

# ***Revised Final Feasibility Study Report – Soils***

***St. Regis Paper Company Site  
Cass Lake, Minnesota***

***Prepared for:  
International Paper  
BNSF Railway Company***

***April 14, 2011***



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## List of Acronyms

|                  |  |
|------------------|--|
| AOC              | Administrative Order on Consent  |
| ARAR             | Applicable or Relevant and Appropriate Requirement                         |
| ATSDR            | Agency for Toxic Substances and Disease Registry                           |
| ATSM             | Alternatives Technical Screening Memorandum                                |
| ATV              | All-terrain Vehicle  |
| BaP <sub>e</sub> | Benzo(a)pyrene Equivalent  |
| BNSF             | Burlington Northern Santa Fe Railway Company                               |
| CERCLA           | Comprehensive Environmental Response and Compensation Liability Act        |
| CFR              | Code of Federal Regulations  |
| CLU-IN           | Hazardous Waste Clean-up Information                                       |
| COEC             | Chemical of Ecological Concern   |
| COC              | Chemical of Concern  |
| CPAHs            | Carcinogenic Polycyclic Aromatic Hydrocarbons                              |
| CTE              | Central Tendency Exposure  |
| CY               | Cubic Yard   |
| EcoSSL           | Ecological Soil Screening Level  |
| FS               | Feasibility Study  |
| FS-AOC           | Feasibility Study – Administrative Order on Consent                        |
| GAC              | Granular Activated Carbon  |
| GW               | Groundwater  |
| HHERA            | Human Health and Ecological Risk Assessment – St. Regis Paper Company Site |
| HI               | Hazard Index   |
| HSCA             | Hazardous Substance Control Act (LLBO Tribal Ordinance)                    |
| IP               | International Paper  |
| LLBO             | Leech Lake Band of Ojibwe  |
| MPCA             | Minnesota Pollution Control Agency   |
| MRL              | Minimum Risk Level   |
| NCP              | National Contingency Plan (U.S. EPA, 1990)                                 |
| NPDES            | National Pollutant and Discharge Elimination System                        |
| OSHA             | Occupational Safety and Health Administration                              |
| OSWER            | Office of Solid Waste and Emergency Response                               |
| OU               | Operable Unit  |
| O&M              | Operation and Maintenance  |

|                   |  |
|-------------------|--|
| PAH               | Polycyclic Aromatic Hydrocarbon                                |
| PCB               | Polychlorinated Biphenyls                                      |
| PHASP             | Project Health and Safety Plan                                 |
| PRG               | Preliminary Remediation Goal                                   |
| PRGs-R            | Preliminary Remediation Goals – Residential Land Use           |
| PRGs-I/C          | Preliminary Remediation Goals – Industrial/Commercial Land Use |
| RA                | Risk Assessment  |
| RAG               | Risk Assessment Guidance (U.S. EPA)                            |
| RAO               | Remedial Action Objective                                      |
| RCRA              | Resource Conservation and Recovery Act                         |
| REACH IT          | Remediation and Characterization Technology Database           |
| RI/FS             | Remedial Investigation/Feasibility Study                       |
| RME               | Reasonable Maximum Exposure                                    |
| ROD               | Record of Decision   |
| RP                | Responsible Party  |
| SOW               | Statement of Work  |
| SLV               | Soil Leaching Value (MPCA)                                     |
| SRV               | Soil Reference Value (MPCA)                                    |
| SW                | Sitewide   |
| SWPPP             | Storm Water Pollution Prevention Plan                          |
| TBC               | To Be Considered Criteria                                      |
| TEQ <sub>DF</sub> | Toxicity Equivalence – Dioxins/Furans                          |
| USC               | United States Code   |
| U.S. DOT          | United States Department of Transportation                     |
| U.S. EPA          | United States Environmental Protection Agency                  |
| VIC               | Voluntary Investigation and Cleanup                            |
| WHO               | World Health Organization                                      |

## 1.0 Introduction

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In 2004, the U.S. EPA ordered International Paper to conduct a baseline site-specific human health and ecological risk assessment for the St. Regis Paper Company Site. In response to the Order, International Paper prepared a risk assessment work plan, including a sampling and analysis plan to gather the additional data required to prepare the risk assessment. Extensive field work was conducted in the fall of 2004 and a Data Report (Barr, 2005) summarizing the field work and analytical data was submitted to the U.S. EPA on April 28, 2005. This analytical data set was added to the previously collected data and the combined data set was used to identify chemicals of concern at the Site and calculate exposure point concentrations for the qualitative baseline risk assessment. International Paper submitted the Human Health and Ecological Risk Assessment (HHERA) Report to the U.S. EPA on September 28, 2007. The U.S. EPA reviewed and provided comments on the HHERA Report. An addendum to the HHERA Report was submitted to the U.S. EPA on May 30, 2008. The U.S. EPA approved the HHERA Report with modifications in a letter dated August 15, 2008.

U.S. EPA determined that while most of the extensive risk scenarios evaluated by the HHERA showed no unacceptable risk levels, certain risks as evaluated by the HHERA were in a range above acceptable levels. This determination was the basis for the September 2008 Administrative Settlement Order and Agreement on Consent for Feasibility Study (Docket No. V-W-'08-C-912) (FS-AOC), specifying that a feasibility study be prepared for the Site soils.

International Paper completed a Final Feasibility Study Work Plan (Barr, 2008) summarizing the scope of work, general schedule and technical approach that would be used to complete the feasibility study required by the FS-AOC. The Work Plan was approved by the U.S. EPA with modifications in a letter dated December 23, 2008.

International Paper completed a Draft Alternatives Screening Technical Memorandum – Soils and submitted the draft to the U.S. EPA on February 23, 2009. Technical review comments were received from the U.S. EPA on June 19, 2009. The U.S. EPA technical review comments were incorporated into a Draft Feasibility Study Report.

A Draft Feasibility Study Report was prepared by International Paper and the BNSF Railway Company (BNSF) as required and in accordance with the Statement of Work in the FS-AOC (U.S. EPA, 2008) and the U.S. EPA comments on the Draft Alternatives Screening Technical

Memorandum. The Draft Feasibility Study Report documented the development and evaluation of remedial action alternatives at the operable units at the Site (Figure 1-1). The Draft Feasibility Study Report was submitted to the U.S. EPA on September 17, 2009. Comments on the Draft Feasibility Study Report were received from the U.S. EPA on November 19, 2010. The U.S. EPA comments were incorporated into a Final Feasibility Study Report that was submitted to the U.S. EPA on January 13, 2011. This Revised Final Feasibility Study Report incorporates changes directed in additional comments that were received on February 28, 2011 (U.S. EPA, 2011) as well as follow-up discussions between International Paper and the U.S. EPA.. Specific responses to the U.S. EPA comments to the Final Feasibility Study Report are in Appendix A of this report.

Prior remedial actions have been implemented and are continuing at the Site. These remedial actions, all of which were undertaken at the direction of and under the oversight of either the MPCA or the U.S. EPA, include the following:

- In 1985, the Cass Lake Community Water System was extended to residents not serviced and potentially affected by groundwater contamination at the Site. The City of Cass Lake has adopted an ordinance (No. 12282005) that requires all new and existing structures to be connected to the municipal water supply system in areas where the system is available.
- In 1985, sludge and visibly contaminated soil from the oil/water separator tank area at the wood-treating plant (1,900 cubic yards of material), and the city dump pit (4,500 cubic yards of material) were excavated and placed in a temporary onsite stockpile. Excavated areas were backfilled with soils from the Site.
- In 1986, construction of a double-lined containment vault was completed in the southwest area of the Site (OU2). Sludge and visibly contaminated soil from the former wood-treating areas—including the area around the wood-treating plant, along the conduit to the wastewater ponds, and around the wastewater ponds (37,500 cubic yards of material) were excavated and placed in the containment vault. The sludge and visibly contaminated soil from the 1985 excavation were also placed in the containment vault. Excavated areas were backfilled with soil removed during construction of the containment vault and covered with additional fill materials to establish the final grade. The containment vault was closed (capped) in 1988 in a manner consistent with RCRA Subtitle C requirements. Long-term monitoring of groundwater in the vicinity of the containment vault has been performed since June 1987, with no impacts to groundwater detected.

- In 1986, ten groundwater extraction wells were installed, and a granular activated carbon (GAC) treatment plant was constructed to remove and treat contaminated groundwater. The GAC system, which consists of three 20,000-lb. carbon contactor units operating in series, is a widely applied and proven water treatment technology for removal of a wide range of organic chemicals, including polycyclic aromatic hydrocarbon (PAH) and phenolic compounds. Treated effluent from the system discharges to the channel between Cass Lake and Pike Bay in accordance with U.S. EPA requirements. The extraction system was designed to capture and treat contaminated groundwater in OU1 and to operate until applicable cleanup objectives are achieved.
- In 1987, three groundwater extraction wells were installed at the city dump pit area to remove contaminated groundwater. This groundwater is pumped to the GAC treatment facility. This extraction system was designed to capture contaminated groundwater in the vicinity of the dump pit and to operate until applicable cleanup objectives are achieved.
- In 1989, a land use restriction was recorded on Quit Claim Deed – Document Number: 310258, which transferred property in OU1 to the City of Cass Lake per their request. In addition, an affidavit pursuant to Minnesota Statutes 115B.16 was recorded (as Document Number: 310257) with the Quit Claim Deed. The Quit Claim Deed and affidavit are in Appendix H.
- Monitoring of groundwater and surface water continues to be performed to monitor the effectiveness of the groundwater extraction systems at the Site since the extraction systems went into operation. As of November 30, 2010, an estimated 29,600 pounds of PCP and 15,600 pounds of PAH compounds have been removed from the groundwater by the extraction systems and treated.
- U.S. EPA issued a Unilateral Administrative Order for Removal on City-owned Property (Docket No. V-W-'04-C-771) to International Paper in December 2003 for a removal action in OU1. International Paper performed the removal action field work from June to October 2004, with final restoration being completed in June 2005. The removal action involved excavating the surface and shallow subsurface soils on the City-owned property and the Allen property where analytical results had shown dioxin/furan toxic equivalent (TEQDF-WHO98) concentrations in soils exceeding 1,000 ng/kg. A total of 3,321 tons of contaminated soil was excavated, transported offsite, and disposed of at a RCRA Subtitle D landfill. The U.S. EPA

closed the December 2003 Unilateral Administrative Order in a letter dated October 13, 2005.

- U.S. EPA and BNSF entered into an Administrative Order on Consent (BNSF AOC) for Removal Action (Effective Date: August 25, 2005) to complete a soil removal action on BNSF property in OU1. The August 2005 BNSF AOC required BNSF to (1) excavate soils with a dioxin/furan TEQDF-WHO98 concentration exceeding 5,000 ng/kg with disposal of the excavated soils in a RCRA Subtitle D landfill; (2) install perimeter fencing to limit access to remaining areas with dioxin/furan TEQDF-WHO98 concentrations in surface soil exceeding 1,000 ng/kg; and (3) maintain vegetative cover in all areas with TEQDF-WHO98 concentrations at or above 1,000 ng/kg. This removal action was completed in October 2005. A total of 675 tons of contaminated soil was excavated, transported offsite, and disposed of at a RCRA Subtitle D landfill. An additional load (i.e., 5.7 tons) of wood debris and plastic sheeting was also transported to the landfill for disposal. The U.S. EPA reportedly closed the BNSF AOC.
- At the U.S. EPA's request, International Paper performed a voluntary response action consisting of fencing an inactive portion and covering an active portion of Cass Forest Products property in OU1 where analytical results had shown dioxin/furan (TEQDF-WHO98) concentration in soils exceeding 1,000 ng/kg. This property is located in the former operations area of the Site. This response action was completed in November 2006.
- U.S. EPA issued a Unilateral Administrative Order for Human Health and Ecological Risk Assessment (Docket No. V-W-'04-C-796) to International Paper with an effective date of August 11, 2004. International Paper developed a risk assessment work plan, including a sampling and analysis plan, to gather additional data. The field work described in the risk assessment work plan was conducted in the fall of 2004 and a Data Report (Barr, 2005) was submitted to the U.S. EPA on April 28, 2005. International Paper submitted the Human Health and Ecological Risk Assessment Report to the U.S. EPA on September 28, 2007. An addendum to the Human Health and Ecological Risk Assessment Report was submitted to the U.S. EPA on May 30, 2008. The U.S. EPA approved, with modifications, the May 2008 HHERA in a letter dated August 15, 2008. The U.S. EPA provided a Notice of Completion of the work on February 22, 2011.

- Prior to completion of the site-specific risk assessment, the U.S. EPA determined that an interim remedy was necessary in OU7 to protect human health from actual or threatened releases of hazardous substances into the environment. The decision is documented in an Interim Record of Decision, St. Regis Paper Company Site (U.S. EPA, 2005). The Interim Record of Decision selected the following interim remedy for residences in OU7 near the former operations area: (1) remove and replace carpets; (2) provide initial and periodic house cleaning for dust removal; (3) cover yards with clean fill and plant grass seed; and (4) apply dust suppressant to public unpaved roads. This interim remedy was implemented by International Paper as required by the December 2005 Administrative Order for Remedial Action (Docket No. V-W-'05-C-833). Implementation of remedial measures began in 2006 and is continuing. Remedial measures included replacement of home carpets, an initial and periodic cleaning of the interiors of homes, covering of residential yards with clean topsoil and reseeded, placing clean gravel aggregate on unpaved driveways, and the periodic application of dust suppressant on unpaved public roads. The majority of the occupied homes, as well as properties with vacant homes that could be occupied, have been included in the interim remedy. A few homeowners did not allow access for some or all of the work. Thirty-four residences were included in the initial housecleaning, and 35 were included in the yard covering. Under the terms of the Interim Record of Decision, periodic supplemental housecleaning will continue until a permanent remedy is selected for the Site. Currently, eight residences are participating in the supplemental cleaning program.

The locations of the previous actions at the Site are shown on Figures 1-2 through 1-6.

U.S. EPA, in consultation with International Paper, BNSF, State of Minnesota and the Leech Lake Band of Ojibwe (LLBO), and with input from the public, will use information in this Revised Final Feasibility Study Report to select a remedial action alternative in its Record of Decision in accordance with the *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP) (40 CFR 300.430(e)(9)(iii)(B)). The criteria for remedy selection under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) require that Superfund remedial actions be considered using the following requirements:

- Overall Protection of Human Health and the Environment
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
- Long-Term Effectiveness and Permanence
- Reduction in Toxicity, Mobility, or Volume through Treatment

- Short-Term Effectiveness
- Implementability
- Cost
- State Acceptance
- Community Acceptance

As described in the RI/FS guidance document (U.S. EPA, 1988b) and in the NCP, a feasibility study consists of the following three phases: development of remedial alternatives, screening of alternatives, and the detailed analysis of selected alternatives.

The FS-AOC states the following (Section V., U.S. EPA's Findings of Fact):

“34. In August 2004, U.S. EPA issued a CERCLA Unilateral Administrative Order to IP for the performance of a Human Health and Ecological Risk Assessment for the Site. The Assessment was delivered by IP to U.S. EPA for review on September 28, 2007. In sum, the Risk Assessment concluded that human health and ecological risks remain at the Site above acceptable levels. Specifically, the Risk Assessment found:

- a) The future child resident scenario is above acceptable levels for noncancer risk on nearby residential properties.
- b) The utility worker scenario with regard to ground water exposures is above acceptable levels for noncancer risk in a portion of the former operations area.
- c) With the addition of fish consumption to total risk for a residential land use scenario in the former operations area, the cumulative total Site cancer risks are above acceptable levels.
- d) A sample taken near the contaminated soil containment vault that was acutely toxic to soil invertebrates had high values of Site-related contaminants.
- e) Analysis indicates that city dump contaminants including arsenic, barium, chromium, cobalt, lead, manganese, nickel, silver, LPAH, and HPAH are potential contributors to reduced chironomid growth identified in samples taken from the Fox Creek area.”

Effectively mitigating the risks described in items a-d above and other risks identified by the U.S. EPA in comments to the Draft Alternatives Screening Technical Memorandum and the Draft and Final Feasibility Study Reports is the subject of this Revised Final Feasibility Study Report. Mitigating any potential ecological risk in the Fox Creek area described in item e above is not included in this report and is being addressed separately.

The FS-AOC Statement of Work (Appendix A, Section III) (U.S. EPA, 2008) contains the following language regarding the development and screening of alternatives at the Site:

“TASK 2: DEVELOPMENT AND SCREENING OF ALTERNATIVES

The Respondents shall develop and screen an appropriate range of remedial alternatives that will be evaluated in the FS. The alternative array will build on the FS Workplan, as appropriate. The range of alternatives shall include, as appropriate, options in which treatment is used to reduce the toxicity, mobility, or volume of wastes, but which vary in the types of treatment, the amount treated, and the manner in which long-term residuals or untreated wastes are managed; options involving containment with little or no treatment; options involving both treatment and containment; and a no-action alternative.

The conclusions of the September 2007 Risk Assessment (RA) document the positive impact the 2006 Site Interim Remedy has had on temporarily reducing human health risk to the residential area of the St. Regis Site (OU7). However, two of the nine criteria to be considered in evaluating remedial alternatives under the NCP, long-term effectiveness and permanence, were not considered in the selection of the Interim Remedy. As such, alternatives in the FS for the final Site remedy must include options that provide for long-term and permanent reduction of risk in the residential area. At a minimum, an alternative that includes the excavation of soil on residential properties should be included in the array of alternatives to be developed.

While the September 2007 Risk Assessment documented that exposures to surface contaminants in the Former Operations Area are within the Agency's acceptable risk range for commercial/industrial use, unacceptable risks were identified for workers performing excavations. Additionally, the Former Operations Area shows unacceptable risk from surface contamination under a future residential scenario. Finally, migration of soils from the Former Operations Area through surface runoff and wind-blown dust have been documented at the Site. Alternatives in the FS must, therefore, include remedial options for addressing risk at the Former Operations Area by addressing: 1) the future residential scenario; 2) migration risk to the nearby residential properties and roads; and 3) any contamination risk to workers at the Site. At a minimum, an alternative that includes covering contaminated areas to prevent contaminant migration and sufficient controls to prevent worker exposures and future potential residential use in the Former Operations Area should be included in the array of alternatives to be developed.

Concerning ecological risk, the FS must evaluate alternatives that characterize and address contaminated soil in the area of high worm mortality located in the southwestern portion of the Site's Contaminated Soil Containment Vault. In addition, since Site contaminants were not ruled out as impacting the growth of invertebrates in the City Dump Area of Fox Creek, the FS must evaluate alternatives for remediation of Fox Creek. Therefore an alternative that includes further characterization for contaminant excavation of the area of high invertebrate mortality and an evaluation of remediation of the Fox Creek Area against the nine criteria should be included.”

