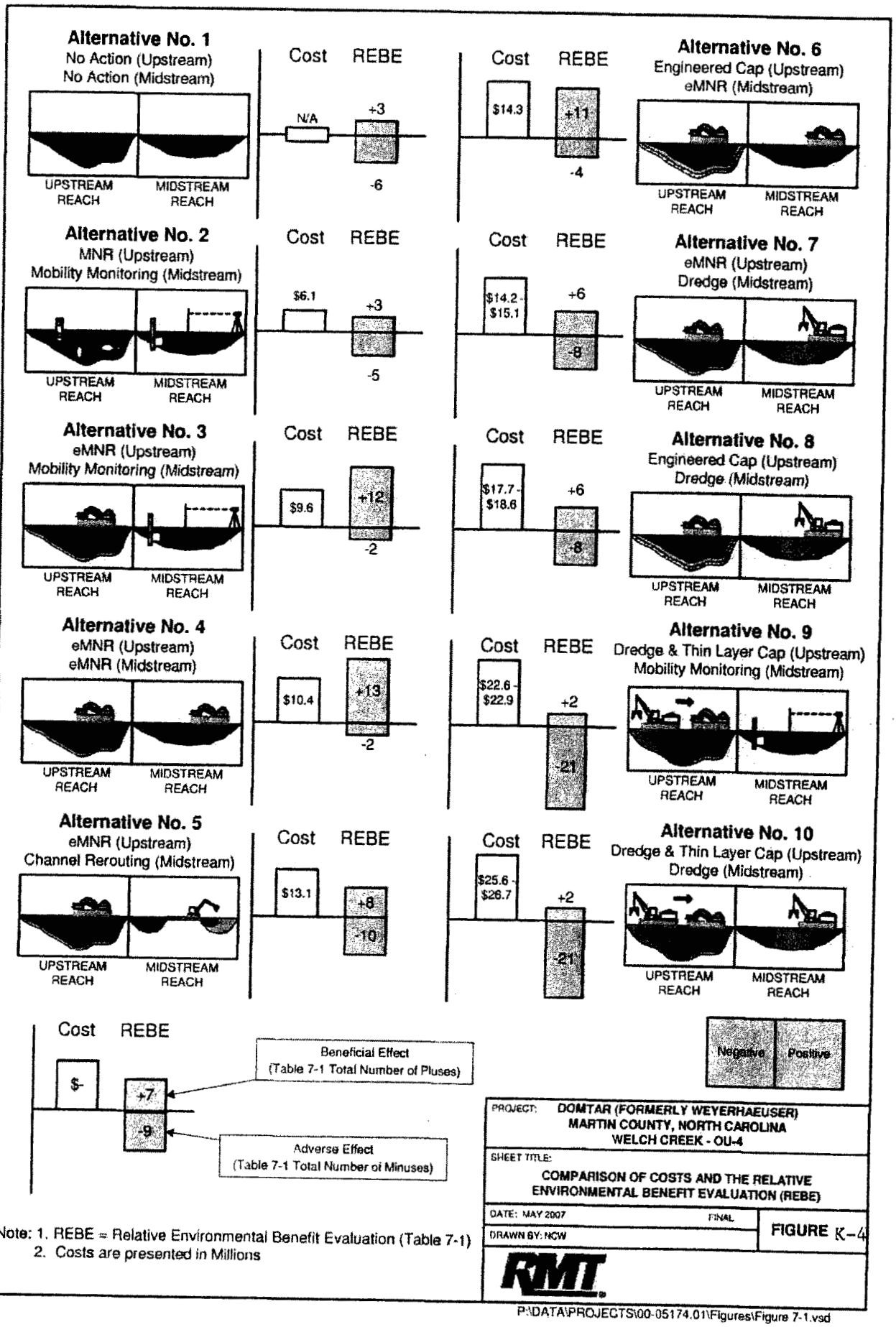
DATE: MAY 2007 FINAL

DRAWN BY: NCW

FIGURE K-3

RMT

P:\DATA\PROJECTS\00-05174.01\Figures\Figure 7 all 0207.vsd



Note: 1. REBE = Relative Environmental Benefit Evaluation (Table 7-1)
2. Costs are presented in Millions

PROJECT: DOMTAR (FORMERLY WEYERHAEUSER)
MARTIN COUNTY, NORTH CAROLINA
WELCH CREEK - OU-4

SHEET TITLE:
COMPARISON OF COSTS AND THE RELATIVE ENVIRONMENTAL BENEFIT EVALUATION (REBE)

DATE: MAY 2007 FINAL

DRAWN BY: NCW

FIGURE K-4

RMT

P:\DATA\PROJECTS\00-05174.01\Figures\Figure 7-1.vsd

L. Principal Threat Wastes

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP §300.430(a)(1)(iii)(A)). Identifying principal threat waste combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile, which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. The contaminant concentrations in sediment are somewhat elevated relative to the selected cleanup goal, but the contaminated sediment does not pose a significant risk to people. There is potential risk to environmental receptors, but as noted in the rationale for the selected remedy, there are positive trends in some biota. These factors, when considered with the low potential for erosion and transport of the contaminated sediment, indicate that these materials are not considered a principal threat waste.