As described above, the evaluation of the need to remediate Fox Creek is being addressed in a separate report.

This Revised Final Feasibility Study Report does not address groundwater issues other than those associated with exposure due to work in soil excavations. Other groundwater issues are being addressed separately.

The following steps were used to develop and evaluate the remedial alternatives to mitigate the risks identified:

1. Develop remedial action objectives (RAOs).
2. Identify volumes or areas of media where RAOs will be applied.
3. Identify ARARs and to be considered criteria (TBCs).
4. Develop quantitative Preliminary Remediation Goals (PRGs) using chemical-specific ARARs/TBCs and human health- and ecological-based risk levels.
5. Develop general response actions.
6. Identify and screen technologies.
7. Identify and evaluate technology process options.
8. Assemble remaining process options into remedial action alternatives.
9. Evaluate the remedial alternatives in accordance with the NCP.

The alternatives screening sections of this Revised Final Feasibility Study Report (Sections 2.0 and 3.0) and the assembly of remaining process options into remedial action alternatives (Section 4.0) document the first eight steps in the development and evaluation of remedial action alternatives for soils in the residential area (OU7), the former operations area (OU1), the southwest area (OU2), and the former city dump (OU3) at the Site, all in conformance with the FS-AOC – Appendix A and U.S. EPA comments to the Draft Alternatives Screening Technical Memorandum and the Draft and Final Feasibility Study Reports. The locations of OU1, OU2, OU3 and OU7 are shown on Figure 1-1.

As required by the U.S. EPA for purposes of the feasibility study process, the limits of OU7 have been expanded to include additional areas where judgment based on sampling results indicates that soils could exceed PRGs.

The U.S. EPA also required that the possibility be considered that OU7 could be expanded to include residential land use on property not owned by International Paper in the vicinity of OU2. On December 21, 2010, U.S. EPA furnished International Paper with a Phase II Environmental Site Assessment Report for the Division of Resource Management Site, Cass Lake, MN (LLBO, 2010). The report describes the results from a 2007 investigation of surface soils at the “DRM Site” located adjacent to the western boundary of OU2. In response to an inquiry by International Paper, U.S. EPA furnished International Paper with partial data validation reports for the investigation on February 24, 2011 (semivolatile organic compounds) and March 3, 2011 (metals). A data validation report for dioxins/furans has not been received from the U.S. EPA.

The purpose of the alternatives screening process is to develop an appropriate range of remedial action alternatives that will be analyzed more fully in the detailed analysis phase (step 9 above) of the feasibility study process. Appropriate remedial action alternatives that provide for the protection of human health and the environment may involve, depending on site-specific circumstances, elimination or destruction of hazardous substances, reduction of concentrations of hazardous substances to acceptable health-based levels, prevention of exposure to hazardous substances via engineering or institutional controls, or some combination of the above.

The detailed analysis section of this Revised Final Feasibility Study Report (Section 5.0) summarizes and compares the detailed evaluation of the range of remedial action alternatives developed in the alternatives screening process in accordance with the NCP and as directed by the U.S. EPA.

The locations and media of concern to be addressed in this feasibility study are as follows.

### **OU1 – Former Operations Area**

1. Soil that the U.S. EPA has concluded presents an unacceptable potential risk to human health under the following scenarios:
  - a. from future exposure in the former operations area that the U.S. EPA believes has the potential for residential development to Site-related contaminants due to ingestion of soil and garden produce, inhalation of soil and indoor dust, and dermal routes of exposure if land use is changed to residential use in the future
  - b. from future exposure on nearby residential property and roads to Site-related contaminants transported from OU1 by surface water runoff and/or windblown dust

- c. from future exposure to Site-related contaminants due to ingestion of soil, inhalation of soil and indoor dust, and dermal routes of exposure with industrial/commercial land use
2. Groundwater that the U.S. EPA has concluded presents an unacceptable potential risk to worker exposure during below-ground construction. Other potential groundwater related exposures at the Site are being investigated by International Paper and the U.S. EPA separately from this feasibility study. For that reason and pursuant to the FS-AOC, groundwater-related exposures in this feasibility study are limited to the underground worker scenario in the former operations area until the groundwater investigation work is completed.

## **OU2 – Southwest Area**

1. Soil that the U.S. EPA has concluded presents an unacceptable risk to organisms from exposure to Site-related contaminants.
2. Soil on property owned by International Paper that the U.S. EPA has concluded presents an unacceptable potential risk to human health from future exposure to Site-related contaminants due to ingestion of soil, inhalation of soil and indoor dust, and dermal routes of exposure with industrial/commercial land use.

## **OU3 –Former City Dump**

1. Soil that the U.S. EPA has concluded presents an unacceptable potential risk to human health from future exposure to Site-related contaminants due to ingestion of soil, inhalation of soil and indoor dust, and dermal routes of exposure with industrial/commercial land use.

## **OU7 – Residential Area**

1. Soil that the U.S. EPA has concluded presents an unacceptable potential risk to human health from exposure to Site-related contaminants through ingestion of soil and garden produce, inhalation of soil and indoor dust, and dermal routes of exposure.

## 2.0 Remedial Action Objectives, ARARs/TBCs and PRGs

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This section presents remedial action objectives, identifies potentially applicable or relevant and appropriate requirements (ARARs) and to be considered criteria (TBCs), and presents preliminary remediation goals (PRGs) for the soil and groundwater at the locations of concern that are the subject of this Revised Final Feasibility Study Report. The remedial action objectives, potential ARARs and TBCs and PRGs are based on the understanding of Site conditions developed during the various investigations that have been completed at the Site, the Site-specific risks derived from the Human Health and Ecological Risk Assessment (HHERA) (Integral, 2007 and 2008), the FS-AOC, and U.S. EPA comments on the Draft Alternatives Screening Technical Memorandum and comments on the Draft and Final Feasibility Study Reports.

### 2.1 General Remedial Action Objectives

General remedial action objectives are defined by CERCLA and the NCP and are applicable to all Superfund sites. Under CERCLA (42 USC Chapter 103 § 9621), the statutory scope of remedial actions at all CERCLA sites includes the following general objectives:

- Remedial actions will “*attain a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and a control of further release at a minimum which assures protection of human health and the environment.*”
- Remedial actions must comply with or attain the level of “*any standard, requirement, criteria, or limitation under any Federal environmental law ... or any promulgated standard, requirement, criteria, or limitation under a State environmental or facility siting law that is more stringent than any Federal standard, requirement, criteria, or limitation, including each such State standard, requirement, criteria, or limitation contained in a program approved, authorized or delegated by the Administrator under a statute cited in subparagraph (A), and that has been identified to the President by the State in a timely manner.*”
- Preference should be given to selection of remedial actions “*in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants is a principal element*”. An explanation must be provided if a permanent solution using treatment or recovery technology is not selected.

The NCP (40 CFR § 300.430(f)(ii)) lists the following general objectives for selection of a remedy:

- *“Each remedial action selected shall be protective of human health and the environment.”*
- *“On-site remedial actions selected in a ROD must attain those ARARs that are identified at the time of ROD signature or provide grounds for invoking a waiver under §300.430(f)(1)(ii)(C).”*
- *“An alternative that does not meet an ARAR under federal environmental or state environmental or facility siting laws may be selected under the following circumstances:*
  - ( 1 ) The alternative is an interim measure and will become part of a total remedial action that will attain the applicable or relevant and appropriate federal or state requirement;*
  - ( 2 ) Compliance with the requirement will result in greater risk to human health and the environment than other alternatives;*
  - ( 3 ) Compliance with the requirement is technically impracticable from an engineering perspective;*
  - ( 4 ) The alternative will attain a standard of performance that is equivalent to that required under the otherwise applicable standard, requirement, or limitation through use of another method or approach;*
  - ( 5 ) With respect to a state requirement, the state has not consistently applied, or demonstrated the intention to consistently apply, the promulgated requirement in similar circumstances at other remedial actions within the state; or*
  - ( 6 ) For Fund-financed response actions only, an alternative that attains the ARAR will not provide a balance between the need for protection of human health and the environment at the site and the availability of Fund monies to respond to other sites that may present a threat to human health and the environment. ”*
- *“Each remedial action selected shall be cost-effective, provided that it first satisfies the threshold criteria set forth in §300.430(f)(1)(ii)(A) and (B)” (i.e., overall protection of human*

health and the environment, and compliance with ARARs (unless a specific ARAR is waived)).

- *“Each remedial action shall utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.”*

## **2.2 Site-Specific Remedial Action Objectives**

The Site-specific potential risks identified by the HHERA (Integral, 2007 and 2008), the FS-AOC and U.S. EPA comments to the Draft Alternatives Screening Technical Memorandum and the Draft and Final Feasibility Study Reports provide the basis for defining the site-specific remedial action objectives for the Site. Site-specific remedial action objectives address the chemicals of concern (COCs) and chemicals of ecological concern (COECs) identified in each OU and are based upon the evaluation of the potential risks to human health and the environment and consideration of the applicable or relevant and appropriate requirements (ARARs). These remedial action objectives are to be as specific as possible without limiting the range of alternatives that can be developed for detailed analysis.

The U.S. EPA has determined that the following potential exposures to COCs/COECs in each OU pose a sufficient potential human health and/or ecological risk to warrant establishment of remedial action objectives. A Site-specific remedial action objective is listed for each exposure.

- **OU1 – Soil**

- **Chemicals of Concern**

COCs for risk to human health resulting from exposure to soil in OU1 are TEQ<sub>DF</sub> and BaP<sub>e</sub>. No COECs have been established for OU1 soil because the ecological risk assessment (Integral 2007, 2008) did not identify unacceptable risk to any ecological receptors inhabiting OU1.

- **U.S. EPA Exposure of Concern**

Potential future exposure to Site-related COCs in OU1 soil through ingestion of soil and garden produce, inhalation of soil and indoor dust and dermal adsorption routes of exposure if land use in the former operations area is converted to residential use in the future.

### **Site-Specific Remedial Action Objective**

Prevent unacceptable potential risk to human health from future exposure to Site-related COCs in OU1 soil through ingestion of soil and garden produce, inhalation of soil and indoor dust and dermal adsorption routes of exposure if land use in portions of the former operations area is converted to residential use in the future.

#### **– U.S. EPA Exposure of Concern**

Potential future transfer of Site-related COCs in OU1 surface soil through runoff and/or windblown dust from the former operations area to nearby residential property and roads.

### **Site-Specific Remedial Action Objective**

Prevent the potential for the future transfer of Site-related COCs in OU1 surface soil to present an unacceptable potential risk to human health through runoff and/or windblown dust to nearby residential property and roads.

#### **– U.S. EPA Exposure of Concern**

Potential future exposure to Site-related COCs in OU1 soil through ingestion, inhalation of soil and indoor dust and dermal adsorption routes of exposure with industrial/commercial land use.

### **Site-Specific Remedial Action Objective**

Prevent unacceptable potential risk to human health from future exposure to Site-related COCs in OU1 soil through ingestion, inhalation of soil and indoor dust and dermal adsorption routes of exposure with industrial/commercial land use in the former operations area.

#### **• OU1 – Groundwater**

##### **– Chemicals of Concern**

COCs for risk to human health resulting from exposure to groundwater in OU1 are naphthalene and pentachlorophenol. No COECs have been established for OU1

groundwater because the ecological risk assessment (Integral 2007, 2008) did not identify unacceptable risk to any ecological receptors inhabiting OU1.

– **U.S. EPA Exposure of Concern**

Potential future exposure to Site-related COCs in OU1 groundwater through ingestion, inhalation and dermal adsorption routes of exposure if a construction worker encounters contaminated groundwater in the former operations area.

**Site-Specific Remedial Action Objective**

Prevent unacceptable potential risk from the future exposure to Site-related COCs in OU1 groundwater through ingestion, inhalation and dermal adsorption routes of exposure during below-ground construction by workers in the area of contaminated groundwater in the former operations area.

• **OU2 – Soils**

– **Chemicals of Concern**

COCs for risk to human health resulting from exposure to soil in OU2 are TEQ<sub>DF</sub> and BaP<sub>e</sub>. COECs for risk to ecological receptors exposed to OU2 soils are HPAH and pentachlorophenol.

– **U.S. EPA Exposure of Concern**

Potential exposure of organisms to Site-related COECs in OU2 soil.

**Site-Specific Remedial Action Objective**

Prevent unacceptable risks to organisms from exposure to Site-related COECs in OU2 soil.

– **U.S. EPA Exposure of Concern**

Potential future human exposure to Site-related COCs in OU2 soil through ingestion, inhalation of soil and indoor dust and dermal adsorption routes of exposure with future industrial/commercial land use on property owned by International Paper.

### **Site-Specific Remedial Action Objective**

Prevent unacceptable potential risk to human health from future exposure to Site-related COCs in OU2 soil through ingestion, inhalation of soil and indoor dust and dermal adsorption routes of exposure with future industrial/commercial land use.

- **OU3 – Soils**

- **Chemicals of Concern**

COCs for risk to human health resulting from exposure to soil in OU3 are TEQ<sub>DF</sub> and BaP<sub>e</sub>. No COECs have been established for OU3 soil because the ecological risk assessment (Integral 2007, 2008) did not identify unacceptable risk to any ecological receptors inhabiting OU3.

- **U.S. EPA Exposure of Concern**

Potential future human exposure to Site-related COCs in OU3 soil through ingestion, inhalation of soil and indoor dust and dermal adsorption routes of exposure with future industrial/commercial land use on property in OU3.

### **Site-Specific Remedial Action Objective**

Prevent unacceptable potential risk to human health from future exposure to Site-related COCs in OU3 soil through ingestion, inhalation of soil and indoor dust and dermal adsorption routes of exposure with future industrial/commercial land use in OU3.

- **OU7 – Soils**

- **Chemicals of Concern**

COCs for risk to human health resulting from exposure to soil in OU7 are TEQ<sub>DF</sub> and BaP<sub>e</sub>. No COECs have been established for OU7 soil because the ecological risk assessment (Integral 2007, 2008) did not identify unacceptable risk to any ecological receptors inhabiting OU7.

– **U.S. EPA Exposure of Concern**

Potential future human exposure to Site-related COCs in OU7 soil through ingestion of soil and garden produce, inhalation of soil and indoor dust and dermal adsorption routes of exposure at residential properties in and adjacent to OU7.

**Site-Specific Remedial Action Objective**

Prevent unacceptable potential risk to human health from future exposure to Site-related COCs in OU7 soil through ingestion of soil and garden produce, inhalation of soil and indoor dust and dermal adsorption routes of exposure at residential properties in and adjacent to OU7.

## **2.3 Potentially Applicable or Relevant and Appropriate Requirements and Criteria to Be Considered**

The NCP requires that remedial action alternatives be assessed to evaluate whether they attain applicable or relevant and appropriate requirements under federal and state environmental laws or facility siting laws, or provide grounds for invoking one of the waivers under the NCP. In addition to ARARs, the identification and evaluation of remedial action alternatives may consider, as appropriate, other advisories, criteria, or guidelines, collectively called to-be-considered criteria (TBCs).

### **2.3.1 Applicable Requirements**

The NCP (40 CFR 300.5) defines applicable requirements as *“those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental 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.”*

For a requirement to be applicable, the remedial action or the circumstances at the site must satisfy the jurisdictional prerequisites of that requirement. For example, RCRA Subtitle C requirements are applicable to the disposal of a RCRA Subtitle C hazardous waste generated in a remedial action.

### **2.3.2 Relevant and Appropriate Requirements**

The NCP (40 CFR 300.5) defines relevant and appropriate requirements as “*those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental 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.*”

In some circumstances, a requirement may be relevant to the particular site-specific situation but will not be appropriate because of differences in the purpose of the requirement, the duration of the regulated activity, or the physical size or characteristic of the situation it is intended to address.

### **2.3.3 Application of ARARs**

A requirement that is judged to be relevant and appropriate must be complied with to the same degree as if it is applicable (U.S. EPA, 1988a). More discretion can be applied in the determination of relevant and appropriate requirements than in the determination of applicable requirements (U.S. EPA, 1988a). It is possible for only a part of a requirement to be relevant and appropriate (U.S. EPA, 1988a).

A requirement is either substantive or administrative (U.S. EPA, 1988a). On-site CERCLA response actions usually must comply with substantive requirements but not with administrative requirements of a statute or regulation (U.S. EPA, 1988a). Substantive requirements are those that pertain directly to actions or conditions in the environment (U.S. EPA, 1988a). Administrative requirements are the mechanisms that facilitate the implementation of the substantive requirements of a statute or a regulation (U.S. EPA, 1988a). In general, administrative requirements prescribe methods and procedures, such as fees, permits, inspections, and reporting requirements by which substantive requirements are implemented for purposes of a particular environmental or public health program. In other words, on-site CERCLA response actions must meet the intent of the law or regulation but need not conform to all the applicable administrative requirements. This distinction applies only to on-site actions; off-site response actions are subject to the full requirements of all applicable statutes or regulations, included administrative requirements such as permits (U.S. EPA, 1988a).

### 2.3.4 Other Criteria to be Considered

Federal and state programs have developed criteria, advisories, guidelines or proposed standards that may provide useful information, or recommended procedures if no ARARs address a particular situation, or if existing ARARs do not provide adequate protection. In such situations these “to-be-considered” criteria (TBCs) may be used to set preliminary remediation goals. For example, risk-based cleanup concentrations that have not been promulgated are considered TBCs. TBCs are meant to complement the use of ARARs, not to compete with or replace them (U.S. EPA, 1992). The final acceptable exposure levels should be determined on the basis of the results of the baseline risk assessment and the evaluation of the expected exposures and associated risks for each alternative (U.S. EPA, 1988b). Risk-based concentrations from a site-specific human health and environmental risk assessment typically take precedence over other risk-based criteria that are based on default exposure assumptions.

The Site is located within the external boundaries of the Leech Lake Reservation. As a result, tribal criteria, ordinances, and guidance were reviewed to determine if there was additional information or recommended procedures that should be considered. The LLBO Hazardous Substances Control Act (HSCA) was identified as a potential ARAR/TBC by the U.S. EPA. The consideration of the LLBO HSCA as it relates to the Site raises a number of issues, including whether the HSCA is enforceable as to the Site, whether the HSCA may be considered promulgated for purposes of the NCP, and legal issues involving the regulation of non-tribal private property within a reservation. This Revised Final Feasibility Study Report does not address these issues, nor has the U.S. EPA reached a conclusion on these issues. As required by the U.S. EPA, the LLBO HSCA was considered and is included as a potential ARAR/TBC (Table 2-4). U.S. EPA also confirmed that it has made no decision as to whether HSCA is an ARAR. As a result, the detailed analysis portion of this Revised Final Feasibility Study Report does not address specific conformance with the HSCA. According to the U.S. EPA in comments to the Draft Feasibility Study Report (U.S. EPA, 2010), the LLBO HSCA soil cleanup concentrations for dioxins and other chemicals were obtained from the 1999 Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health and the U.S. EPA Region 9 PRGs for dioxin in residential soil. Some of the HSCA cleanup concentrations are below background soil concentrations at the Site. Also, the U.S. EPA considers the LLBO Land Acquisition Ordinance as a potential ARAR/TBC for the Site (U.S. EPA, 2010) (Table 2-4).

The Risk-Based Guidance for the Soil-Human Health Pathway (MPCA, 1998b) published by the MPCA was also reviewed. This guidance is used by the MPCA to publish soil reference values (SRVs). The SRVs are identified as a TBC since the risk-based concentrations are not promulgated

standards. The HHERA provides a site-specific evaluation of exposure pathways and associated risks. As such, the HHERA and not the SRVs provide the basis for establishing risk-based remediation goals in this feasibility study.

Soil Leaching Values (SLVs) (MPCA, 1998a) established by the MPCA were also reviewed. SLVs are identified as a TBC since they are not promulgated standards. The use of the SLVs as preliminary remediation goals is not warranted for OU1 or OU3 where large areas of significant pentachlorophenol contamination is documented in the groundwater (U.S. EPA, 2010). The MPCA guidance and groundwater monitoring results were used to demonstrate that the No Action Alternative for soil remediation in OU2 will likely not result in adverse groundwater impacts in OU2. The basis for this conclusion is in Appendix C to this Revised Final Feasibility Study Report.

### **2.3.5 Classification of ARARs and TBCs**

ARARs and TBCs are classified as action-specific, location-specific, or chemical-specific in the ARAR and TBC evaluation process.

#### **2.3.5.1 Action-specific ARARs and TBCs**

Action-specific ARARs and TBCs are technology or activity-based requirements or limitations on actions or conditions. They establish performance, design, or other similar action-specific controls or regulations on actions (e.g., RCRA Subtitle C transportation regulations). Action-specific ARARs and TBCs potentially applicable to the Site are identified in Tables 2-1 (federal) and 2-2 (state and tribal).

#### **2.3.5.2 Location-specific ARARs and TBCs**

Location-specific ARARs and TBCs are those requirements that relate to the geographical location of the site and restrict actions or contaminant concentrations in certain environmentally sensitive areas. Examples of areas regulated under such ARARs and TBCs include floodplains, wetlands, and locations where endangered species or historically significant cultural resources are present. Location-specific ARARs and TBCs potentially applicable to the Site are identified in Tables 2-3 (federal) and 2-4 (state, tribal, county and city).

#### **2.3.5.3 Chemical-specific ARARs and TBCs**

Chemical-specific ARARs and TBCs are usually health or risk-based numerical values or methodologies used to calculate acceptable chemical concentrations that may be found in or discharged to the environment. Chemical-specific ARARs and TBCs include those that regulate the release to the environment of specific substances having certain chemical or physical characteristics

or materials containing specific chemical compounds. Chemical-specific ARARs and TBCs potentially applicable to the Site are identified in Table 2-5.

## 2.4 Preliminary Remediation Goals

Preliminary remediation goals (PRGs) consist of chemical concentrations that are protective of human health and the environment or that are consistent with ARARs/TBCs and serve as goals for the remedial action alternatives (U.S. EPA, 1990). Chemical-specific PRGs are concentration goals for individual chemicals at CERCLA sites. There are two general sources of chemical-specific PRGs: (1) concentrations based on ARARs and TBCs (ARAR/TBC-based PRGs); and (2) concentrations based on a risk assessment (risk-based PRGs).

Where chemical-specific ARARs exist for a COC or COEC, these ARARs are the basis of the PRG. Where chemical-specific ARARs are not available, risk-based or TBC-based PRGs are developed. The procedure for developing risk-based PRGs is presented in Risk Assessment Guidance for Superfund: Volume I – Human Health Evaluation Manual – Part B, Development of Risk-based Preliminary Remediation Goals (RAGs-Part B) (U.S. EPA, 1991). Site-specific risk-based PRGs typically take precedence over risk-based criteria from TBC sources that are based on default exposure assumptions.

Risk-based human-health and ecological PRGs have been developed for COCs/COECs in soil and groundwater (groundwater for worker protection only) at the locations and media of concern at the Site consistent with the HHERA (Integral, 2007 and 2008), the Site-specific RAOs, the FS-AOC and U.S. EPA comments to the Draft Alternatives Screening Technical Memorandum. These PRGs were used in the alternatives provided by the U.S. EPA in comments to the Draft Feasibility Study Report (U.S. EPA, 2010).

For human health, U.S. EPA has defined the following targets for achieving acceptable risk levels at CERCLA sites undergoing remediation:

- For carcinogenic effects, a concentration that results in an incremental risk in the range of  $1 \times 10^{-6}$  (one in a million) to  $1 \times 10^{-4}$  (one in ten thousand) of an individual developing cancer over a lifetime as a result of all significant site-related exposures to carcinogenic chemicals in a given environmental medium (U.S. EPA, 1990).
- For non-carcinogenic effects, a concentration that results in a hazard index of less than 1, which is the level of exposure to a chemical from all significant exposure pathways for a

given medium below which it is unlikely for even a sensitive population to experience adverse noncancer health effects.

When the cumulative current or future baseline risk from all potential carcinogens from all significant exposure pathways for a given medium is within the range of  $1 \times 10^{-6}$  to  $1 \times 10^{-4}$  incremental cancer risk, a decision about whether or not to implement remedial action is a risk management determination.

For ecological receptors, PRGs are derived to address unacceptable risks that were identified in the ecological risk assessment (Integral 2007, 2008). The methodology for deriving ecologically protective PRGs for the Site is presented in Appendix B.

## **2.4.1 Site-Specific PRGs**

### **2.4.1.1 Risk-Based PRGs**

The derivation of the risk-based PRGs for each of the target risk levels is described in Appendix B to this Revised Final Feasibility Study report. For human health, the range of risk-based PRGs is based on target risks levels of  $1 \times 10^{-6}$ ,  $1 \times 10^{-5}$  and  $1 \times 10^{-4}$  for carcinogens and a noncancer hazard index (HI) of 1 for noncarcinogens, as directed by the U.S. EPA in comments to the Draft Alternatives Screening Technical Memorandum. Risks to human health from cumulative exposures to more than one chemical were also considered in the development and application of PRGs for the Revised Final Feasibility Study Report. For ecological receptors, unacceptable risks were identified in the HHERA for soils in a portion of OU2 based on acute toxicity to soil invertebrates observed in laboratory soil toxicity bioassays (Integral 2007, 2008). Risk-based ecological PRGs for this area were developed based on a range of published ecological soil screening levels (EcoSSLs) for the COECs implicated in the observed toxicity to soil invertebrates.

Dioxin/furans and PAHs are present at detectable concentrations throughout most environmental media, even in the absence of local point sources of these chemicals. The presence of these compounds at background levels in the environment is largely due to releases from anthropogenic sources that occurred in the past and continue to occur today. Background concentrations are important because the U.S. EPA typically does not set cleanup levels at concentrations below natural or anthropogenic background concentrations (U.S. EPA, 2002). Local background soil concentrations (95<sup>th</sup> percentile values) are calculated in Appendix B for TEQ<sub>DF</sub>, benzo(a)pyrene equivalents (BaP<sub>e</sub>), total high molecular weight PAHs (HPAH), and total low molecular weight PAHs (LPAH) using the analytical data from the background reference area stations selected by the U.S. EPA during the 2001

and 2004 sample collection efforts. Appendix B includes (1) identification of the sample analytical results used to calculate the values, (2) the location within the related documentation where the sample-specific analytical results are presented, and (3) a description and documentation of the statistical calculations performed to generate the background concentrations.

The risk-based PRGs for each COC/COEC at the Site, the basis for their selection, and 95<sup>th</sup> percentile background concentrations (where relevant) are summarized in Appendix B and are carried forward in Table 2-6 of this report.

#### **2.4.1.2 ARAR/TBC-Based PRGs**

In addition to the site-specific, risk-based PRGs and background values, potential ARAR/TBC-based PRGs were identified for soil contaminants of concern at the Site. One set of potential ARAR/TBC-based PRGs is from the December 2009 U.S. EPA draft recommended interim PRGs (EPA, 2009). A second set of potential ARAR/TBC-based PRGs is from Appendix B of the LLBO HSCA. The U.S. EPA directed International Paper and the BNSF to include the HSCA dioxin cleanup value as a PRG for this Revised Final Feasibility Study Report and the HSCA pentachlorophenol cleanup value for the eco-risk area in OU2 (U.S. EPA, 2011). In addition, in comments to the Final Feasibility Study Report, the U.S. EPA directed the inclusion of institutional controls on properties with soil exceeding the HSCA dioxin cleanup value after remediation is complete.

#### **2.4.2 Application of PRGs in the Evaluation of Remedial Alternatives**

The PRGs presented in Table 2-6 provide a spectrum of values that will be considered in the detailed evaluation of remedial alternatives and, ultimately, in the U.S. EPA's determination of cleanup levels in the Record of Decision. Along with the analysis of remedial alternatives against the evaluation criteria discussed in this Revised Final Feasibility Study Report, the selection of cleanup levels frequently involves consideration of a number of other risk management and policy issues. Among these are technical and policy issues relevant to the derivation and selection of cleanup levels, consistency with cleanup precedents established at similar sites, and the relative effectiveness of different cleanup levels in achieving overall risk reduction considering other (i.e., non-site related) routes of exposure to contaminants of concern for the Site.

#### **2.4.3 Technical and Policy Issues for Deriving and Selecting PRGs**

As discussed previously, the U.S. EPA considers  $1 \times 10^{-6}$  to  $1 \times 10^{-4}$  to be the target range for acceptable incremental cancer risks associated with exposure to chemicals in environmental media at sites where remediation is considered (U.S. EPA, 1990). Estimates of lifetime incremental increases

in cancer risks less than  $1 \times 10^{-6}$  are considered low enough not to warrant any further investigation or analysis (U.S. EPA, 1990). In an OSWER directive, the U.S. EPA (1991b) further clarifies that where a cumulative incremental increased cancer risk based on a recommended maximum exposure (RME) scenario is less than  $1 \times 10^{-4}$  and the hazard index is less than 1, action is generally not warranted unless an adverse environmental impact (i.e., risk to ecological receptors) warrants action. For this reason, and as directed by the U.S. EPA in comments to the Draft Alternatives Screening Technical Memorandum, target risk levels of  $1 \times 10^{-6}$ ,  $1 \times 10^{-5}$  and  $1 \times 10^{-4}$  were used to derive Site-specific PRGs based on cancer endpoints for both TEQ<sub>DF</sub> and BaP<sub>e</sub>.

In the case of dioxins, an OSWER directive issued by the U.S. EPA in 1998 recommended the use of a dioxin (TEQ<sub>DF</sub>) soil PRG of 1,000 ng/kg (1 ppb) for residential scenarios and a range of 5,000-20,000 ng/kg (5-20 ppb) for commercial/industrial scenarios as the starting point for selecting cleanup values at CERCLA and RCRA sites (U.S. EPA, 1998). This directive states that these cleanup levels are protective of human health and the environment<sup>1</sup> and underscores the importance of national consistency in selecting cleanup levels for remediation efforts. On this basis, the 1998 directive recommended:

“In the interim, for sites that require the establishment of a final dioxin soil clean-up level prior to the release of [EPA’S final dioxin] reassessment report..., EPA should generally use 1 ppb (TEQs) as a starting point for residential soil clean-up levels for CERCLA non-time critical removal sites (time permitting, for emergency and time critical sites) and as a PRG for remedial sites. EPA should generally use a level within the range of 5 ppb to 20 ppb (TEQs) as a starting point for clean-up levels at CERCLA non-time critical removal sites (time permitting, for emergency and time critical sites) and as a PRG for remedial sites for commercial/industrial soil.”

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<sup>1</sup> Applying default exposure assumptions for a RME scenario, the directive states that “lifetime excess cancer risk from residential exposure to a concentration of 1 ppb dioxin is approximately  $2.5 \times 10^{-4}$ , which is at the higher end of the range of excess cancer risks that are generally acceptable at Superfund sites.” Under the RME exposure assumptions for a tribal adult used in the HHERA (Integral, 2007; 2008), excess cancer risks associated with exposure to soil at a concentration of 1,000 ng/kg (1 ppb) would be on the order of  $1.6 \times 10^{-4}$  similar to, although slightly lower than, the risk reported in the OSWER directive.

U.S. EPA has relied on the 1998 OSWER directive to select soil cleanup levels at some dioxin remediation sites since the OSWER directive was issued in 1998. In other cases, site-specific, risk-based cleanup levels have been selected. A 2008 update to the ATSDR's dioxin policy guidelines (ATSDR, 2008) affirms that "ATSDR believes that health risks associated with levels of dioxins in soil below 1 ppb would be low under most scenarios where the primary exposure pathway is incidental ingestion through direct exposure to soil."

At the end of 2009, U.S. EPA released draft guidance for public review and comment on a revised set of recommended interim PRGs for dioxins in soil (U.S. EPA, 2009). The recommended interim draft PRGs of 72 ng/kg for residential soil and 950 ng/kg for commercial/industrial soil were developed based on an analysis of soil concentrations that would be protective for noncancer health effects (Hazard Quotient = 1) using an oral reference dose (RfD) of 1.0 pg/kg - day TEQ<sub>DF</sub>, based on a published ATSDR chronic minimal risk level (MRL) for noncancer health effects. (This is the same MRL that was selected in the HHERA [Integral 2007, 2008] to evaluate site-specific noncancer risks from dioxins). U.S. EPA stated in the draft guidance document (U.S. EPA, 2009) that the draft PRGs based on a noncancer endpoint "generally are protective for cancer effects at approximately the  $1 \times 10^{-5}$  risk level, which is within EPA's protective risk range of  $1 \times 10^{-4}$  to  $1 \times 10^{-6}$  (see 40 CFR §300.430(e)(2)(i)(A)). It should be noted that because these recommended interim PRGs correspond to a HQ of 1, they limit the upper bound cancer risk level to  $1 \times 10^{-5}$  rather than the typical upper limit of  $1 \times 10^{-4}$ . These recommended interim PRGs are set at a more protective cancer risk level than the 1998 PRGs, which reflect a cancer risk level of  $2 \times 10^{-4}$ ."

The chronic MRL/RfD of 1.0 pg/kg - day cited by U.S. EPA (2009) was also used to derive a Site-specific noncancer PRGs of 186 ppt for residential scenarios and 2,040 ppt for commercial/industrial scenarios (Appendix B). A noncancer PRG was not established for BaP<sub>e</sub> because a reference dose for benzo(a)pyrene, on which the noncancer PRG for BaP<sub>e</sub> would be based, has not been established.

#### **2.4.4 Perspectives on Intake Reduction**

Because carcinogenic PAHs and dioxins/furans are persistent chemicals, they have become widespread and subject to global atmospheric transport, ultimately entering the food chain. For people living in OU7, the total exposure to these chemicals will be a combination of intakes from Site-related soil exposures and intakes from non-Site related foods. It is thought that the primary mechanism by which these chemicals enter the terrestrial food chain is atmospheric deposition onto vegetation and subsequent ingestion of the plant material by animals; the primary mechanism by which they enter the aquatic food chain is by atmospheric deposition onto soil with subsequent

erosion and runoff into water bodies followed by bioaccumulation in aquatic biota (ATSDR 1995, USEPA 2003). Carcinogenic PAHs can also be introduced into foods through cooking methods that involve grilling or smoking (ATSDR, 1995).

One way of evaluating the relative protectiveness of the various PRG target risk levels for BaP<sub>e</sub> and TEQ<sub>DF</sub> is to consider the incremental reduction in total contaminant intake as a result of possible additional remedial actions at the Site. The HHERA (Integral 2007, 2008) evaluated the following four exposure pathways in residential areas under the current scenario: ingestion of soil and house dust, dermal contact with soil, and inhalation of outdoor particulates. Remediation of soil would reduce exposures through all four of these pathways, but it would not reduce typical dietary exposures through food.

Figures 2-1, 2-2 and 2-3 illustrate soil and dietary intakes under several scenarios. Within each figure, the gray portion of each bar represents chemical intake from soil-related exposures calculated consistent with the HHERA. The soil concentrations considered included cancer- and noncancer-based PRGs and background concentrations. The hatched portion of each bar represents background dietary intake from food exposures. Dietary BaP<sub>e</sub> and TEQ<sub>DF</sub> intakes shown are average (central tendency) background values based on current literature. Because these exposures are not related to the Site, they cannot be addressed through remediation. Appendix B discusses the intake calculations supporting Figures 2-1, 2-2 and 2-3 in greater detail.

The majority of BaP<sub>e</sub> and TEQ<sub>DF</sub> exposures occur through the diet under most of the scenarios considered. Soil-related intakes constitute 50 percent or less of the total intake of BaP<sub>e</sub> for the PRGs based on cancer risks of  $1 \times 10^{-6}$  and  $1 \times 10^{-5}$  (Figure 2-1), whereas they represent more than 50 percent of total intake both for soil background concentrations and the risk-based PRG at the  $1 \times 10^{-4}$  level. Soil-related intakes constitute less than 50 percent of the total intake of TEQ<sub>DF</sub> for soil background concentrations, the PRGs based on cancer risks of  $1 \times 10^{-6}$  and  $1 \times 10^{-5}$  (Figure 2-2), and the PRG based on a Hazard Quotient of 1 for noncancer risks (Figure 2-3). Only in the case of the TEQ<sub>DF</sub> PRG based on cancer risk of  $1 \times 10^{-4}$  do soil-related intakes constitute slightly more than 50 percent of total intakes. Remediation at most residential locations would address only a relatively small portion of the total intakes of BaP<sub>e</sub> and TEQ<sub>DF</sub> because the remedial action cannot address intakes received through the diet.

## 2.4.5 Application of PRGs in the Evaluation of Remedial Alternatives

To facilitate the use of PRGs in developing and evaluating remedial alternatives, the risk-based PRGs for protection of human health (Table 2-6) were grouped into “PRG levels” that draw together considerations of target cancer risks, noncancer risks, and local background concentrations of TEQ<sub>DF</sub> and BaP<sub>e</sub>. These groupings are presented in Table 2-7. The following three general principles were used in the PRG groupings: (1) risk-based PRGs below local background concentrations were not carried forward; (2) for PRGs higher than background, the lower of the noncancer-based PRG and the cancer-based PRG at a given incremental risk level was retained; and (3) a narrative PRG was provided to address areas with risks from individual chemicals below a given risk level, but with a cumulative risk above that risk level. The calculation of the background values is explained in Section 2.4.1 and Appendix B.