M. The Selected Remedy

1. Rationale for the Selected Remedy

The Selected Remedy is Alternative 3: eMNR (thin layer cap) for sediment with contaminant levels above the cleanup goals noted in Table M-2 for the upstream reach and mobility monitoring for the midstream reach of Welch Creek. Several factors were key to the selection of this remedy. The ecological risk assessment indicated the potential for unacceptable risks. Modeling results indicated that it would take about 100 years for natural sedimentation to sufficiently cover the contaminated materials along the bottom of Welch Creek. These two factors suggested that no action or monitoring only were not the best options for Welch Creek. The upstream reach, which is the more contaminated reach, is considered the least likely to erode and thus well suited to a cap. A thin layer cap was chosen over a thicker cap due to the increasing likelihood of side slope failure with increasing cap thickness. Side slope failure could re-expose contaminated material making it available for uptake by ecological receptors. Dredging was not chosen due in part to the physical characteristics of the contaminated wastewater solids. These solids are not like natural sediments; the solids are less likely to settle quickly once disturbed increasing the likelihood of transport and uptake by some ecological receptors. In addition, dredging would likely leave behind residual materials that would require a thin layer cap anyway. The impetus for intense actions such as dredging is tempered somewhat by declining contaminant trends in at least some receptors such as fish and ducks. The use of a thin layer cap is expected to prevent or greatly reduce the uptake of contaminants by organisms in the bioactive layer and thus further up the food chain. Physical monitoring of the cap and chemical monitoring of the biota will enable the performance of the remedy to be evaluated. The use of a thin layer cap lends itself to the idea of adaptive management based on the performance monitoring results. An initial thin cap allows for supporting the weight of additional capping material, if necessary. Alternatively, if dredging were determined to be necessary, then the volume of sand applied for the thin cap would not cause a significant increase in the volume of material to be removed.

2. Description of the Selected Remedy

The eMNR™ remedy includes placement of a thin layer (5 to 10 cm) of sand over the sediment with contaminant levels above the cleanup goals noted in Table M-2 to reduce contaminant concentrations in the bioactive layer. This sand layer would cover an estimated 18 acres of creek bottom in the upstream reach. eMNR™ functions to accelerate natural recovery processes. This layer isolates the underlying sediment while a new benthic community colonizes on the clean substrate and entrains natural organic matter (leaf litter, etc.) as food.

Establishing the clean sand layer thickness slightly greater than the thickness of the bioactive layer is intended to limit the ability of benthic organisms to mix contaminated underlying sediment into the clean sand. This enhanced recovery of surficial sediment concentrations will reduce the bioavailability of dioxin in the water column and lower trophic level organisms.

Engineering and institutional controls, and O&M activities are included with this alternative. Institutional controls include the existing fish consumption advisories, maintenance of the existing fencing which limits access to the Welch Creek area, maintenance of signs in Welch Creek noting fish advisories and the presence of the sand cover, and deed restrictions to limit land development on the Domtar (formerly Weyerhaeuser) property that could impact the remedy. The Welch Creek fish tissue consumption advisory will continue until tissue concentrations are below applicable thresholds.

The remedy also includes active monitoring and adaptive management components to ensure remedy success. Periodic inspection and maintenance of the thin-layer cap will be performed, as necessary, to maintain integrity of the eMNR™ system in controlling the bioavailability of contaminants. Long term monitoring will be performed for surface water, sediment, fish and benthic organisms. Long-term monitoring in the upstream reach will focus on evaluating fish tissue trends, sediment concentrations, and monitoring benthic invertebrates. The midstream reach monitoring plan would focus on the continued evaluation of water depth and sediment mobility to ensure risks are minimized. Mobility monitoring includes monitoring the sediment for potential mobilization and additional hydrologic modeling, if appropriate. Monitoring and sampling and analysis activities will be conducted before, during, and after remedy implementation. Details will be developed during preparation of the Remedial Design/Remedial Action Work Plan. Details of the performance monitoring plan will be developed during the remedial design as part of a performance standard verification plan. Data from the final performance monitoring program will form the basis for updating the Welch Creek site conceptual models. Evaluation of the monitoring data will be conducted on a yearly basis and at the five-year review timeframe.