Ecological PRGs developed to be protective of soil invertebrates were selected as the main eco-risk PRGs that will be used to delineate areas and volumes of soil in OU2 for purposes of the detailed analysis of remedial alternatives (see Sections 4 and 5), because soil invertebrates were the only receptor group for which unacceptable ecological risks were identified in the HHERA (Integral 2007, 2008). Additionally, the lowest ecological PRGs shown in Table 2-6 were also retained for use in an analysis of the sensitivity of the OU2 areas and volumes to the range of potential ecological PRGs. This sensitivity analysis is presented in Section 3.2 and Table 3-2 of this Revised Final Feasibility Study Report.

In order to provide risk managers with information on the feasibility of remedial options that achieve different target risk levels, the remedial alternatives evaluated in this Revised Final Feasibility Study Report are designed to meet different combinations of the PRGs presented in Tables 2-6 and 2-7.

Following review of the Draft Feasibility Study Report, the U.S. EPA stated the following in their November 19, 2010 comments to the Draft Feasibility Study Report.

*“The Agency has made the decision to alter the range of alternatives to those that, with regard to dioxin in soil:*

- *Provide remediation to 63 ppt for residential property and 380 ppt for commercial/industrial property for dioxin in soil*
- *Provide remediation to the HSCA dioxin in soil cleanup number of 10 ppt.”*

*OU1:*

- *Regarding commercial/industrial use, it is not necessary to evaluate an alternative that cleans up the site to Level 3,  $1 \times 10^{-4}$  cleanup standards.*
- *Level 1 cleanup standard should be changed to the 10 ppt dioxin in soil tribal HSCA number, not background.*

*OU2:*

- *PRGs for dioxin in soil (63 ppt and 10 ppt) and estimated volumes and areas for remediation are needed for the residential properties in OU2, as well as for the commercial/industrial properties (380 ppt and 10 ppt) in OU2 that are not addressed by the needed remediation to address ecological risk.<sup>2</sup>*

*OU3:*

- *PRGs for dioxin in soil (380 ppt and 10 ppt) and estimated volumes and areas for remediation are needed for commercial/industrial properties in OU3.*

*OU7:*

- *It is not necessary to evaluate an alternative that cleans up the site to Level 3,  $1 \times 10^{-4}$  cleanup standards.*
- *Level 1 cleanup standard should be changed to 10 ppt dioxin in soil tribal HSCA number, not background.”*

Additionally, to be consistent with the NCP, it is appropriate for this feasibility study to evaluate alternatives based on a noncancer PRG for  $TEQ_{DF}$  and  $1 \times 10^{-4}$  excess cancer risk for  $BaP_e$  (Level 3 PRGs in Table 2-7). With respect to  $TEQ_{DF}$ , this is consistent with the approach used by U.S. EPA to derive its draft recommended interim soil PRGs for dioxins and furans (U.S. EPA, 2009), and the resulting Site-specific PRGs of 190 ng/kg (residential) and 2,000 ng/kg (industrial/commercial) are protective for both noncancer health effects and excess cancer risks at slightly higher than the  $1 \times 10^{-5}$  level, but well below the  $1 \times 10^{-4}$  level. As a practical matter, the residential PRG for  $BaP_e$  corresponding to  $1 \times 10^{-4}$  excess cancer risk is only slightly higher than local background and its

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<sup>2</sup> In February 28, 2011 comments to the Final FS Report, U.S. EPA stated “Please modify the description of OU7 to include the areas adjacent to OU2 that were identified as residential..”

application results in a cleanup area “footprint” that is almost identical to the application of the background value.

The specific elements of the remedial alternatives that address the PRG combinations discussed above and outlined in Table 2-7 are described in Sections 4 and 5 of this report.

## 3.0 Screening of Technologies

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### 3.1 Introduction

The objective of developing and screening remedial action technologies and the processes within these technologies is to end up with an appropriate range of remedial action alternatives for the media and locations where remedial action may occur. This range of alternatives is then further evaluated in the detailed analysis phase of the feasibility study. Appropriate remedial technology processes that meet the remedial action objectives may involve the elimination or destruction of hazardous substances, the reduction of hazardous substance concentrations to acceptable health-based levels, prevention of exposure to hazardous substances via engineering or institutional controls, or a combination of the above. Remedial alternatives are developed by assembling combinations of technology processes into alternatives that address the contamination for the identified media and locations of concern.

### 3.2 Media and Locations

The areas where the response actions would apply are shown on Figures 3-1 through 3-7.

#### OU1 – Soil

**Soil in Former Operations Area:** The first remedial action objective is to prevent unacceptable potential risk to human health from future exposure to Site-related COCs in soil in the former operations area if land use in the former operations area is changed to residential use in the future. As directed by the U.S. EPA in their comments to the Draft Feasibility Study Report (U.S. EPA, 2010), this is applicable to all of OU1, although residential use of the BNSF property is not feasible because it is railroad right-of-way and residential use of the International Paper property is not feasible due to the presence of the groundwater contaminant plume and the groundwater remediation system.

Portions of OU1 are owned by BNSF, the City of Cass Lake, and International Paper. In addition, property in OU1 is owned by four private parties with property in non-residential use. The original boundary outlines for OU1 and OU7 have been changed so that two residential properties (identified as Allen-C and Res-20) are now within OU7. Additionally, International Paper acquired sixteen properties in OU7 in 2010. International Paper is demolishing the homes on these properties and placing deed restrictions that would only allow commercial/industrial land use. In the Final Feasibility Study Report, the original boundaries of OU7 and OU1 were redrawn so that these sixteen properties were within OU1 where International Paper believed they better fit with the remedial

alternatives and land use assumptions. In comments to the Final Feasibility Study Report (U.S. EPA, February 2011), the U.S. EPA directed that the properties be returned to OU7 and remediated as residential property. Finally, a few properties that are located within the original boundary of OU1 are zoned residential and are not in active commercial/industrial use. At U.S. EPA's direction (U.S. EPA, 2010), the boundaries of OU1 and OU7 have been adjusted so these properties are now in OU7. The City of Cass Lake zoning map is in Appendix I.

In comments to the Final Feasibility Study Report, the U.S. EPA directed International Paper to include the LLBO Division of Resource Management site (DRM Site) in OU7 and to use the data reported in *Phase II Environmental Site Assessment Report for the Division of Resource Management Site* (LLBO, 2010). The data validation report for the dioxin/furan analyses in this report was received by International Paper on April 13, 2011 (one day before this Revised Final Feasibility Study Report was required to be submitted to the U.S. EPA). The samples were collected in 2007 and the data validation report had been requested for several months. There was insufficient opportunity to review the data validation report prior to publication of this Revised Final Feasibility Study Report. At the direction of the U.S. EPA, the data was considered valid and used in the scoping of alternatives and cost estimates in this report.

The properties that have been moved into and out of OU1 and OU7 for the purposes of this Revised Final Feasibility Study Report are summarized in Table 3-1. Tables, figures and text from this point through the end of this Revised Final Feasibility Study Report will include these operable unit boundary revisions.

PRGs for this remedial action objective applied to OU1 are the Level 1 PRGs-R, the Level 2 PRGs-R and the Level 3 PRGs-R (Table 2-7).

The areas with available data showing surface soil exceeding these PRG levels are shown on Figures 3-1, 3-2 and 3-3, respectively. The basis for the determination in each sampled area is shown in Appendix E. The estimated areas, volumes, and characteristics of the soils exceeding each of these residential PRG levels in OU1 are summarized in Table 3-2. The areas and volumes exceeding these residential PRGs in Table 3-2 have been calculated using reasonable assumptions for areas that have not been sampled and for the likely depth of soil exceeding these PRGs (see footnote to Table 3-2 and detailed cost estimates in Appendix F).

A second remedial action objective for the soil in OU1 is to prevent the future transfer of Site-related COCs in surface soil exceeding residential PRGs through runoff and/or windblown dust to nearby

residential property and roads. The PRGs for this objective are identical to the PRGs for the first remedial action objective. Soils in OU1 exceeding these PRGs are shown on Figures 3-1, 3-2, and 3-3. The estimated areas, volumes, and characteristics of the soil exceeding each of these PRG levels in OU1 are the same as for the previous remedial action objective and are summarized in Table 3-2.

The third remedial action objective for the soils in OU1 is to prevent unacceptable potential risk to human health from future exposure to Site-related COCs in soil exceeding PRGs with industrial/commercial land use. The PRGs for this objective apply to all of OU1 except as noted and are the Level 2 PRGs-I/C and the Level 3 PRGs-I/C (Table 2-7). The areas with available data showing surface soil exceeding these commercial/industrial PRGs in OU1 are shown on Figures 3-4 and 3-5. The basis for the determination in each sampled area is shown in Appendix E. The estimated area, volume, and characteristics of the soil exceeding these commercial/industrial PRGs in OU1 are summarized in Table 3-2. The areas and volumes exceeding the industrial/commercial PRGs in Table 3-2 have been calculated using reasonable assumptions for areas that have not been sampled and for the likely depth of soil exceeding these PRGs (see footnote to Table 3-2 and detailed cost estimates in Appendix F).

## **OU1 –Groundwater**

**Groundwater in Former Operations Area:** The remedial action objective for groundwater in the former operations area, in the context of this soil feasibility study, is to prevent unacceptable risks to workers from exposure to Site-related chemicals in shallow groundwater during subsurface construction in the area of contaminated groundwater. Additional remedial action objectives for groundwater may be developed for future actions based on ongoing groundwater investigations.

Table D4-14a of the Human Health and Ecological Risk Assessment addendum (Integral, 2008) documents that 99.8% of the unacceptable risk to an unprotected utility worker is associated with dermal contact and inhalation of vapors from shallow groundwater. At U.S. EPA's direction (U.S. EPA, 2010), groundwater quality data was used to identify a conservatively large area of potentially unacceptable risk to an unprotected worker working below-ground at the Site (Appendix D). The area of potential unacceptable risk is shown on Figure 3-6. The area is approximately 24 acres and includes shallow (5 to 15 feet below ground surface) groundwater. There are no underground utilities in this area except piping and electrical wiring associated with the groundwater remediation system for the Site.

## **OU2 – Soil**

**Soil in Southwest Area:** The first remedial action objective is to prevent unacceptable risk to organisms from exposure to Site-related COECs in soil in OU2. The only unacceptable eco-risk in OU2 as determined by the HHERA was to invertebrates. The ecological-based PRGs (based on invertebrate EcoSSLs) are shown in Table 2-7. The area of soil that is assumed to exceed these eco-risk PRGs is shown on Figure 3-7. The estimated area, volume, and characteristics of the soil exceeding these eco-risk PRGs are summarized in Table 3-2.

The U.S. EPA in their comments to the Draft Feasibility Study Report (U.S. EPA, 2010) directed that the lowest EcoSSLs for plants, invertebrates, birds and mammals should be used as ecological PRGs for this area. These lowest EcoSSLs are also shown in Table 2-7. The estimated area and volume of the soil exceeding these lowest eco-risk PRGs are also summarized in Table 3-2. The area is shown on Figure 3-7. The volume of soil requiring remediation with the lowest EcoSSLs PRGs is about four times greater than the volume of soils requiring remediation if just the invertebrate EcoSSLs are considered. Use of the lowest EcoSSLs for PRGs will translate to four times greater cost to remediate the area to the lowest eco-risk PRGs since excavation of soil exceeding the eco-risk PRGs is the selected remedial action for this area in all alternatives (except the No Action Alternative).

The second remedial action objective for the soils in OU2 is to prevent unacceptable potential risk to human health from future exposure to Site-related COCs exceeding PRGs with industrial/commercial land use. The PRGs for this objective apply to the portion of OU2 owned by International Paper (excepting the fenced containment vault) and are the Level 2 PRGs-I/C and the Level 3 PRGs-I/C. The areas with available data showing surface soil exceeding these commercial/industrial PRGs in the portion of OU2 outside the fenced containment vault are shown on Figures 3-4 and 3-5. The basis for the determination in each sampled area is in Appendix E. The estimated areas, volumes and characteristics of the soil exceeding these commercial/industrial PRGs are summarized in Table 3-2. The areas and volumes exceeding the industrial/commercial PRGs in Table 3-2 have been calculated using reasonable assumptions for areas that have not been sampled and for the likely depth of soil exceeding these PRGs (see footnotes to Table 3-2 and detailed cost estimates in Appendix F).

## **OU3 – Soil**

**Soil in City Dump Area:** The remedial action objective for the soils in OU3 is to prevent unacceptable potential risk to human health from future exposure to Site-related contaminants in soil exceeding PRGs with industrial/commercial land use. The PRGs for this objective apply to all of OU3 and are the Level 2 PRGs-I/C and the Level 3 PRGs-I/C. The areas with available data showing

surface soil exceeding these commercial/industrial PRGs in OU3 are shown on Figures 3-4 and 3-5. The basis for the determination in each sampled area is in Appendix E. The estimated area, volume, and characteristics of the soil exceeding these commercial/industrial PRGs are summarized in Table 3-2. The areas and volumes exceeding the industrial/commercial PRGs in Table 3-2 have been calculated using reasonable assumptions for areas that have not been sampled and for the likely depth of soil exceeding these PRGs (see footnote to Table 3-2 and detailed cost estimates in Appendix F).

## **OU7 – Soil**

**Soil at Residential Properties in OU7:** The remedial action objective is to prevent unacceptable potential risk to human health from future exposure to Site-related contaminants in soil through ingestion of soil and garden produce, inhalation of soil and indoor dust, and dermal routes of exposure at residential properties. The PRGs are the same as those for the residential remedial action objective in OU1. The Revised Final Feasibility Study Report uses the Level 1 PRGs-R, the Level 2 PRGs-R, and the Level 3 PRGs-R to evaluate selected alternatives for this remedial action objective.

The limits of OU7 will be expanded as appropriate to include areas that are in residential use and exceed the appropriate residential PRGs. Additionally, at the direction of the U.S. EPA in comments to the Final Feasibility Study Report (U.S. EPA, 2011), the DRM Site and properties acquired by International Paper in 2010 were added to OU7. The areas in OU7 with U.S. EPA data showing surface soil exceeding these three residential PRG levels are shown on Figures 3-1, 3-2 and 3-3. The basis for the determination in each sampled area is shown in Appendix E. The estimated areas, volumes, and characteristics of the soils exceeding these PRGs in OU7 and the surrounding area are summarized in Table 3-2. The areas and volumes exceeding these residential PRGs in Table 3-2 have been calculated using reasonable assumptions for areas that have not been sampled and for the likely depth of soil exceeding these PRGs (see footnotes in Table 3-2 and detailed cost estimates in Appendix F).

### **3.3 Development of General Response Actions**

Following development of RAOs and PRGs, general response actions are identified to address the RAOs and PRGs for affected soil and groundwater (below-ground worker exposure only) and the operable units at the Site. As defined in U.S. EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (U.S. EPA, 1988b), general response actions are medium-specific actions that satisfy response action objectives. The response actions selected for evaluation must be capable of dealing with the volumes and areas of contaminated soil at the site and

the types of contaminants in the soil in a timely and effective manner. General response actions for mitigating risks posed by affected soil may be applied individually or in combination.

Potential general response actions that may be applied to the Site and their applicability to achieving the RAOs and the PRGs are summarized as follows and in Table 3-3:

- **No Further Action:** A no further action alternative is evaluated because it is required by CERCLA. The no further action alternative typically does not achieve the RAOs and the PRGs.
- **Monitoring:** This general response action involves monitoring of soil contaminant concentrations to evaluate achievement of the RAOs and PRGs. Dioxins/furans and high molecular weight PAHs do not degrade readily in the environment. Therefore, monitoring of natural attenuation is not evaluated further as a stand-alone action for soils, although performance monitoring (e.g., verification sampling with excavation, sampling of soil use for backfill or covers) will be a part of all remedial alternatives.
- **Institutional Controls:** Institutional Controls are legal and administrative tools used to maintain protection of human health and the environment at sites where exposure to contaminated materials could occur. U.S. EPA defines Institutional Controls as “non engineered instruments that help minimize the potential for human exposure to contamination and protect the integrity of the remedy” (U.S. EPA, 2010). Institutional Controls are generally consolidated into the following four categories:
  - Governmental controls (e.g., zoning, local ordinances)
  - Proprietary controls (e.g., easements, restrictive covenants)
  - Enforcement and permit tools (e.g., consent decrees, administrative orders)
  - Informational tools (e.g., notices filed in the land records, advisories)

Institutional controls restrict access to contaminated soil and groundwater by notifying property owners, prospective property purchasers, and workers of contamination. Institutional controls help ensure the effectiveness of remedial actions by limiting site activities that could degrade the effectiveness of the remedy, by providing access for regulatory agencies to monitor the effectiveness of the remedy and by requiring periodic reporting. Options for this

response action will include (in MPCA nomenclature) real property notifications and affidavits, easements and environmental restrictive covenants, as well as local ordinances, well construction advisories, etc. U.S. EPA considers institutional controls as not usually appropriate for residential land use. Institutional controls are retained for further evaluation. In comments to the Draft Feasibility Study Report, U.S. EPA commented that, at this Site, there are different jurisdictions which might raise claims to potentially competing authorities to establish, enforce, and record Institutional Controls within an Indian Reservation (U.S. EPA, 2010).

- **Engineering Controls:** Engineering Controls restrict access to contaminated soil and groundwater by various engineered approaches. Options for this response action at this Site include warning signs to warn workers of the presence of contaminated groundwater in the former operation area of the Site. Engineering Controls are retained for groundwater remedial actions in OU1.
- **Containment:** Containment technologies for soil consist of low permeability caps, clean soil and vegetation covers and below-ground vertical barriers. Caps and clean soil covers over the soil render any human direct contact pathway incomplete. Caps, clean soil covers and vegetation are effective at limiting erosion by wind or water. A low permeability cap is not expected to be necessary at this Site because dioxins/furans and heavier molecular weight PAHs are not mobile with the infiltration of rainwater. More mobile COCs (e.g., PCP, naphthalene) are not expected to be a leaching concern based on the available Site information (Appendix C). The U.S. EPA considers that containment is not usually appropriate for residential land use. Containment is retained for further evaluation because it is effective in preventing exposure, water erosion, and windblown dust and is compatible with industrial/commercial land use. Below-ground vertical barriers are not retained for further evaluation for this Site because they are not effective in preventing exposure to surface soils or preventing water erosion or windblown dust.
- **Excavation:** Excavation involves the removal of the contaminated soil for disposal or treatment. Excavation of contaminated soil can be used to achieve the RAOs and PRGs and is retained for further evaluation in all land use scenarios.
- **In-Situ Treatment:** In-situ treatment involves treating contaminants in place to below the PRGs without removing the soil matrix. In-situ treatment technologies are not typically used

for remediating dioxins/furans and heavier molecular weight PAHs in soils, especially when present at the low concentrations that have been measured at the Site. In-situ treatment is not retained for further evaluation due to the low contaminant concentrations present in soils at the Site.

- **Ex-Situ Treatment:** Ex-situ treatment involves excavating soil or removing groundwater followed by the use of treatment technology(ies) to remove the contaminants. The treated soil is then either disposed of or returned to the excavation as clean backfill. An example of an ex-situ treatment technology for dioxin and high-molecular-weight PAHs is high temperature incineration after the soil has been excavated. Ex-situ treatment of excavated soil is not retained for further evaluation due to the low concentrations of contaminants in soils at the Site. Ex-situ treatment of groundwater is already occurring in OU1 and OU3.
- **Disposal:** Disposal involves disposing of the excavated soil offsite at a licensed RCRA Subtitle C or D landfill or onsite in an engineered disposal cell. Disposal of soil, both offsite and onsite, is retained for further evaluation.

Although some of the above general response actions may meet the RAOs and PRGs alone, the most effective remedial action is usually a combination of the above response actions to meet the RAOs and PRGs.

### **3.4 Evaluation and Screening of Technologies and Technology Process Options**

In this section, the general response actions that are retained in Section 3.3 for further evaluation are subdivided first into remedial technologies and then into process options for evaluation and screening. Remedial technologies are general categories of technologies within a general response action and process options are specific processes within a technology category. For example, capping and below-ground vertical barriers are two technology categories within the general response action of containment and a low permeability cap and covering with clean soil are two process options within the technology category of capping.

The evaluation and screening of technologies and process options for the Site was conducted using effectiveness, implementability and relative cost. Remedial technologies and process options considered feasible at the conclusion of this screening step are carried on to the assembly of comprehensive remedial action alternatives for the Site.

Remedial technologies and process options potentially applicable to soils containing Site-related contaminants were identified by searching the following resources:

1. U.S. EPA guidance documents (e.g., RI/FS, U.S. EPA, 1988b).
2. Dioxin Treatment Technologies Background Paper (U.S. Congress, 1991).
3. Presumptive Remedies for Soils, Sediments, and Sludges at Wood Treater Sites, Office of Solid Waste and Emergency Response, Directive: 9200.5-162, EPA/540/R-95/128, PB 95-963410, December 1995.
4. Hazardous Waste Clean-up Information (CLU-IN) Website [www.clu-in.org/](http://www.clu-in.org/)
5. Remediation and Characterization Technology Database (EPA REACH IT) [www.epa.gov/tio/reachit.html](http://www.epa.gov/tio/reachit.html)

Potentially viable technologies and process options for each general response action retained in the screening conducted in Section 3.3 and applicable to the Site-related contaminants are summarized in Table 3-4. The potentially viable technologies and technology process options were then screened based on effectiveness, implementability and relative cost. Those criteria are defined as follows:

- **Effectiveness** – the ability of the technology process option to perform adequately to achieve the remedial action objectives alone or as part of an overall system.
- **Implementability** – the degree of difficulty expected in implementing a particular process option at the site under practical technical, regulatory, and schedule constraints.
- **Relative cost** – qualitative and comparative only and is judged similar to the effectiveness criterion. It is used to preclude further evaluation of process options that are very costly where there are other choices that perform similar functions with comparable effectiveness. It considers construction and long-term operation and maintenance costs.

The screening is presented in Table 3-4. Screening was based on professional experience and judgment, published sources (see above list), and experience with the implementation of removal actions and interim remedial actions at the Site.

The screening of technologies and process options for the Site-related contaminants (especially dioxins/furans and high-molecular PAHs) failed to identify commercially available or innovative

technologies or process options that employ treatment which permanently and significantly reduces the volume, toxicity or mobility of the contaminants as a principal element and are capable of dealing with the volumes of contaminated soil, the types of contaminants and anticipated contaminant concentrations at the Site. No principal threat wastes (e.g., source material) have been identified as part of the final soil remedial measures under consideration in this feasibility study; therefore, the need for technologies that comply with CERCLA's and NCP's preference of treatment of the soil is less critical.

## 4.0 Development of Selected Remedial Alternatives

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Remedial technologies and process options that were retained for alternative development are combined to form comprehensive remedial action alternatives for the Site in this section of the report. Assembly of alternatives provides a method of identifying and screening the inter-relationships between remedial technologies and process options applicable to the Site.

Alternatives were developed by the U.S. EPA based on the RAOs and the PRGs described in Sections 2 and 3 and the Draft Feasibility Study Report (U.S. EPA, 2010). In addition, to be consistent with the NCP, a range of alternatives has been evaluated at the  $1 \times 10^{-4}/HI=1$  risk level (i.e., Level 3 PRGs). The alternatives described in this section will be evaluated in the detailed analysis section of the Revised Final Feasibility Study Report. The ARARs/TBCs for the alternatives are shown in Tables 2-1 through 2-5.

Each of the alternatives, except the No Action Alternative, includes the excavation of soil exceeding PRGs under various land use assumptions with offsite and onsite disposal options. In general, the issues being evaluated in this Revised Final Feasibility Study Report involve soil contaminated with low levels of CPAHs and dioxins/furans with very low mobility. It is recognized that there is some potential to encounter unexpected areas of more highly-contaminated soil that could be a RCRA Subtitle C hazardous waste. Likewise, it is recognized that there is some potential to encounter unexpected areas of contaminated soil that could cause contaminant leaching issues with onsite consolidation in an unlined cell. In the unlikely event such soils are encountered, the alternatives would contemplate transportation offsite to a RCRA Subtitle D facility for any such non-hazardous waste or to a Subtitle C facility for any such hazardous waste.

The design of all alternatives will include provisions for encountering such materials including the testing of soils with visual evidence of contamination (staining, odor, etc.) and management of such soils at a RCRA Subtitle D or C facility as appropriate. However, the results of previous studies and regulatory decisions for the Site suggest that the large majority of excavated materials will be RCRA non-hazardous soil, and soil with low leachability, and so the evaluations of the excavation elements of the alternatives are appropriately focused on these types of soils and materials.

**Alternative 1 – No Further Action.** Alternative 1 consists of taking no further action at the Site with respect to soils or groundwater risks (to construction workers). The NCP requires that a no-action alternative be retained throughout the feasibility study process as a baseline for comparison to the other approaches.

**Alternative 2 –** Alternative 2 involves the following: Excavate soil on residential and potential residential properties in OU7 exceeding Level 2 PRGs-R to a depth no greater than 2 feet. Place a permeable geotextile to demarcate the base of the excavation if soil exceeding the PRGs is left in place. Backfill the excavated area with clean backfill to existing grade. Re-establish vegetation in the excavated area. Place a 12-inch thick clean soil cover (composed of at least 6 inches of topsoil) on commercial/industrial properties exceeding the Level 2 PRGs-I/C in OU1, OU2, and OU3. Establish vegetation on the cover and maintain the vegetation cover. Place a highly visible, permanent and permeable geotextile to demarcate the base of the cover soils. Place institutional controls on these properties to protect the integrity of the cover and prevent exposure to contaminated soil and groundwater. Pave the heavy machinery area at Cass Forest Products and the unpaved roads in the remediated residential and commercial/industrial areas. Excavate soil in excess of the invertebrate eco-risk PRGs in the ecological risk area in OU2 and replace with clean backfill. Re-establish vegetation in the excavated area. Monitor the water quality in the forested wetland area east of OU1 for Site-related COCs.

Alternative 2A will involve disposal of the excavated soil offsite at a permitted RCRA Subtitle D landfill. Alternative 2B will involve disposal of the excavated soil onsite in OU1.

**Alternative 3 –** Alternative 3 is identical to Alternative 2 except that the 12-inch thick clean soil cover (composed of at least 6 inches of topsoil) will be placed on commercial/industrial properties exceeding the Level 2 PRGs-R in OU1, OU2, and OU3 (rather than the Level 2 PRGs-I/C in Alternative 2), the unremediated area in OU2 that exceeds the HSCA PCP cleanup level will be covered with 12 inches of clean soil and institutional controls will be placed on unremediated areas that exceed the Level 1 PRGs-R. These last two elements were included in this alternative in accordance with the direction by the U.S. EPA in comments to the Final Feasibility Study Report (U.S. EPA, 2011).

Alternative 3A will involve disposal of the excavated soil offsite at a permitted RCRA Subtitle D landfill. Alternative 3B will involve disposal of the excavated soil onsite.

**Alternative 4** – Alternative 4 is the same as Alternative 3 except that the 12-inch thick clean soil cover (composed of at least 6 inches of topsoil) will be placed on all property exceeding the Level 1 PRGs-R in OU1, OU2 and OU3 and on all properties exceeding the Level 1 PRGs-R, but less than the Level 2 PRGs-R (unexcavated areas), on residential and potential residential properties in OU7. Institutional controls will be placed on the covered properties in OU1, OU2, OU3 (as in Alternatives 2 and 3) and in OU7 as appropriate to protect the integrity of the cover and prevent exposure to contaminated soil and groundwater.

Alternative 4A will involve disposal of the excavated soil offsite at a permitted RCRA Subtitle D landfill. Alternative 4B will involve disposal of the excavated soil onsite.

**Alternative 5** – Alternative 5 is different than Alternatives 2 through 4 and will involve the following: Excavate soil on the Site that exceeds the Level 2 PRGs-R and replace the excavated soil to existing grade with clean soil – excavation is not limited to the upper 2 feet. Excavate soil in excess of invertebrate eco-risk PRGs in the ecological risk area in OU2 and replace with clean soil. Cover unremediated areas in OU2 that exceed the HSCA PCP cleanup level. Place institutional controls on unremediated areas that exceed the Level 1 PRGs-R. Re-establish vegetation and property features in the excavated and covered areas. Place institutional controls on the properties as needed to prevent exposure to contaminated groundwater. Replace excavated roads with clean fill and a gravel surface.

Alternative 5A will involve disposal of the excavated soil offsite at a permitted RCRA Subtitle D landfill. Alternative 5B will involve disposal of the excavated soil onsite.

**Alternative 6** – Alternative 6 is the same as Alternative 5 except that it involves excavating soil on the Site that exceeds the Level 1 PRGs-R (rather than the Level 2 PRGs-R in Alternative 5).

Alternative 6A will involve disposal of the excavated soil offsite at a permitted RCRA Subtitle D landfill. Alternative 6B will involve disposal of the excavated soil onsite.

**Alternative 7** – Alternative 7 is the same as Alternative 2 except that soil on residential and potential residential properties in OU7 exceeding the Level 3 PRGs-R will be excavated to a depth no greater than 2 feet and a 12-inch thick clean soil cover will be placed on commercial/industrial properties exceeding the Level 3 PRGs-I/C in OU1, OU2, and OU3 (rather than the Level 2 PRGs-R in residential areas and the Level 2 PRGs-I/C in industrial/commercial areas in Alternative 2).

Alternative 7A will involve disposal of the excavated soil offsite at a permitted RCRA Subtitle D landfill. Alternative 7B will involve disposal of the excavated soil onsite in OU1.

**Alternative 8** –Alternative 8 is the same as Alternative 7 except that the 12-inch thick clean soil cover will be placed on commercial/industrial properties exceeding the Level 3 PRGs-R in OU1, OU2, and OU3 (rather than the Level 3 PRGs-I/C in Alternative 7).

Alternative 8A will involve disposal of the excavated soil offsite at a permitted RCRA Subtitle D landfill. Alternative 8B will involve disposal of the excavated soil onsite.

## 5.0 Detailed Analysis of Alternatives

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This section presents the results of the detailed analysis of the alternatives described in Section 4.0. The purpose of the detailed analysis is to provide the regulatory agencies with sufficient information to adequately compare the alternatives, select an appropriate remedy for the Site, and demonstrate that the CERCLA remedy selection requirements are fulfilled.

The FS-AOC Statement of Work (Appendix A, Section III) contains the following language regarding the detailed analysis of alternatives at the Site:

“TASK 3: DETAILED ANALYSIS OF ALTERNATIVES (“FS REPORT”)”

Building on the previous FS Documents the Respondents shall conduct and present a detailed analysis of remedial alternatives to provide U.S. EPA, in consultation with its Support Agency Partners, with the information needed to select a remedy.

### 3.1 Detailed Analysis of Alternatives

The Respondents shall conduct a detailed analysis of the remedial alternatives for each identified Area. Each detailed analysis shall include an analysis of each remedial option measured against each of the nine evaluation criteria set forth in 40 C.F.R. § 300.430(e)(9)(iii) and as listed below in Section 3.1.1, and a comparative analysis of all options using the same nine criteria as a basis for comparison.

#### 3.1.1 Apply Nine Criteria and Document Analysis

The Respondents shall apply the nine evaluation criteria to the assembled remedial alternatives to ensure that the selected remedial alternative will protect human health and the environment and meet remedial action objectives; will comply with or include a waiver of ARARs; will be cost-effective; will utilize permanent solutions and alternative treatment technologies, or resource recovery technologies, to the maximum extent practicable; and will address the statutory preference for treatment as a principal element. The evaluation criteria include: (1) overall protection of human health and the environment and how the alternative meets each of the remedial action objectives; (2) compliance with ARARs; (3) long-term effectiveness and permanence; (4) reduction of toxicity, mobility, or volume through treatment; (5) short-term effectiveness; (6) implementability; (7) cost; (8) state and tribal acceptance; and (9) community acceptance. (Note: criteria 8 and 9 will be considered after the FS report has been released to the general public.) For each alternative, the Respondents shall provide: 1) a description of the alternative that outlines the waste management strategy involved and identifies the key ARARs associated with that alternative, and 2) a discussion of the individual criterion assessment. If the Respondents do not have direct input on criteria 8, state and tribal acceptance, and 9, community acceptance, U.S. EPA will address these criteria in consultation with its Support Agency Partners.

### 3.1.2 Compare Alternatives Against Each Other and Document the Comparison of Alternatives

The Respondents shall perform a detailed comparative analysis between the remedial alternatives. That is, the Respondents shall compare each alternative against the other alternatives using the nine evaluation criteria as a basis of comparison. U.S. EPA in consultation with its Support Agency Partners will identify and select the preferred alternative.

### 3.1.3 Alternatives Analysis for Institutional Controls

For any alternative that relies on Institutional Controls, Respondents shall include an evaluation of the following: (1) *Overall Protection of Human Health and the Environment* including what specific institutional control components will ensure that the alternative will remain protective and how these specific controls will meet remedial action objectives; (2) *Compliance with ARARs*; (3) *Long-Term Effectiveness* including the adequacy and reliability of institutional controls and how long the institutional control must remain in place; (4) *Short-Term Effectiveness* including the amount of time it will take to impose the Institutional Control; (5) *Implementability* including research and documentation that the proper entities (e.g., potentially responsible parties, state, local government entities, local landowners, conservation organizations) are willing to enter into any necessary agreement or restrictive covenant with the proper entities and/or that laws governing the restriction exist or allow implementation of the institutional control; (6) *Cost* including the cost to implement, maintain, monitor and enforce the institutional control; and (7) *State and Community Acceptance* of the Institutional Control.

## 3.2 Feasibility Study Report

In accordance with the Schedule in Exhibit A to this SOW, the Respondents shall prepare and submit a draft FS Report to U.S. EPA, MPCA, and LLBO for review and approval pursuant to Section X of the AOC. The FS report shall summarize the development and screening of the remedial alternatives and present the detailed analysis of remedial alternatives. In addition, the FS Report shall also include the information U.S. EPA, in consultation with its Support Agency Partners, will need to prepare relevant sections of the Record of Decision ("ROD") for the Site [see Chapters 6 and 9 of EPA's A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (EPA/540/R-98/031, OSWER Publication 9200.1-23P, July 1999) for the information that is needed].”

## 5.1 Detailed Analysis Overview

The detailed analysis of the eight site-wide alternatives consists of the following three components: (1) further definition of each alternative, if necessary, with respect to volumes or areas of contaminated media to be addressed, the technologies to be used, and any performance requirements associated with those technologies; (2) an assessment and a summary of each alternative against the established evaluation criteria; and (3) a comparative analysis among the alternatives to assess the relative performance of each alternative with respect to each evaluation criteria.

### **5.1.1 Alternative Definition**

The Site-wide alternatives are defined in Section 4.0. Each alternative defined in Section 4.0 was reviewed to determine if additional definition was required or appropriate to apply the evaluation criteria consistently and appropriately and to develop order-of-magnitude cost estimates. Information considered to refine the alternatives consisted of preliminary design concepts and an evaluation of the limitations, assumptions, and uncertainties concerning each alternative. Alternatives were also reviewed and decisions were made as to the specific aspects of the individual alternatives (e.g., excavation depth) to include in each alternative. An important factor in the decisions was to provide a reasonable set of design assumptions for each alternative, but not all possible intermediate alternatives, to provide a reasonable detailed analysis. Refinements in the definition of the alternatives and decisions on the specific aspects of the alternatives are summarized in Table 5-1. The features of portions of several of the alternatives are identical and only the differences between the alternatives are highlighted in Table 5-1.

### **5.1.2 Evaluation Criteria**

The U.S. EPA has established nine evaluation criteria (NCP 40 CFR 300.430(e)(9)iii) to address CERCLA requirements and considerations and to address the technical and policy considerations that have proven to be important for selecting among remedial alternatives. These criteria serve as the basis for conducting the detailed analyses phase of the feasibility study and for subsequently selecting an appropriate remedial action. These criteria are:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Short-term effectiveness
- Reduction of toxicity, mobility, or volume through treatment
- Implementability
- Cost
- State acceptance
- Community acceptance

#### **5.1.2.1 Overall Protection of Human Health and the Environment**

The assessment of the overall protection of an alternative draws on assessments conducted under other criteria, especially long-term effectiveness and permanence, short-term effectiveness,

compliance with ARARs and consideration of TBCs. This assessment focuses on whether the alternative meets the RAOs and PRGs and achieves adequate overall protection, and describes how the site risks are eliminated, reduced, or controlled through treatment, or engineering or institutional controls for each pathway being addressed by the feasibility study. This assessment also considers any short-term and multimedia risks. Preliminary remediation goals for the Site are identified in Table 2-7 and in Section 3. The PRGs for the alternatives are described in Section 4.

#### **5.1.2.2 Compliance with ARARs**

This evaluation criterion is used to evaluate whether the alternative will meet the federal, state and local ARARs that have been identified. ARARs developed in Section 2 (Tables 2-1 through 2-5) are reviewed to determine if the alternative complies. ARARs that are not met are identified.

#### **5.1.2.3 Long-Term Effectiveness and Permanence**

This evaluation criterion addresses the risks remaining at the Site after the alternative is implemented and the response action objectives are met. The primary focus is on the extent, effectiveness and permanence of the controls that are required to manage the risks posed by treatment residuals and/or untreated soil/waste.