Institutional Controls

Institutional controls and deed restrictions will be considered and used where appropriate. Institutional controls include the existing fish consumption advisories, maintenance of the existing fencing which limits access to the Welch Creek area, maintenance of signs in Welch Creek noting fish advisories and the presence of the sand cover, and deed restrictions to limit land development on the Domtar (formerly Weyerhaeuser) property that could impact the remedy. Fish consumption advisories will continue until State of North Carolina guidelines have been met.

EPA Institutional Controls (ICs) guidance (EPA 2000) recommends four specific factors be considered when documenting the ICs to be implemented at a Site: Objective, Mechanism, Timing and Responsibility. The following is a listing of these factors relative to the Gurley Pesticide Site.

1. **Objective:** The objectives of the ICs are to protect the integrity of the cap and to prevent or reduce potential human consumption of contaminated fish.
2. **Mechanism:** The remedy includes ICs to achieve the objectives noted above. ICs are non-engineered instruments, such as administrative and/or legal controls, that help to minimize and/or manage the potential for human exposure to contamination and/or protect the integrity of a remedy. The following are general explanations of the four categories of IC mechanisms available for use followed by those controls to be used for the Domtar Site:

    - *Proprietary Controls* - These controls are based on State law and use a variety of tools to prohibit activities that may compromise the effectiveness of the remedy or restrict activities or future uses of resources that may result in unacceptable risk to human health or the environment. They may also be used to provide site access for operation and maintenance activities. The most common examples of proprietary controls are easements and covenants.
    - *Governmental Controls* - These controls impose land or resource restrictions using the authority of an existing unit of government. Typical examples of governmental controls include zoning, building codes, drilling permit requirements and State or local groundwater use regulations.
    - *Enforcement and Permit Tools with IC Components* - These types of legal tools include orders, permits, and consent decrees. These instruments may be issued unilaterally or negotiated to compel a party to limit certain site activities as well as ensure the performance of affirmative obligations (e.g., to monitor and report on an IC's effectiveness).
    - *Informational Devices* - These tools provide information or notification about whether a remedy is operating as designed and/or that residual or contained contamination may remain on-site. Typical information devices include State registries, deed notices, and advisories.

For the Domtar Site, Institutional Controls will include the following:

Proprietary Control – The Site will have restrictions placed on the Site property deed via restrictive covenants that run with the land to notify future interested parties or owners of the presence of wastewater solids along the bottom of Welch Creek and the presence of a sand cap over contaminated wastewater solids in the upstream reach. The restrictions will also prohibit the activities on the Domtar property in the adjacent upland areas that could impact the integrity of the cap such as building a boat launch, pier, or bridge. The ICs will also require consultation with EPA and/or NCDENR before any future construction in the impacted area.

Government Control – The State of North Carolina Department of Health and Human Services, Division of Public Health, Epidemiology Section issues fish consumption advisories. The fish consumption advisories will remain in place until State standards have been met. The current fish consumption advisory notes that catfish and carp from waters near the site may contain low levels of dioxins. Women of childbearing age and children should not eat any catfish or carp from this area until further notice. All other persons should eat no more than one meal per

month of catfish and carp from this area. The North Carolina State Health Director uses a concentration of 3×10^{-6} mg/kg total dioxins in fish tissues for issuing fish consumption advisories.

Informational Devices – Signs will be posted in Welch Creek notifying boaters of the presence of the capped area and the fish consumption advisories. If possible, the location of the capped area will be incorporated into government maps or registries.

3. **Timing:** The Institutional Controls must be described in the Remedial Design (RD) and the Operations and Maintenance (O&M) Plan. These controls must stay in place as long as the remedy remains in place. Fish consumption advisories will remain in effect until the protective levels established by the State for fish tissue have been met.

3. **Responsibility:** Domtar, the PRP, will be responsible for implementing the ICs on the Domtar property including any property surveys, fees, etc., needed for the ICs. The PRPs will prepare O&M Reports or similar status reports such as an IC Implementation Plan/Report that summarizes all ICs implemented for the Site. USEPA is responsible for monitoring (e.g., in O&M Report, in IC Implementation Report, during the 5 year reviews, etc.) the implementation and effectiveness of the ICs. The State of North Carolina will be responsible for determining if and when the fish consumption advisories can be lifted or modified.

3. Summary of the Estimated Remedy Costs

The selected remedy has a present worth cost of approximately $ 9.6 million which includes construction and maintenance/monitoring as shown in Table M-1.