#### **5.1.2.4 Short-Term Effectiveness**

This evaluation criterion addresses the following factors:

- Protection of the community during implementation of remedial actions.
- Protection of workers during implementation of remedial actions.
- Environmental impacts during implementation of remedial actions.
- Time to achieve the project remediation goals.

#### **5.1.2.5 Reduction of Toxicity, Mobility, or Volume through Treatment**

This evaluation criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently reduce toxicity, mobility, or volume of hazardous substances as their principal element.

#### **5.1.2.6 Implementability**

This evaluation criterion addresses the technical and practical implementability of the alternative. It also addresses the availability of services and materials required during remediation activities.

#### **5.1.2.7 Cost**

Order-of-magnitude cost estimates are prepared. This evaluation considers the capital and general operation and maintenance costs associated with the alternative. Because very little of the detailed remedial design is typically completed at the time of the feasibility study, order of magnitude estimates are provided and are expected to provide an accuracy of plus 50 to minus 30 percent for the described scope of the alternative. The operation and maintenance costs for the alternatives evaluated for this Site are low compared to the construction costs but have been estimated as required by the U.S. EPA (U.S. EPA, 2010). The present worth of the long-term costs associated with the alternative are calculated assuming an interest rate of 7 percent (U.S. EPA, 2000). A maximum performance period of 30 years is used in the present worth calculations, although some alternatives may require a longer performance period.

#### **5.1.2.8 State Acceptance**

This assessment is intended to evaluate the technical and administrative issues and concerns the state (and the LLBO) have regarding each of the alternatives. This criterion is addressed by the U.S. EPA in the Record of Decision once comments on the feasibility study have been received and is not addressed in this Revised Final Feasibility Study Report.

#### **5.1.2.9 Community Acceptance**

This assessment is intended to evaluate the issues and concerns the public has regarding each of the alternatives. This criterion will be addressed by the U.S. EPA in the Record of Decision once comments on the feasibility study have been received and is not addressed in this Revised Final Feasibility Study Report.

### **5.1.3 Comparative Analysis of Alternatives**

A comparative analysis of alternatives follows the individual analyses. The comparative analysis considers the same criteria used to evaluate the individual alternatives. The intent of the comparative analysis is to qualitatively rank alternatives within each of the evaluation criteria and point out significant trade-offs between the different alternatives.

## **5.2 Detailed Analysis of Alternatives**

The alternatives described in Section 4.0 of this report are evaluated in detail using the seven evaluation criteria described in Section 5.1.2 (state and community acceptance are evaluated by U.S. EPA in the Record of Decision and not in this Revised Final Feasibility Study Report).

### 5.2.1 Alternative 1 – No Further Action

Alternative 1 is described in Table 5-1.

**Alt. 1 – Overall Protection of Human Health and the Environment.** Since no further remedial actions for soils would be implemented in OU1, Alternative 1 would not reduce human health risks from Site-related COCs in OU1 soil. As described in the FS-AOC, the U.S. EPA has determined that the 2004/2005 removal action did not sufficiently reduce the human health risk in OU1 for workers performing excavations and for a future residential land use scenario. In addition, in comments to the Draft Alternatives Screening Technical Memorandum and the September 2009 Draft Feasibility Study Report, the U.S. EPA required that industrial/commercial scenarios be evaluated for OU1 (and OU2 and OU3) even though the FS-AOC SOW contains the statement “While the September 2007 Risk Assessment documented that exposures to surface contaminants in the Former Operations Area are within the Agency’s acceptable risk range for commercial/industrial use...” Since no further remedial actions for soils would be implemented in OU2 or OU3, Alternative 1 would not reduce human health risks from Site-related COCs in OU2 or OU3 soil.

Since no remedial actions would be implemented in the ecological risk area in OU2, there would be no reduction in potential toxicity to soil organisms from Site-related contaminants in the soil. As determined by U.S. EPA, and as described in the FS-AOC, this alternative would not protect the environment at this location.

No further remedial action would be taken to protect workers in underground excavations over the contaminated groundwater plume in OU1. The U.S. EPA has determined that no further action will not be protective of human health in this area.

As described in the FS-AOC, the U.S. EPA has concluded that the interim remedial actions in OU7 had a positive impact on temporarily reducing human health risk but did not sufficiently reduce the human health risks for all exposure scenarios. The interim actions also did not include consideration of long-term effectiveness and permanence. Since no further remedial actions would be implemented in OU7 under this alternative, there would be no further reduction in the existing potential human health risks from Site-related COCs in the soil.

Alternative 1 would avoid the environmental impacts, community and property owner/occupant disruptions and exposures to potential safety and health hazards associated with the high volume of truck traffic, construction activity, noise and inconveniences to the local community with the other Site-wide alternatives under consideration.

**Alt. 1 – Compliance with Applicable or Relevant and Appropriate Requirements.** The No Further Action alternative does not address additional consideration of the permanence, long-term effectiveness, and environmental protection in remedy selection.

**Alt. 1 – Long-Term Effectiveness and Permanence.** Risks to humans from exposure to COCs in soil would not be reduced under Alternative 1. The residential or commercial/industrial PRGs would not be achieved over the long term because of the lack of significant natural attenuation of dioxins and high-molecular-weight PAHs.

Ecological risk, in the form of potential toxicity to organisms, would persist within the area of soil in OU2 that exceeds the eco-risk PRGs under Alternative 1. Additional protection of the environment would not be achieved over the long term because of the lack of significant natural attenuation of high-molecular-weight PAHs.

Alternative 1 would not address long-term risks to workers exposed to contaminated groundwater while performing subsurface excavations because there would be no further action to prevent such exposures and the time needed to remediate the groundwater.

**Alt. 1 – Reduction of Toxicity, Mobility, or Volume through Treatment.** Alternative 1 does not provide treatment of the soil for toxicity, mobility, or volume reduction. Alternative 1 does not address the statutory preference for treatment.

**Alt. 1 – Short-Term Effectiveness.** Since Alternative 1 requires no construction, there would be no construction-related risks to workers, the community, or the environment.

**Alt. 1 – Implementability.** The technical or administrative feasibility of the No Further Action alternative is not applicable since no action would be implemented. The availability of services, materials, and technologies also is not applicable.

**Alt. 1 – Cost.** No additional costs are associated with Alternative 1.

### **5.2.2 Alternative 2 – Excavate Soil Exceeding Level 2 PRGs-R in Residential Areas, Cover Soil Exceeding Level 2 PRGs-I/C in Industrial/ Commercial Areas, Excavate Soil Exceeding Eco-Risk PRGs in OU2, Pave Roads, Implement Required Institutional and Engineering Controls – Alternative 2A: Offsite Disposal, Alternative 2B: Onsite Disposal**

The details of this alternative are described in Table 5-1 and in the cost tables in Appendix F. The areas that the available data show will be excavated (OU7) and covered (OU1, OU2, OU3) are shown

on Figure 5-1. The area to be excavated in the eco-risk area in OU2 is shown on Figures 3-7 and 5-1. The area with risk to below-ground workers identified as unacceptable is shown on Figure 3-6.

**Alt. 2 – Overall Protection of Human Health and Environment.** Soil exceeding the Level 2 PRGs-R will be excavated from OU7, addressing any human health risks presented by this soil that have been identified as potentially unacceptable. Clean soil used as backfill will be tested to verify it meets the Level 2 PRGs-R. Excavated soil will be tested and soil that is not a hazardous waste will be transported to a permitted RCRA Subtitle D landfill for disposal (Alternative 2A) or to an engineered onsite consolidation cell in OU1 (Alternative 2B). Although the maximum excavation depth in this alternative has been established at two feet by the U.S. EPA, it is anticipated that soils exceeding the Level 2 PGGs-R will not extend below this depth. The exception may be areas that were within the original limits of OU1 or OU2, but were moved within the boundaries of OU7 for this feasibility study. Excavated soil that is consolidated onsite will be covered to preclude the direct contact pathway and eliminate the potential migration of Site-related contaminants by windblown dust and surface water erosion. Following property restoration, Alternative 2 will be protective of human health in residential areas by eliminating the direct contact pathway and the erosion of soil exceeding the Level 2 PRGs-R.

The vegetated soil cover over soil exceeding the Level 2 PRGs-I/C in OU1, OU2 and OU3 will prevent direct human contact and exposure to contaminated soil and will mitigate windblown dust and surface water erosion of soil exceeding the Level 2 PRGs-I/C. Under this alternative, soil exceeding the Level 2 PRGs-R, but less than the Level 2 PRGs-I/C in OU1, OU2 and OU3 will not be remediated. This is consistent with the remedial action objectives for OU2 and OU3 but is inconsistent with the remedial action objective for OU1 to prevent potential migration of COCs to nearby residential properties via windblown dust or surface water erosion of soil. This will be mitigated by the flat topography and the vegetation that has established in these areas. Surface water drainage will be maintained to minimize the potential for erosion and/or to direct runoff away from existing or potential future residential areas to the extent practical. Any future industrial/commercial development of the covered portions of OU1, OU2 or OU3 will need to be designed and constructed to maintain the protection of human health and the environment.

The majority of the OU1 area owned by International Paper and all of OU2 are fenced, and both areas have established vegetation made up of mature, 20-year-old pine trees. The effectiveness of the fencing in restricting access and the viability of the existing vegetation have been demonstrated for many years. Placement of vegetated soil cover on portions of OU1 and OU2 owned by International

Paper will require clearing of existing pine trees. The trees and other existing vegetation provides a substantial measure of protection to human health and the environment by limiting direct exposure to COCs in soil, reducing potential erosion and windblown dust generation, providing habitat, and sequestering carbon. While placement of a new vegetated cover will prevent direct contact with COCs in soils and will address erosion and windblown dust generation, removal of the trees will have permanent adverse effects on habitat and carbon storage. Additionally, there will be significant short-term environmental impacts to clear the forested areas in order to implement remedial actions.

At the direction of the U.S. EPA in comments to the Final Feasibility Study Report, the feasibility study assumes that unpaved roads will be paved with asphalt.

Overall protection of human health and the environment for this alternative depends on institutional controls on the commercial/industrial properties in OU1, OU2 and OU3 to protect the integrity of the cover, prevent exposure to contaminated soil and groundwater, and not allow residential land use. Institutional controls are described for this alternative and are evaluated in detail in Appendix G as required by Section 3.1.3 of the FS-AOC SOW.

If property owners deny access for remedial actions in OU1, OU2 or OU3 under this alternative (and all alternatives in this feasibility study), a risk of direct contact with soil above the Level 2 PRGs-I/C and the erosion of soil above the PRGs in windblown dust and surface runoff will still be present at those properties. Likewise, if property owners deny access for remedial actions in the residential areas in OU7, a risk of direct contact with soil above the Level 2 PRGs-R and the erosion of soil above the PRGs in windblown dust and surface runoff will still be present at those properties. A risk of direct contact with soil above the Level 2 PRGs-R will be present with future excavation or grading below a depth of 2 feet if soil exceeding the residential PRGs is left in place in OU7 and institutional controls described in Appendix G for this alternative are not implemented or followed.

Engineering and institutional controls placed in the area of groundwater contamination in OU1 would preclude work in excavations in the area of concern in OU1 without a health and safety plan being followed and protective equipment being used. The health and safety plan for below-ground workers would be assessed and updated as needed at each five-year review.

Excavating soil exceeding eco-risk PRGs from the ecological risk area in OU2 to a maximum depth of five feet will address environmental risks to organisms presented by this soil. Following area restoration, this remedial action will be protective of the environment by eliminating soil that exceeds the eco-risk PRGs to a depth of five feet below the ground surface.

The monitoring of surface water in the wetland east of OU1 will provide information needed to verify that remedial actions are protective of the wetland.

Following completion of remedial action activities and Site restoration, Alternative 2 will be protective of human health and the environment by eliminating the direct contact pathway for residential or industrial/commercial land use and by eliminating the potential migration of Site-related contaminants by windblown dust and surface water erosion except as described above for OU1. It is restated that the HHERA (Integral, 2007; 2008) documented that exposure to soil COCs in OU1 (and OU2 and OU3) are within the U.S. EPA's acceptable risk range for industrial/commercial use. Monitoring and maintenance will be required to ensure the protectiveness of the cover, especially until vegetation is established.

No unacceptable multimedia risks are created with this alternative with the exception of the potential for erosion of soil exceeding the Level 2 PRGs-R from OU1 toward residential areas as discussed above. Short-term risks are described below.

**Alt. 2 – Compliance with Applicable or Relevant and Appropriate Requirements.** This alternative will be designed and implemented to comply with chemical-specific, action-specific and location-specific ARARs. No ARAR waivers will be required. ARARs that will need to be satisfied will include RCRA rules for the excavation and disposal of contaminated soil and U.S. DOT rules for the transportation of hazardous materials. The consolidation cell in Alternative 2B will involve the consolidation of contaminated soils into a smaller area located within the existing area of contamination in OU1, so RCRA-regulated wastes will not be generated in this alternative. Compliance with RCRA Subtitle C rules (if any of the excavated soil is a hazardous waste) will be challenging if the soil does not meet land disposal restrictions since commercially available and permitted treatment facilities may not be available. OSHA standards for work on hazardous sites will need to be followed to provide worker safety for onsite work. State ARARs to protect surface waters will need to be followed during construction. Potential ARARs are identified in Tables 2-1 through 2-5.

**Alt. 2 – Long-Term Effectiveness and Permanence.** Alternative 2 is expected to permanently and effectively reduce risks to acceptable levels for existing and potential future exposures to Site-related COCs in soil in the residential areas in OU7 and the surrounding neighborhood over the long term. This is a permanent remedy for the remediated residential properties unless soil exceeding the Level 2 PRGs-R is unexpectedly found at depths greater than 2 feet and is left in place. Five-year reviews,

ongoing maintenance and monitoring and institutional controls will not be required for remediated residential properties unless soil exceeding the Level 2 PRGs-R is left in place below a depth of 2 feet. Five-year reviews and institutional controls, likely in the form of a municipal ordinance requiring regulatory agency approval of land alteration activities will be required in any areas where access for excavation of soil is denied or where soil exceeding the Level 2 PRGs-R is left below a depth of 2 feet (Appendix G).

Excavation is an effective and reliable technology for removing contaminated soil. Verification sampling can be used to confirm that soils with COC or COEC concentrations above the selected PRGs have been adequately remediated across exposure-based sampling areas, although the long turnaround time makes verification sampling inefficient at this Site. Offsite disposal in permitted facilities is an effective and reliable remediation technology for contaminated soil. Onsite containment of contaminated soil under a clean soil cover in an industrial/commercial land use setting is an effective and reliable remediation technology for disposal of contaminated soil with low contaminant leaching potential.

Covering industrial/commercial property in OU1, OU2 and OU3 with clean fill/topsoil and establishing vegetation on the cover is an appropriate approach for preventing direct exposure and controlling surface water erosion and windblown dust or soil. As with most remediated Superfund sites, additional remedial actions in covered areas may be needed with industrial/commercial development and such remedial actions would be coordinated with the specific industrial/commercial development (e.g., covering with buildings, parking lots, etc.) to provide a developed industrial/commercial site that is protective of human health and the environment, provides a remedy that is permanent and effective over the long term, and is consistent with U.S. EPA and MPCA guidance.

Five-year reviews and ongoing maintenance, monitoring and institutional controls will be required for OU1, OU2 and OU3 where contaminated soil exceeding the Level 2 PRGs-I/C is covered. The institutional controls will describe any limitations to activities on the property that could disturb the clean cover (e.g., excavation, grading, building construction, etc.) absent appropriate measures and regulatory oversight to address the residual impacts. An easement will be considered for each property deed to provide long-term access to the property by regulatory agencies.

Institutional controls in the form of real property notifications/affidavits and environmental restrictive covenants to preclude residential land use will also be required on OU1, OU2 and OU3.

These institutional controls will be layered with the existing city zoning ordinance and with new community ordinances to provide additional protection. The institutional controls for these areas are described and evaluated in more detail in Appendix G.

As owners of property in OU1 and OU2, BNSF (OU1) and International Paper (OU1 and OU2) will consider the use of appropriate institutional controls on their properties. Placing institutional controls (real property notification/affidavits, environmental restrictive covenants, and easements) on City property (in OU1 and OU3) and on the commercial/industrial properties in OU1 that are owned by private parties will be more difficult and the long-term effectiveness of the remedy may be diminished if the institutional controls are not implemented or enforced.

Alternative 2 will be effective in the long term for the ecological remediation area in OU2 since soil with PAH and PCP concentrations greater than the eco-risk PRGs in the top five feet below the ground surface will be removed and suitable plant and organism habitat will be provided with the backfilled soil. Five-year reviews, ongoing maintenance, monitoring or institutional controls will not be required in the ecological risk remediation area if all contaminated soil exceeding eco-risk PRGs is excavated. Five-year reviews will be required if soil exceeding the eco-risk PRGs is left in place below a depth of five feet.

Warning signs will be an effective means of communicating with workers intending to work below the ground surface in the groundwater area of concern. Such workers are used to looking for signs (e.g., buried electrical lines, buried pipelines, etc.) before work begins on an unfamiliar site. Periodic inspections would be necessary to document that the signs remain in place. Five-year reviews would be used to be sure the warning signs remain protective and to update the excavation health and safety plan for the Site. An ordinance prohibiting underground construction in the groundwater area of concern without a permit will be effective if it is understood and enforced. Ordinances are permanent unless changed after a public involvement process.

**Alt. 2 – Reduction of Toxicity, Mobility, or Volume through Treatment.** Alternative 2 (as well as the other alternatives in this feasibility study) does not use soil treatment so there is no reduction in toxicity, mobility or volume of contaminants through treatment. This is due to the lack of commercially available and permitted technologies to treat dioxins and high-molecular-weight PAHs at the low concentrations present in the soil at this Site. Although Alternative 2 does not satisfy the statutory preference for remedial actions that employ treatment technologies as their principal element, it is recognized that the contaminated soil on the Site is a low-level threat waste and soil

treatment technologies were screened out early in the feasibility study process (U.S. EPA, 2010). Since Alternative 2A involves excavation and offsite disposal, the volume of Site-related contaminants on the Site will be reduced under this alternative. The groundwater remediation system in OU1 provides treatment of Site-related contaminants in the area of groundwater concern using pump-out wells and granulated activated carbon. In addition, in situ biological treatment may be occurring to an undocumented extent in the area of groundwater concern.