Table M-1: Estimated Costs for Selected Remedy

ITEM DESCRIPTION	UNITS	QUANTITY	UNIT PRICE DOLLARS	TOTAL COST DOLLARS
MOBILIZATION/DEMOBILIZATION				
(Barges, Cranes, Field Office, Supplies and Personnel, H&S Equipment)				
Labor and Expenses	days	6	$17,800	$106,800
Equipment Mobilization	each	1	$176,200	$176,200
Materials and Supplies	each	1	$40,700	$40,700
SET UP and TEAR DOWN				
(Silt Curtains, Staging Areas Assemble Barges, Settling Plates, String Cables, Install Safety Equipment on Creek				
Labor and Expenses	days	14	$20,500	$287,000
Equipment	each	1	$123,000	$123,000
Materials and Supplies	each	1	$32,000	$32,000
PREP CREEK				
(Trim Trees, Remove Submerged logs as necessary, Assume 500 feet of shoreline per day)				
Labor and Expenses	days	14	$18,400	$257,600
Equipment	each	1	$145,200	$145,200
Materials and Supplies	each	1	$13,000	$13,000
CAPPING				
Installation of thin layer cap	sf	805,000	$1.28	$1,031,865
SURVEYS				
Preconsruction and Post Construction	ea	2	$30,000.00	$60,000
Weekly (settlement plates, underwater survey)	ea	4	$2,400.00	$9,600
Verification Cores	ea	72	$600.00	$43,200
SITE RESTORATION				
(Remove Staging areas, grade and seed disturbed areas)	acre	2.5	$10,800.00	$27,000
Pre Design and BaselinE Studies	each	1	$350,000	$350,000
Subtotal - Capital Cost				$2,703,165
Facility support and corporate costs	10%	Direct capital		$270,316
Project management	8%	Direct capital		$216,253
Remedial design and predesign studies	20%	Direct capital		$540,633
Construction management documentation and oversight	10%	Direct capital		$270,316
Permit equivalent submittals/regulatory interaction	10%	Direct capital		$270,316
Subtotal				$4,271,000
Contingency (25% of Subtotal)				$1,067,750
TOTAL CONSTRUCTION COST				$5,338,750

Table M-1: Estimated Costs for Selected Remedy (cont.)

	UNITS	QUANTITY	UNIT PRICE	ANNUAL COST	TIME YEARS	PRESENT WORTH
MONITORING - UPSTREAM					30	$1,890,000
MONITORING - MIDSTREAM					30	$463,000
CAP MAINTENANCE					30	$1,032,000
SUBTOTAL						$3,385,000
CONTINGENCY (25% of Subtotal)						$846,250
TOTAL PRESENT WORTH MAINTENANCE/MONITORING						$4,231,250
NOTE: Estimated annual monitoring and maintenance costs year 0 - 5						$450,000-$500,000

4. Expected Outcomes of the Selected Remedy

The purpose of this response action is to protect human health and the environment by addressing the risk associated with exposure by ecological receptors to contaminated sediments at the Site. The response action may also reduce contaminant concentrations in fish in Welch Creek which in turn will reduce risk to humans as expressed in the current fish consumption advisory.

1. Available Use after Clean-up

General land use adjacent to Welch Creek in the proximity of the capped sediments will continue to be industrial. Domtar already owns property on the east side and most of the west side of Welch Creek. Deed restrictions will note that potential future site activities must be conducted in a manner not to disturb or interfere with the remedy for contaminated sediments. Public access to Welch Creek will not be blocked, but signage will be placed in Welch Creek to note the presence of the remedy and fish consumption advisories. Fish consumption advisories will remain in effect until tissue concentrations have met the State guidelines.

2. Final Clean-up Levels

As described in the risk assessment, EPA first identified chemicals of potential concern (COPCs) to develop the clean-up goals at the site. The COPCs are the chemicals whose data are of sufficient quality for use in the quantitative risk assessment, are potentially site-related, are above background concentrations at the site, and represent the most significant contaminants in terms of potential toxicity to people or ecological receptors.

Contaminants of Concern (COCs) are the COPCs that significantly contribute to a human exposure pathway that exceeds either a 10-4 cumulative site cancer risk or a non-carcinogenic hazard index of 1 or an ecological exposure pathway that exceeds a hazard index of 1. In addition, a contaminant may be retained as a COC if the observed concentration exceeds a state or federal chemical-specific ARAR.

The Final Clean-up Levels for sediment and surface water are listed below in Table M-2.