**Alt. 2 – Short-Term Effectiveness.** The volume of soil that is estimated to be excavated in OU7, the volume of cover soil required in OU1, OU2 and OU3, and the associated number of truck-trips of excavated soil, backfill and cover soil for Alternatives 2A and 2B are summarized in the following table. This is intended to illustrate the relative magnitude of community disruption and worker risk associated with this alternative.

|               | Excavation Volume (cy) | Cover Soil Volume (cy) |                | Truck-Trips (at 15 cy/truck) |                |
|---------------|------------------------|------------------------|----------------|------------------------------|----------------|
|               |                        | Alternative 2A         | Alternative 2B | Alternative 2A               | Alternative 2B |
| Alternative 2 | 31,300                 | 78,600                 | 83,800         | 9,400                        | 7,700          |

The number of truck-trips and the time required to excavate and haul soil offsite (Alternative 2A) and to import and place clean fill for backfill and cover (Alternatives 2A and 2B) will have an effect on the local community under this alternative. The local community will be affected by construction noise and truck traffic and will be disrupted as roads are paved and detours are provided. Residents and construction workers could be exposed to airborne dust during dry conditions. Dust-suppressing measures would be used to mitigate this concern. Additional short-term risks to workers include risks associated with construction on hazardous sites and construction risks associated with equipment and work around earth-moving operations. Community and worker risks would be mitigated by a site-specific project health and safety plan meeting OSHA requirements, a traffic and materials handling plan, an air quality monitoring plan, and a Construction Quality Assurance Plan, all developed during remedial design. Potential local environmental impacts from soil excavation and covering are related largely to the potential for sediment in surface water runoff to reach Cass Lake. These impacts will be mitigated through the use of a Stormwater Pollution Prevention Plan meeting State of Minnesota and local requirements.

On a larger scale, one set of potential environmental impacts associated with Alternative 2, while somewhat difficult to quantify, will depend on the scope and duration of the transportation phases of

the work. For example, using standard emission factors, the pollutants released by the estimated truck miles required to transport contaminated and clean soil to/from the Site with Alternative 2 will be as shown in Table 5-2. As shown in Table 5-2, an estimated 2,000 tons of criteria pollutants would be generated with this truck traffic with Alternative 2A, equivalent to the pollutants generated to serve the electrical power needs of a community of about 250 people for a year. As shown, the impacts with Alternative 2B (onsite disposal of excavated soil) are less than those of 2A. The risk of injury or fatal accidents with the truck traffic under this alternative is also shown in Table 5-2. The round-trip haul distance to the landfill is estimated to be 300 miles and the round-trip haul distance to the clean borrow soil and topsoil source is anticipated to be 5 to 40 miles.

Short-term impacts in forested areas will occur when trees are cleared to construct soil covers in OU1 and OU2 under this alternative. The impacts will affect carbon storage and sequestration in these ecosystems, and will result in the release of aboveground forest carbon and some release of carbon stored in forest soils. The amount of carbon that will be released is difficult to accurately quantify due to the variability in carbon storage associated with different ecosystem types and maturity levels. However, Table 5-3 provides estimates of the release of sequestered carbon (in tons of CO<sub>2</sub> equivalents) due to tree clearing and chipping using general assumptions and emission factors (COLE, 2009). It is estimated that 4,000 tons of CO<sub>2</sub> equivalent will be released with Alternative 2.

The time to construct Alternative 2 is difficult to estimate due primarily to the unknown difficulties of obtaining access. An estimate is that construction could take on the order of three years. It is expected that vegetation establishment will require at least two growing seasons.

**Alt. 2 – Implementability.** The soil excavation and restoration of the residential properties and potential residential properties that exceed the Level 2 PRGs-R in OU7 are considered to be implementable but several challenges will need to be overcome (although the relative magnitude differs, the description of these challenges apply to all alternatives in this feasibility study except the No Further Action alternative). One challenge will be obtaining access to the properties where excavation will be required. Without access, remedial action obviously cannot proceed. International Paper anticipates the need for significant help from the U.S. EPA in obtaining access if this alternative is selected. Another challenge will be gaining neighborhood acceptance of construction impacts (dust, traffic, roadway detours, noise) that can be partially, but not completely, mitigated. A challenge for the residential property owners will be the long duration of the excavation activities on their property resulting from the approximate 30-day turnaround time on receipt of results from verification sampling. This will present significant challenges to the orderly conduct of field

operations in terms of scheduling of labor and equipment and will cause costs to escalate as a result of schedule interruptions, down time, and repeated mobilization/demobilization activities. It is possible that the duration of the excavation and the volume of the excavated soils could significantly exceed estimates that are based on the estimated areas of surface soils exceeding the Level 2 PRGs-R and assumed excavation depths.

The excavation of soil to meet the eco-risk PRGs in OU2 should be implementable as long as the limits of the area can be well defined in remedial design. However, if the soil is determined to be a hazardous waste, disposal of the soil may not be implementable.

It is anticipated that sufficient landfill capacity will be available for the excavated soil (Alternative 2A) and that the necessary specialized equipment and construction expertise will be available. Obtaining community support for the long-term disposal of the contaminated soil onsite (Alternative 2B) is anticipated to be challenging, although it has been used at commercial/industrial properties at other Superfund sites. Preliminary design shows there is enough space on OU1 to construct the consolidation cell (details as to the area and volume of the cell are provided in the cost estimate in Appendix F).

Covering and establishing vegetation on the soils exceeding the Level 2 PRGs-I/C in OU1, OU2 and OU3 are implementable. Challenges with this work include sustaining the vegetation during dry weather periods, particularly in the initial few seasons, and keeping trespassers off the vegetated area so vegetation can become established. The covered and vegetated areas, as well as the consolidation cell in Alternative 2B, will require periodic inspection and maintenance to repair eroded areas. These requirements will be lessened by the use of native vegetation or other species well-suited for Site conditions. The effectiveness of the remedy will be monitorable as any breaks in the cover and vegetation will be visible using the geotextile marker. A challenge will be to obtain access to the properties where covering will be required. This will involve the City in OU1 and OU3 and up to four property owners whose property is currently in non-residential use in OU1. Without access to a property, remedial action on that property obviously cannot proceed. A final challenge will be placing and enforcing the necessary institutional controls on properties in OU1, OU2 and OU3.

The implementability of this alternative in the groundwater area of concern will depend in large part on the willingness of the City to pass an ordinance not allowing below-ground work in the area of concern without a permit. The willingness of the City to adopt such an ordinance is unknown. In

addition, U.S. EPA commented that the enforceability of City ordinances within an Indian Reservation is uncertain (U.S. EPA, 2010).

**Alt. 2 – Cost.** Costs associated with excavation, transportation and disposal of the soil, and backfilling the excavations in OU7 are dependent on the number of properties that need to be remediated and the volume of the soil excavated. The unit costs used in the estimate are based on earlier remedial actions at the Site, more recent landfill and contractor contacts, and professional judgment.

The properties in OU7 that have soils exceeding the Level 2 PRGs-R are reasonably well known, based on data collected from previous investigations. Sampling results have been used to make reasonable assumptions regarding the need to remediate unsampled properties that may exceed the Level 2 PRGs-R and are within or adjacent to OU7. Sampling of unsampled properties will be conducted in the remedial design phase following applicable sampling procedures so that data are available on each property in OU7 and into the adjacent neighborhoods. Properties that exceed the Level 2 PRGs-R in OU7 for this alternative based on the available data are shown on Figure 5-1.

Uncertainty exists regarding the depth of soil contamination exceeding the Level 2 PRGs-R in OU7 due to a lack of data on soil concentrations below a depth of 4 inches. Investigations conducted over the last ten years have not been designed to characterize COCs below the surficial soils on the Site. Reasonable assumptions regarding the depth of soil exceeding the Level 2 PRGs-R have been made (Table 3-2 footnote, Table 5-1 and cost tables in Appendix F). The uncertainty about the depth of soil contamination in OU7 is made greater by the inclusion of residentially-zoned property that was within the original boundaries of OU1 into OU7 for this feasibility study. Costs associated with re-establishing vegetation, lawns, plantings, gardens, fences, etc. following excavation at the residential properties with soil concentrations exceeding the Level 2 PRGs-R are assumed based on the number of properties, past experience with the 2006 interim action, and information from other sites involving excavation of shallow soil contamination on residential properties and restoration of the properties.

Once excavation and restoration are complete, there will be no five-year reviews, monitoring, or maintenance associated with this alternative for the remediated residential properties assuming that soil exceeding the Level 2 PRGs-R is not left in place below a depth of 2 feet. Five-year reviews and enforcement of an ordinance requiring regulatory agency approval of land alteration activities (and the placement of on-property institutional controls where possible) will be required in any portions of

OU7 where access for remediation is not provided or where soil exceeding the Level 2 PRGs-R remains below a depth of 2 feet. For purposes of all the cost estimates in the Revised Final Feasibility Study Report, it is assumed that access will be provided to all properties and that soil exceeding the appropriate PRGs will not be left in place below a depth of 2 feet in residential areas.

Costs associated with covering and establishing vegetation on OU1, OU2 and OU3 are a function of area. The assumed areas of OU1, OU2 and OU3 requiring clean fill/topsoil and vegetation are based on the sampling results and an assumption of proportionality as described above. The cost of covering is significantly more predictable than is the cost of excavation. The costs associated with remediating OU1 and OU2 would be less if the mature trees on property owned by International Paper are not cut to facilitate covering of soil exceeding PRGs.

Institutional controls, five-year reviews, and ongoing maintenance will be required in the covered portions of OU1, OU2 and OU3, in any portions of OU1 or OU3 where access for remediation is not provided, and at the onsite consolidation cell (Alternative 2B). Annual maintenance costs are based on repair or replacement of small percentages of the remedial components each year as shown on the cost tables in Appendix F.

Costs associated with the excavation, transportation and disposal of the soil exceeding eco-risk PRGs in OU2 and backfilling the excavation are dependent on the volume of soil excavated and are based on experience at earlier remediation projects at the Site, recent landfill and contractor contacts, and professional judgment. The cost per cubic yard will be significantly higher if the soil is a RCRA hazardous waste, and finding a disposal location may not be possible. The assumed excavation area and costs for the area exceeding eco-risk PRGs in OU2 are based on data collected from previous investigations and the invertebrate eco-risk PRGs from Table 2-7 (used as the eco-risk PRGs through this Revised Final Feasibility Study Report). Assumptions have been made regarding the size of the excavation area. Large uncertainties exist regarding the area, depth and subsurface distribution of soil exceeding the eco-risk PRGs in OU2 due to the lack of data on soil concentrations laterally and with depth. As described in Table 5-1, it is assumed that the depth of soil exceeding the eco-risk PRGs in OU2 is three feet and that the area is two acres. The volume of contaminated soil could be much greater or less than assumed. Once excavation, backfilling and revegetation are complete, there will be no maintenance, institutional controls, or five-year reviews needed for the eco-risk area in OU2 as long as all soil exceeding the eco-risk PRGs is removed. Five-year reviews will be required if soil exceeding the eco-risk PRGs is left in place below a depth of five feet. The cost of excavating and disposing of the contaminated soil from the eco-risk area to meet the invertebrate eco-risk PRGs is

approximately \$2 million. It is estimated that four times the volume of soil will be excavated if the lowest eco-risk PRGs from Table 2-7 are used. This would increase the cost of remediating the eco-risk area to \$8 million, increasing the cost of the remedial action under this alternative (and all alternatives except Alternative 1) by \$6 million.

The cost estimate for Alternative 2A is based on the disposal of the excavated soil at the offsite RCRA Subtitle D landfill in Minnesota that has been used previously for Site soils. The cost estimate for Alternative 2B is based on the disposal of the excavated soil in an onsite containment cell. Simplifying assumptions were made to estimate the cost of onsite containment of the soil. It was assumed that the containment cell would be about 2.3 acres, an average of about 9 feet high with 5:1 side slopes and would be covered by a two-foot-thick soil cover and surrounded by a fence with locked gates.

The costs for Alternatives 2A and 2B are summarized in the following table. The cost estimates and the assumptions that went into the estimates are in Appendix F.

|                | <b>Present Value Cost</b> | <b>Accuracy Range</b>        |
|----------------|---------------------------|------------------------------|
| Alternative 2A | \$22.5 Million            | \$16 Million to \$34 Million |
| Alternative 2B | \$20.3 Million            | \$14 Million to \$30 Million |

**5.2.3 Alternative 3 – Excavate Soil Exceeding Level 2 PRGs-R in Residential Areas, Cover Soil Exceeding Level 2 PRGs-R in Industrial/Commercial Areas, Excavate Soil Exceeding Eco-Risk PRGs in OU2, Cover Soil Exceeding HSCA PCP Level in OU2, Pave Roads, Implement Required Institutional and Engineering Controls – Alternative 3A: Offsite Disposal, Alternative 3B: Onsite Disposal**

This alternative is the same as Alternative 2 except soil exceeding the Level 2 PRGs-R will be covered in industrial/commercial areas (rather than soil exceeding the Level 2 PRGs-I/C in Alternative 2) and with the following two additions as directed by U.S. EPA in comments to the Final Feasibility Study Report (U.E. EPA, 2011).

1. Institutional controls stating that the properties are not suitable for unrestricted use must be placed on all properties that exceed the Level 1 PRGs-R after remediation. This could include as many as 100 properties in OU7 and properties owned by International Paper, BNSF, City of Cass Lake, U.S. Forest Service and Cass Forest Products in OU1, OU2 and OU3.

2. Areas in OU2 that exceed the HSCA cleanup level for PCP and are not otherwise remediated must be covered with a 12-inch thick clean soil cover (made up of at least 6 inches of topsoil).

The details of this alternative are described in Table 5-1 and in the cost tables in Appendix F. The areas that the available data show will be excavated (OU7) and covered (OU1, OU2, OU3) are shown on Figure 5-2. The areas to be excavated and covered in the eco-risk area in OU2 are shown on Figure 5-2. The area with unacceptable risk to below-ground workers is shown on Figure 3-6.

**Alt. 3 – Overall Protection of Human Health and Environment.** The description of the overall protection of human health and the environment for Alternative 3 is the same as the description for Alternative 2, with the understanding that under Alternative 3, soil on OU1, OU2 and OU3 will be covered to meet the Level 2 PRGs-R. This is consistent with the remedial action objectives for OU1 but covering soil to meet residential PRGs goes beyond the remedial action objectives for OU2 and OU3. Placement of a vegetated soil cover on portions of OU1 and OU2 owned by International Paper under this alternative will require clearing of most of the existing 20-year-old pine trees on International Paper property. The trees and other existing vegetation provides a substantial measure of protection to human health and the environment by limiting direct exposure to COCs in soil, reducing potential erosion and windblown dust generation, providing habitat, and sequestering carbon. Removal of the trees will have permanent adverse effects on habitat and carbon storage. Additionally, there will be significant short-term environmental impacts to clear the forested areas in order to implement remedial actions.

Excavation of the portions of OU2 under Alternative 3 will address unacceptable risks to soil invertebrates, which are the only ecological receptor group for which unacceptable risks were identified in the HHERA (Integral, 2007; 2008). Therefore, covering the areas that exceed the HSCA PCP cleanup level in OU2 does not provide any additional protection to the environment. Soil exceeding the Level 2 PRGs-R will be excavated from OU7, addressing any human health risks presented by this soil that have been identified as unacceptable. The same issues associated with the denial of property access described for Alternative 2 are applicable to Alternative 3. The same engineering controls and institutional controls for the industrial/commercial properties described in Alternative 2 will be applicable to Alternative 3 with the addition of institutional controls on property exceeding the Level 1 PRGs-R.

Following completion of remedial action activities and Site restoration, Alternative 3 will be protective of human health and the environment by eliminating the direct contact pathway for residential or industrial/commercial land use and by eliminating the migration of Site-related contaminants by windblown dust and surface water erosion exceeding the Level 2 PRGs-R. The U.S. EPA has determined that Alternative 3 will reach a surficial Site-wide average TEQ<sub>DF</sub> of less than the Level 1 PRGs-R (10 ng/kg) in soil (U.S. EPA, 2010). Monitoring and maintenance will be required to ensure the protectiveness of the cover, especially until vegetation is established. The required institutional controls will be implemented and enforced (Appendix G). No unacceptable multimedia risks are created with this alternative.

**Alt. 3 – Compliance with Applicable or Relevant and Appropriate Requirements.** This alternative will be designed and implemented to comply with chemical-specific, action-specific, and location-specific ARARs. No ARAR waivers will be required. Potential ARARS are identified in Tables 2-1 through 2-5.

**Alt. 3 – Long-term Effectiveness and Permanence.** The descriptions of the long-term effectiveness and permanence of the elements of Alternative 3 are identical to the descriptions of the long-term effectiveness and permanence of the same elements in Alternative 2, with Alternative 3 being effective at the Level 2 PRGs-R for the commercial/industrial areas.

**Alt. 3 – Reduction of Toxicity, Mobility or Volume through Treatment.** The descriptions of the reduction of toxicity, mobility or volume through treatment for Alternative 3 are the same as the descriptions for Alternative 2. Alternative 3 does not use soil treatment so there is no reduction in toxicity, mobility or volume of contaminants through treatment.

**Alt. 3 – Short-Term Effectiveness.** The volume of soil that is estimated to be excavated in OU7, the volume of cover soil required in OU1, OU2 and OU3, and the associated number of truck-trips of excavated soil, backfill and cover soil for Alternatives 3A and 3B are summarized in the following table. This is intended to illustrate the relative magnitude of community disruption and worker risk associated with this alternative.

|               | Excavation Volume (cy) | Cover Soil Volume (cy) |                | Truck-Trips (at 15 cy/truck) |                |
|---------------|------------------------|------------------------|----------------|------------------------------|----------------|
|               |                        | Alternative 3A         | Alternative 3B | Alternative 3A               | Alternative 3B |
| Alternative 3 | 31,300                 | 154,000                | 161,400        | 14,400                       | 12,800         |

The number of trucks and time required to excavate and haul soil offsite (Alternative 3A) and to import and place clean fill for backfill and cover will have an effect on the local community under this alternative. The descriptions of these impacts and the required mitigative measures are the same as the descriptions for Alternative 2.

On a larger scale, one set of potential environmental impacts associated with Alternative 3, as with the other alternatives in this feasibility study, will be driven by the scope and duration of the transportation phases of the work. For example, using standard emission factors, the pollutants released by the estimated truck miles required to transport contaminated and clean soil to/from the Site will be as shown in Table 5-2. As shown in Table 5-2, an estimated 2,400 tons of criteria pollutants would be generated by Alternative 3A with this truck traffic, equivalent to the pollutants generated to serve the electrical power needs of a community of 300 people for a year. As shown, the impacts with Alternative 3B (onsite disposal of excavated soil) are estimated to be about one-half of those of Alternative 3A. The risk of injury or fatal accidents with the truck traffic under this alternative is also shown in Table 5-2.