Table M-2: Final Clean-up Levels

MEDIA	CONTAMINANT	CLEAN-UP LEVEL	SOURCE
Sediment	Dioxin TEQ[1]	1 ppb	Ecological Risk Assessment
Surface Water	Dioxin (2,3,7,8-TCDD)	1.4×10^{-8} ug/l	NC DENR Surface Water Standard
[1]EPA International Toxicity Equivalent Factors EPA 1989			

Operable Unit 4 (Welch Creek) focuses on dioxin in sediment. Dioxin in wetland soil did not require the development of alternatives because of the following factors: 1) the human health and ecological risk assessments did not indicate unacceptable risk due to dioxin in wetland soil, 2) no residential development currently or anticipated in wetland areas, 3) the detected concentrations are at or below the current USEPA dioxin cleanup policy 5-20 ppb for industrial exposure scenarios, and 4) modeling by COE indicated that adjacent wetland soils are not subject to enough erosion to transport soil contaminants into Creek.

Cleanup goals for mercury in sediment, surface water, and wetland soil and water were not selected because of the following factors: 1) apparent ongoing air borne deposition of mercury from other regional sources, 2) historic mercury in some Creek sediment may not as bioavailable due to presence of sulfides in sediment, 3) mercury concentrations in fish tissue in Welch Creek are similar to fish tissue concentrations from local, regional, and national background locations, 4) mercury concentrations in surface water were below ecological screening values, 5) maximum methyl mercury concentrations in wetland soil were well below ecological screening values for soil. However, mercury will be included in the long term monitoring program.

3. Anticipated Environmental and Ecological Benefits

The use of eMNR (thin layer cap) over the contaminated sediment will reduce the uptake of dioxin by benthic biota and thus reduce the bioaccumulation of dioxin further up the food chain. Disturbances of the existing blackwater stream environment will be minimized.

N. Statutory Determinations

Protection of Human Health and the Environment

The selected remedy will adequately protect human health and the environment through containment, engineering controls, and/or institutional controls (NCP §300.430(f)(5)(ii)). Contaminated sediment that exceeds the cleanup level of 1 ppb will be addressed through eMNR

which includes the application of a thin layer sand cap. Fish consumption advisories issued by the State of North Carolina will remain in effect until contaminant concentrations in fish have achieved levels established by the State. Other institutional controls such as signage in the impacted area of Welch Creek and deed restrictions on the upland area of the Domtar property will also be used.

Compliance with Applicable or Relevant and Appropriate Requirements

The Federal and State ARARs that are relevant to the Site and the Selected Remedy are presented below. The clean-up will comply with the substantative requirements of the ARARs, but associated permits are not required for work performed on the Site. This exemption from permits for work performed on-site can be found in Section 121(e) of CERCLA.

Table N-1
Applicable or Relevant and Appropriate Provisions of the following Standards, Requirements, Criteria, or Limitations (Chemical-Specific)

CONSTITUENT OF CONCERN	NORTH CAROLINA SURFACE WATER QUALITY STANDARD (µg/L)	CITATION	COMMENT
Dioxin congener 2,3,7,8-TCDD only – Total Concentrations	1.4×10^{-8}	Title 15A NCAC Subchapter 2B.0200, 2B.0208.	The North Carolina 2B standard establishes numerical goals for the protection of surface water quality. Applicable (1-liter sample volumes).

Table N-2
Applicable or Relevant and Appropriate Provisions of the following Standards, Requirements, Criteria, or Limitations (Location-Specific)

STANDARD, REQUIREMENTS, OR LIMITATION	CITATION	DESCRIPTION
Area affecting coastal area waters	North Carolina CAMA (NCGS Chapter 113 A, Article 7)	Establishes criteria for protection, preservation, and conservation of coastal areas. Relevant appropriate for activities that occur on Washington County side of Creek. Relevant and appropriate.
North Carolina Coastal Management	Title 15A NCAC Chapter 7	Protects natural resources and manages development in high hazard areas to achieve quality coastal waters. Provides public access for recreation and redevelop of urban waterfronts. Assures that the public and local governments have a say in coastal decision making and assist in developing a plan for and managing living marine resources. Relevant appropriate for activities that occur on Washington County side of Creek. Relevant and appropriate.
North Carolina Wetlands Protection	Title 15A NCAC Chapter 2B.0202	Provides definition of "functional wetland" and requires protection of wetland resources to maintain functionality standard. Applicable.
Flood Plain Management		
Flood Plain Management	40 CFR 6, Appendix A, 10 CFR 1022	In 100-year flood plains, actions must be taken to reduce the risk of flood loss, minimize the impact of floods on human safety, and restore and preserve the natural and beneficial values of flood plains. Applicable.
	40 CFR 122	In areas that potentially erode or release sediment, controls and best management practices are to be used to control runoff from construction activities. Applicable.
Environmental Protection		
Fish and Wildlife Coordination Act	40 CFR 6.302, 16 USC 661-666	Requires consultation when activities modify any stream or other water body adequate for protection of fish and wildlife resources. Applicable.
Endangered Species Act	16 USC 1531, 50 CFR Part 200, 50 CFR Part 402	Requires action to conserve endangered species within critical habitats on which endangered species depend and includes consultation with Department of the Interior. The U.S. Fish and Wildlife Service has determined that the only federally protected species under Service jurisdiction that is likely to occur in the project area is the bald eagle. Applicable.

STANDARD, REQUIREMENTS, OR LIMITATION	CITATION	DESCRIPTION
Coastal Zone Management Act	16 USC 1451	Requires action to conserve endangered species within critical habitats on which endangered species depend and includes consultation with the Department of Interior. Relevant and appropriate.

Table N-3
Applicable or Relevant and Appropriate Provisions of the following Standards, Requirements, Criteria, or Limitations (Action-Specific)

STANDARD, REQUIREMENT, OR LIMITATION	CITATION	DESCRIPTION
Surface Water Protection		
Classification and water quality standards applicable to surface water and wetlands in North Carolina	Title 15A NCAC Subchapter 2B.0100 and .0200	Establishes a series of numerical standards for surface water and functional standards for wetland quality. Applicable.
Air Quality Protection		
Ambient air quality standard	Title 15A NCAC Subchapter 2D Section .0400	Established ambient air quality standards for sulfur dioxide, total suspended particles, particulate matter (nominally 10 microns and 2.5 microns or less) (PM_{10}), carbon monoxide, ozone, nitrogen dioxide, etc. Potentially applicable.
Requirements for fugitive non-process dust emissions	Title 15A NCAC Subchapter 2D Section .0540	Establishes regulations for the release of fugitive dust from specific sources and activities. Potentially applicable.
Environmental Protection		
Water and Air Resources Statute	NCGS Chapter 143 Article 21	A public policy of the State to maintain, protect, and enhance water quality within North Carolina. Potentially applicable.
Oil Pollution and Hazardous Substances Control Act	NCGS Chapter 143 Article 21A	Establishes criteria for protecting the land and the waters over which this State has jurisdiction from pollution by oil, oil products, oil by-products, and other hazardous substances. Potentially applicable.
Sedimentation Pollution Control Act	NCGS Chapter 113A Article 4, 15A NCAC 4	Requirements for control of erosion and sedimentation of streams, lakes and other waters of North Carolina. Potentially applicable.
Worker Safety		
Worker Health and Safety	29 CFR 1920.120	Training, personnel protection, medical monitoring and other health and safety requirements for employees engaged in hazardous waste site operations. Applicable.
Worker Safety	29 CFR 1926	Standards for general construction. Applicable

STANDARD, REQUIREMENT, OR LIMITATION	CITATION	DESCRIPTION
Clean Water Act		
Dredge or fill requirements (Section 404)	33 USC 1251	In areas encompassing aquatic ecosystems, requires permits for discharge of dredge or fill material into navigable waters. Potentially applicable.
Rivers and Harbors Act of 1889	33 USC 403	Requires permit for structures or work in or affecting navigable waters. Potentially applicable.

(1) Permits are not required for actions that occur on site. Substantive requirements of ARARs will be met

To Be Considered (TBC) Information

In addition to ARARs, there is To Be Considered (TBC) information. TBC items are not legally enforceable requirements, but should be considered during the development and implementation of the remedial action. A list of potential TBC information for Welch Creek includes the following:

- NC DENR – Department of Health and Human Services (DHHS) fish consumption advisory for dioxin
- Clean Water Act Section 303d, watershed planning with respect to waters not meeting water quality standards and requirement to develop total maximum daily loads (TMDL) for pollutants for which standards not being achieved (*e.g.*, mercury)
- Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites (OSWER Directive 9285.6-08, USEPA, 2002)
- USEPA Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (EPA-540-R-05-012, December 2005)
- Ecological Risk Assessment and Risk Management Principles (OSWER Directive 9285.7-28P, USEPA)
- Substantive requirements of local permits and ordinances
- Statement of Procedures on Floodplain Management and Wetland Protections (Executive Order, Appendix A, 40 CFR, Part 6)
- Considering Wetlands at CERCLA Sites (OSWER Directive 9280.0-03, USEPA, 1994a)
- Fish Window – 15A NCAC 07H.1505 Specific Conditions, (9) No excavation may occur during times designated by the N.C. Division of Costal Management for protection of fish, shellfish, or wildlife resources

Cost Effectiveness

This section explains how the Selected Remedy meets the statutory requirement that all Superfund remedies be cost-effective. A cost-effective remedy in the Superfund program is one whose "costs are proportional to its overall effectiveness" (NCP §300.430(f)(1)(ii)(D)). The "overall effectiveness" is determined by evaluating the following three of the five balancing criteria used in the

detailed analysis of alternatives: (1) Long-term effectiveness and permanence; (2) Reduction in toxicity, mobility and volume (TMV) through treatment; and, (3) Short-term effectiveness. "Overall effectiveness is then compared to cost" to determine whether a remedy is cost-effective (NCP §300.430(f)(1)(ii)(D)).

The selected remedy is considered cost effective because it reduces human health and ecological risks to acceptable levels at less expense than some of the other alternatives evaluated. The selected remedy has provisions for long term monitoring and maintenance to ensure effectiveness of the remedy. The selected remedy is the least disruptive of the Welch Creek environment, thus minimizing short term impacts. The selected remedy does not reduce the TMV of contaminants through treatment; rather contaminants are isolated from the benthic organisms in order to reduce the uptake and bioaccumulation of contaminants.

Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable (MEP)

Alternative 3 is a containment remedy. Even if dredging were implemented, a thin layer cap would likely be necessary to contain residual contamination that remained once the dredging was completed. The remedy includes provisions for long term monitoring and maintenance of the thin layer cap for the selected remedy.

Preference for Treatment as a Principal Element

The source materials in Welch Creek can be reliably contained and are not considered to be a principal threat. The contaminant concentrations are not significantly elevated relative to the cleanup level, do not present an unacceptable risk to people based on the scenarios evaluated in the risk assessment, and are not highly mobile. Therefore, the selected remedy (Alternative 3) does not include treatment.

Five-Year Requirements

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, a review will be conducted every five years after construction completion at the Site to ensure that the remedy is, or will be, protective of human health and the environment.

O. Documentation of Significant Changes from Preferred Alternative of Proposed Plan

The Proposed Plan for Welch Creek at the Domtar (formerly Weyerhaeuser) Site was mailed to the community on August 1, 2007. The public comment period was from August 6, 2007, to September 4, 2007. The Proposed Plan identified Alternative 3 (eMNR for the upstream reach and mobility monitoring for the midstream reach) as the Preferred Alternative for remediation. EPA reviewed the verbal and written comments submitted during the public comment period. EPA has determined that no significant changes to the remedy, as originally identified in the Proposed Plan, are necessary or appropriate. The Responsiveness Summary is contained in Appendix A and the transcript of the Proposed Plan Public Meeting is contained in Appendix B.

APPENDIX A: RESPONSIVENESS SUMMARY

The following section provides EPA responses to written comments received during the Public Comment Period on the Proposed Plan for contaminated sediment in Welch Creek which is adjacent to the Domtar (formerly Weyerhaeuser) paper mill in Plymouth, NC. The transcript of the Public Meeting held on August 16, 2007 provides the response to oral comments received at the meeting.

The verbal comments offered by the public at the meeting tended to support no action or monitoring instead of more active measures (see the attached meeting transcript). Five written comments (emails or letters) were submitted to EPA in addition to the verbal comments raised during the public meeting. These five written submittals either supported EPA's preferred alternative or recommended that contaminated sediment be removed from the creek bed. More specific comments are presented below along with EPA's response. Similar comments are grouped together.

Predictions of increased storm activity suggest a greater potential for the dioxin in sediment to be stirred up and then flow into the Sound and its rivers. The proposed sand cap would not go far in keeping the pollution under control. The dioxin should be removed as completely as possible because it will remain a threat to the water quality of the river and a danger to our citizens.

Sediment stability and the potential for dioxin migration in surface water were evaluated during studies at the Site. As noted in the Proposed Plan, sediment in the upstream reach of Welch Creek is considered to be stable (less likely to have significant stream bed erosion) for the foreseeable future. With proper maintenance and monitoring, the sand cap is expected to be protective and achieve the desired risk reduction. The risk to people from dioxin in Welch Creek is associated with the consumption of bottom dwelling fish like catfish and carp. However, dioxin concentrations in fish tissue have declined significantly since the early 1990s. That is one reason that EPA does not feel that intensive measures like dredging are warranted at this time based on the available information.

Sediment stability and the potential for dioxin migration in surface water were evaluated from both a practical perspective, using measurements of conditions in the creek and from a more analytical perspective, based on hydrodynamic modeling and site specific data. The practical perspective was based on bathymetric surveys conducted in Welch Creek during 1995 and 2005. The bathymetric surveys presented the cross sectional profiles or shape of the underwater creek bottom. The surveys noted little change in the profiles even though five named tropical storms or hurricanes passed through the area between 1996 and 2003. The hydrodynamic modeling indicated that the midstream reach bracketed by transects MT-7 to GT-15 was potentially more susceptible to sediment mobilization. However, dioxin concentrations in the midstream reach are already below the sediment cleanup values so there is little need for active measures in that reach.

We believe the most prudent remedy is the removal of the more contaminated sediments in the upstream reach of the creek (as identified in the EPA fact sheet and report) and, once dredging is completed, capping the creek bed with clean sand in both the upstream and midstream reaches. Hydraulic dredging should be used to minimize the potential for mobilization of the dioxin-laden sediments. Isolating, dewatering, and dredging sections of the Upstream reach in a stepwise manner would likely reduce short term impacts to public health and the environment.

EPA has considered various alternatives, including dredging, to deal with contaminated sediment in Welch Creek. Given that dioxin concentrations in fish tissue and duck eggs in this area have declined significantly since the mid early to mid 1990's, EPA believes that the most intensive remediation, dredging, is not warranted at this time. The significant improvement in tissue concentrations that have already occurred is most likely due to more stringent wastewater discharge standards for paper mills that were implemented in the early 1990's. Also, it is worthwhile to note that the maximum concentration of dioxin in Welch Creek sediment is between 6 to 7 ppb, with an average of approximately 2.5 ppb. These values do exceed, but are not greatly higher than, the cleanup value of 1.0 ppb. The thin layer sand cap and monitoring alternative is an appropriate and measured response based on the available data about dioxin concentrations in this area.

It is unlikely that hydraulic dredging could be used alone to remove sediment in the impacted areas. As noted in the feasibility study, there is a good deal of woody debris (fallen trees and similar material) that are present along the creek bank and bottom. This material would have to be removed by mechanical means before a hydraulic dredge could be used. Nevertheless, EPA does not suggest that dredging is not possible. Rather, given the improvements in tissue concentrations that have already occurred, and that a sand cap is suggested even after dredging, the thin layer cap (without dredging) is considered appropriate to achieve the risk reduction goals of the Superfund program.

The remediation must include *pre-project monitoring, beginning immediately,* of benthic invertebrates, amphibians, reptiles, and aquatic animals in Welch Creek, the Roanoke River, and the western Albemarle Sound. This monitoring should be done in addition to the fish, wildlife, and sediment monitoring already planned for the project. In addition, monitoring should be carefully conducted during the sediment removal and capping of the creek bed, so that changes may be made during construction if it looks like the desired results are not being achieved. After construction the integrity of the sediment cap—the shoreline, slope, and deep water areas—must be carefully monitored, and additional monitoring must be conducted to determine if polluted sediments have remobilized. This must include samples taken immediately after storm events and during periods when water levels are unusually high and unusually low. Monitoring of ecological indicators, *including concentrations of dioxin in fish and wildlife,* must also continue after remediation. Finally, all monitoring must be continued indefinitely. It should be conducted on an annual basis, not every five years as is common with completed CERCLA projects. Should the dioxin remobilize, additional remediation must be undertaken.

EPA agrees that appropriate monitoring must be done prior to beginning the remedy construction, during construction, and after construction. Post construction monitoring (long term monitoring) would be conducted on an annual basis. The five year period is associated with the "Five Year Reviews" performed at any Superfund site that use containment remedies or institutional controls (such as fish consumption advisories). Each five year review would consider the previous years' annual monitoring results. Five year reviews would continue at this Site for the foreseeable future. A determination regarding the need for additional remediation would be based on site specific conditions, contaminant trends, and the risk reduction principles of the Superfund program.

I heartily approve of the EPA plan to mitigate the dioxin deposits in this area.

Comment noted.

It is our opinion that the remedial alternative proposed by EPA will meet those criteria and help greatly in reducing the time frame for a full recovery of the ecosystem and recreational fishing while keeping intact the significant healthy portion of the ecosystem and reducing the risk of spreading the impacted sediments and aggravating the problem. We oppose an alternative such as dredging that has a significant potential to further spread the contamination, destroy the established ecosystem, and generate significant volume of solid wastes and waste water.

Comment noted. EPA does not feel that dredging is an appropriate remedy based on the current data and conditions. EPA, in consultation with NCDENR, will monitor the long term performance of the selected remedy. The performance monitoring data would be used to determine if modifications to the remedy were necessary.