As with the other alternatives, short-term impacts in forested areas will occur when trees are cleared to construct soil covers under this alternative. The impacts will affect carbon storage and sequestration in these ecosystems, and will result in the release of aboveground forest carbon and some release of carbon stored in forest soils. The amount of carbon that will be released is difficult to accurately quantify due to the variability in carbon storage associated with different ecosystem types and maturity levels. Table 5-3 provides estimates of the release of sequestered carbon (in tons of CO<sub>2</sub> equivalents) due to tree clearing and chipping using general assumptions and emission factors (COLE, 2009). It is estimated that 13,400 tons of CO<sub>2</sub> equivalent will be released with Alternative 3.

Although difficult to predict due to implementation uncertainties, Alternative 3 could take on the order of three years to construct. It is expected that vegetation establishment will require at least two growing seasons.

**Alt. 3 – Implementability.** The descriptions of the implementability of the features of Alternative 3 are the same as the descriptions of the implementability of the same features in Alternative 2. The U.S. EPA's requirement that institutional controls be placed on all properties with soil that exceeds the Level 1 PRGs-R (including an estimated 100 private residential properties in OU7) may have significant implementability issues depending on the nature of the institutional controls contemplated by U.S. EPA. The descriptions of the challenges associated with the implementation of Alternative 3

are the same as the descriptions of the challenges associated with the implementation of Alternative 2 with the additional implementability issues associated with the institutional controls on properties that exceed the Level 1 PRGs-R after remediation.

**Alt. 3 – Cost.** The factors that affect the costs of Alternative 3 are the same as the factors that affect the costs of Alternative 2. The descriptions of the uncertainties associated with the volumes of excavated soil in Alternative 3 are the same as the descriptions of the uncertainties associated with the volumes of excavated soil in Alternative 2. A great deal of uncertainty exists as to the number of properties that exceed the Level 1 PRGs-R and will need institutional controls as directed by the U.S. EPA in comments to the Final Feasibility Study Report. For the purposes of the cost estimate, it is assumed that sampling will be required to identify these properties. It is estimated that on the order of 100 properties may require these institutional controls. The costs associated with remediating OU1 and OU2 would be less if the mature trees on property owned by International Paper are not cut to facilitate covering of soil exceeding PRGs.

The costs of Alternatives 3A and 3B are summarized in the following table. The cost estimates and the assumptions that went into the estimates are in Appendix F.

|                | <b>Present Value Cost</b> | <b>Accuracy Range</b>        |
|----------------|---------------------------|------------------------------|
| Alternative 3A | \$29.8 Million            | \$21 Million to \$45 Million |
| Alternative 3B | \$27.7 Million            | \$19 Million to \$42 Million |

**5.24 Alternative 4 – Excavate Soil Exceeding Level 2 PRGs-R in Residential Areas, Cover Soil Exceeding Level 1 PRGs-R Sitewide, Excavate Soil Exceeding Eco-Risk PRGs in OU2, Cover Soil Exceeding HSCA PCP Level in OU2, Pave Roads, Implement Required Institutional and Engineering Controls – Alternative 4A: Offsite Disposal, Alternative 4B: Onsite Disposal**

This alternative is the same as Alternative 3 except soil exceeding the Level 1 PRGs-R (and not excavated) will be covered Site-wide rather than the covering of soil exceeding the Level 2 PRGs-R in industrial/commercial areas in Alternative 3. In addition, institutional controls will not be placed on areas exceeding Level 1 PRGs-R since these areas will be covered in this alternative. The details of this alternative are described in Table 5-1 and in the cost tables in Appendix F. The areas that the available data show will be excavated (OU7) and covered (OU1, OU2, OU3 and OU7) are shown on Figure 5-3. The areas to be excavated and covered in the eco-risk area in OU2 are shown on

Figure 5-3. The area with risk to below-ground workers identified as unacceptable is shown on Figure 3-6.

**Alt. 4 – Overall Protection of Human Health and Environment.** The descriptions of the overall protection of human health and the environment for the features of Alternative 4 are the same as the descriptions for the features of Alternatives 2 and 3 with the understanding that, under Alternative 4, soil on OU1, OU2, OU3 and the unexcavated portions of OU7 exceeding the Level 1 PRGs-R will be covered. Placement of a vegetated soil cover on portions of OU1 and OU2 owned by International Paper under this alternative will require clearing of most of the existing 20-year-old pine trees on International Paper property. The trees and other existing vegetation provides a substantial measure of protection to human health and the environment by limiting direct exposure to COCs in soil, reducing potential erosion and windblown dust generation, providing habitat, and sequestering carbon. Removal of the trees will have permanent adverse effects on habitat and carbon storage. Additionally, there will be significant short-term environmental impacts to clear the forested areas in order to implement remedial actions. The covering of residential properties in this alternative is inconsistent with the results of the technology screening in Table 3-4.

Excavation of the portions of OU2 will address unacceptable risks to soil invertebrates, which are the only ecological receptor group for which unacceptable risks were identified in the HHERA (Integral, 2007; 2008).

As in Alternatives 2 and 3, soil exceeding the Level 2 PRGs-R will be excavated from residential properties in OU7, addressing any unacceptable human health risks presented by this soil. The descriptions of the issues associated with the denial of property access for Alternative 4 are the same as the descriptions for Alternatives 2 and 3. The same engineering controls and institutional controls described for Alternatives 2 and 3 will be applicable to Alternative 4, except the institutional controls on properties exceeding the Level 1 PRGs-R after remediation which are a part of Alternative 3 will not be applicable in Alternative 4. Institutional controls will need to be placed on the properties remediated with a soil cover in OU7 to ensure that the overall protection of the soil cover to human health is not degraded over time (Appendix G).

Following completion of remedial action activities and Site restoration, Alternative 4 will be protective of human health and the environment by eliminating the direct contact pathway for residential or industrial/commercial land use and by eliminating the potential migration of Site-related contaminants by windblown dust and surface water erosion exceeding the Level 1 PRGs-R.

Monitoring and maintenance will be required to ensure the protectiveness of the cover. No unacceptable multimedia risks are created with this alternative.

**Alt. 4 – Compliance with Applicable or Relevant and Appropriate Requirements.** This alternative will be designed and implemented to comply with chemical-specific, action-specific, and location-specific ARARs. No ARAR waivers will be required. Potential ARARS are identified in Tables 2-1 through 2-5.

**Alt. 4 – Long-term Effectiveness and Permanence.** The descriptions of the long-term effectiveness and permanence of the features of Alternative 4 are identical to the descriptions of the long-term effectiveness and permanence of those same features of Alternatives 2 and 3 with Alternative 4 effective at the Level 1 PRGs-R and with the addition that institutional controls will be required to address the long-term protectiveness of the cover on the covered properties in OU7. The long-term effectiveness of the institutional controls on privately-owned residential property is uncertain. The potential degradation of the cover with time without the institutional controls or if they aren't followed would reduce the long-term effectiveness and permanence of this alternative.

**Alt. 4 – Reduction of Toxicity, Mobility or Volume through Treatment.** The descriptions of the reduction of toxicity, mobility or volume through treatment for Alternative 4 are the same as the descriptions for Alternatives 2 and 3 Alternative 4 does not use soil treatment so there is no reduction in toxicity, mobility or volume of contaminants through treatment.

**Alt. 4 – Short-Term Effectiveness.** The volume of soil that is estimated to be excavated in OU7, the volume of cover soil required in OU1, OU2, OU3 (including the Chippewa National Forest) and OU7 and neighboring areas, and the associated number of truck-trips of excavated soil, backfill and cover soil for Alternatives 4A and 4B are summarized in the following table. This is intended to illustrate the relative magnitude of community disruption and worker risk associated with this alternative.

|               | Excavation Volume (cy) | Cover Soil Volume (cy) |                | Truck-Trips (at 15 cy/truck) |                |
|---------------|------------------------|------------------------|----------------|------------------------------|----------------|
|               |                        | Alternative 4A         | Alternative 4B | Alternative 4A               | Alternative 4B |
| Alternative 4 | 31,300                 | 326,200                | 333,600        | 25,900                       | 24,300         |

The large number of trucks and time required to excavate and haul soil offsite (Alternative 4A) and to import and place clean fill for backfill and cover will have an effect on the local community under this alternative. The descriptions of these impacts (but not the scale of the impacts) and the required mitigative measures are the same as the descriptions for Alternatives 2 and 3.

One set of potential environmental impacts associated with Alternative 4 will be driven by the scope and duration of the transportation phases of the work. Using standard emission factors, the pollutants released by the estimated truck miles required to transport contaminated and clean soil to/from the Site will be as shown in Table 5-2. As shown in Table 5-2, an estimated 3,400 tons of criteria pollutants would be generated with the truck traffic in Alternative 4A, equivalent to the pollutants generated to serve the electrical power needs of a community of about 430 people for a year. The risk of injury or fatal accidents with the truck traffic under this alternative is also shown in Table 5-2.

Short-term impacts in forested areas will occur when trees are cleared to allow remedial excavations or to construct soil covers. The impacts will affect carbon storage and sequestration in these ecosystems, and will result in the release of aboveground forest carbon and some loss of carbon stored in forest soils. Table 5-3 provides estimates of the release of sequestered carbon (in tons of CO<sub>2</sub> equivalents). It is estimated that 25,900 tons of CO<sub>2</sub> equivalent will be released with Alternative 4.

Although difficult to predict due to the implementation uncertainties, the construction of Alternative 4 could take on the order of five years to complete if the alternative can be implemented. It is expected that vegetation establishment will require at least two growing seasons.

**Alt. 4 – Implementability.** The remediation of the large number of properties in OU7 and the surrounding neighborhood that will be involved in this alternative must overcome several significant challenges. One challenge will be obtaining access to the many residential properties in OU7 where covering will be required. It was International Paper's experience in the 2006 interim action that several property owners were hesitant to provide access for the interim actions, a considerable amount of negotiation was required, and still not everyone agreed to provide access. Although the number of properties exceeding the Level 1 PRGs-R in OU7 and the surrounding neighborhood is unknown, this remedial action could involve as many as 120 properties in OU7 and the adjacent areas.

In OU1, access will be needed from the City and four property owners in addition to the BNSF and International Paper. In OU2, access will be needed from International Paper and in OU3 access will

be needed from the City and perhaps others including the U.S. Forest Service. Without access, remedial action cannot proceed and covering to the Level 1 PRGs-R cannot be met.

The descriptions of the implementability of the excavation features on residential properties and the covering features on industrial/commercial properties of Alternative 4 are the same as the descriptions of the implementability of the same features of Alternatives 2 and 3.

The on-property institutional controls that will be required for the covered private properties in OU7 may result in significant implementability issues as those institutional controls will need to be on the property or deed to be effective.

**Alt. 4 – Cost.** The descriptions of the factors that affect the costs of Alternative 4 are the same as the descriptions of the factors that affect the costs of Alternatives 2 and 3. Uncertainties associated with the volumes of excavated soil in Alternative 4 are the same as the uncertainties associated with the volumes of excavated soil in Alternatives 2 and 3.

The costs of Alternatives 4A and 4B are summarized in the following table. The cost estimates and the assumptions that went into the estimates are in Appendix F.

|                | <b>Present Value Cost</b> | <b>Accuracy Range</b>        |
|----------------|---------------------------|------------------------------|
| Alternative 4A | \$45.8 Million            | \$32 Million to \$69 Million |
| Alternative 4B | \$44 Million              | \$31 Million to \$66 Million |

### **5.2.5 Alternative 5 – Excavate Soil Exceeding Level 2 PRGs-R Sitewide, Excavate Soil Exceeding Eco-Risk PRGs in OU2, Cover Soil Exceeding HSCA PCP Level in OU2, Implement Required Institutional and Engineering Controls – Alternative 5A: Offsite Disposal, Alternative 5B: Onsite Disposal**

The details of this alternative are described in Table 5-1 and in the cost tables in Appendix F. The areas that the available data show will be excavated (OU1, OU2, OU3 and OU7) are shown on Figure 5-4. The areas to be excavated and covered in the eco-risk area in OU2 are shown on Figure 5-4. The area with risk to below-ground workers identified as unacceptable is shown on Figure 3-6.

**Alt. 5 – Overall Protection of Human Health and Environment.** Soil exceeding the Level 2 PRGs-R will be excavated from OU1, OU2, OU3, and OU7 including the unpaved roads, addressing any

human health risks presented by this soil that have been identified as unacceptable. Clean soil used as backfill will be tested to be sure it meets the Level 2 PRGs-R. Excavated soil will be tested and soil that is not a hazardous waste will be transported to a permitted RCRA Subtitle D landfill for disposal (Alternative 5A) or to an engineered onsite consolidation cell in OU1 (Alternative 5B). Excavated soil that is consolidated will be covered with a two-foot thick cover that will preclude the direct contact pathway and eliminate the migration of Site-related contaminants by windblown dust and surface water erosion. Following property restoration, this alternative will be protective of human health Site-wide by eliminating the direct contact pathway and erosion of soil exceeding the Level 2 PRGs-R. This alternative is consistent with the remedial action objectives for OU1 but excavating soil to meet residential PRGs goes beyond the remedial action objectives for OU2 and OU3.

If property owners deny access for remedial actions, a risk of direct contact with soil above the Level 2 PRGs-R and the erosion of soil above the Level 2 PRGs-R in windblown dust and surface runoff will still be present at those properties.

Implementation of Alternative 5 will require clearing a large stand of mature trees in OU1 and OU2 that are now providing significant protection of human health and the environment and, as with Alternatives 2, 3, and 4, will have significant permanent adverse effects on habitat and carbon storage provided by the trees. Additionally, there will be significant short-term environmental impacts to clear the forested areas in order to implement remedial actions.

As with Alternatives 2 through 4, engineering and institutional controls placed in the area of groundwater contamination in OU1 would preclude work in excavations in the area of concern in OU1 without a health and safety plan being followed and protective equipment being used.

As with Alternatives 2 through 4, excavating soil exceeding eco-risk PRGs from the ecological risk area in OU2 to a maximum depth of five feet will eliminate any environmental risks to organisms presented by this soil. Following site restoration, this remedial action will be protective of the environment by eliminating soil exceeding the eco-risk PRGs to a depth of five feet below the ground surface. As with Alternatives 2 through 4, excavation of portions of OU2 under Alternative 5 will address unacceptable risks to soil invertebrates, which are the only ecological receptor group for which unacceptable risks were identified in the HHERA. Therefore, covering soil exceeding the HSCA PCP level in OU2 does not provide any additional protection to the environment.

Following completion of remedial action activities and Site restoration, Alternative 5 will be protective of human health and the environment. No unacceptable multimedia risks are created with this alternative. Short-term risks are described below.

**Alt. 5 – Compliance with Applicable or Relevant and Appropriate Requirements.** This alternative will be designed and implemented to comply with chemical-specific, action-specific and location-specific ARARs. No ARAR waivers will be required. ARARs that will need to be satisfied will include RCRA rules for the excavation and disposal of contaminated soil and U.S. DOT rules for the transportation of hazardous materials. The consolidation cell in Alternative 2B will involve the consolidation of contaminated soils into an existing area of contamination, so RCRA-regulated wastes will not be generated in this alternative. Compliance with RCRA Subtitle C rules (if any of the excavated soil is a hazardous waste) may not be possible if the soil does not meet land disposal restrictions since commercially available and permitted treatment facilities may not be available. OSHA standards for work on hazardous sites will need to be met to provide worker safety for onsite work. State ARARs to protect surface waters will need to be followed during construction. Potential ARARs are identified in Tables 2-1 through 2-5.

**Alt. 5 – Long-term Effectiveness and Permanence.** Alternative 5 will permanently and effectively reduce risks to acceptable levels for existing and potential future exposures to Site-related COCs in soil on remediated properties Site-wide over the long term. This is a permanent remedy for the remediated properties. Five-year reviews, ongoing maintenance and monitoring and institutional controls will not be required for the remediated properties. Five-year reviews and institutional controls, likely in the form of a municipal ordinance requiring regulatory agency approval of land alteration activities will be required in any areas where access for excavation of soil is denied.

Excavation is an effective and reliable technology for removing contaminated soil. The descriptions of the long-term effectiveness and permanence of excavation and disposal for this alternative are the same as the descriptions in Alternatives 2 through 4.

The description of the long-term effectiveness and permanence of the ecological remediation in OU2 under Alternative 5 is the same as the description under Alternatives 2 through 4.

The description of the long-term effectiveness and permanence of the warning signs for worker protection under Alternative 5 is the same as the description under Alternatives 2 through 4. An ordinance prohibiting underground construction in the groundwater area of concern without a permit

will be effective if it is understood and enforced. Ordinances are permanent unless changed after a public involvement process.

**Alt. 5 – Reduction of Toxicity, Mobility or Volume through Treatment.** Alternative 5 does not use soil treatment so (as with all alternatives in this Revised Final Feasibility Study Report) there is no reduction in toxicity, mobility or volume of contaminants through treatment. Since Alternative 5A involves excavation and offsite disposal, the volume of Site-related contaminants on the Site will be reduced under this alternative.

**Alt. 5 – Short-Term Effectiveness.** The volume of soil that is estimated to be excavated and the associated number of truck-trips of excavated soil and backfill with this alternative are summarized in the following table. This is intended to illustrate the relative magnitude of community disruption and worker risk associated with this alternative.

|               | Excavation Volume<br>(cy) |                   | Cover Soil Volume<br>(cy) |                   | Truck-Trips<br>(at 15 cy/truck) |                   |
|---------------|---------------------------|-------------------|---------------------------|-------------------|---------------------------------|-------------------|
|               | Alternative<br>5A         | Alternative<br>5B | Alternative<br>5A         | Alternative<br>5B | Alternative<br>5A               | Alternative<br>5B |
| Alternative 5 | 607,700                   | 363,400           | 12,400                    | 123,300           | 81,800                          | 32,400            |

The large number of trucks and time required to excavate and haul soil offsite (Alternative 5A) and to import and place clean fill for backfill (Alternatives 5A and 5B) will have a significant effect on the local community under this alternative. In addition, communities along the haul route to the landfill(s) and the haul route to the clean borrow source(s) will also be affected by the truck traffic. The local community will be affected by construction noise and truck traffic and will be disrupted as roads are excavated and detours are provided. Residents and construction workers could be exposed to contaminated airborne dust during dry conditions. Dust-suppressing measures would be used to mitigate this concern. Additional short-term risks to workers include risks associated with construction on hazardous sites and construction risks associated with equipment and work around earth-moving operations. Community and worker risks would be mitigated by a site-specific project health and safety plan meeting OSHA requirements, a traffic and materials handling plan, an air quality monitoring plan, and a Construction Quality Assurance Plan, all developed during remedial design. Potential local environmental impacts from soil excavation and backfilling are related largely to the potential for sediment in surface water runoff to reach Cass Lake. These impacts will be

mitigated through the use of a Stormwater Pollution Prevention Plan meeting State of Minnesota and local requirements.

On a larger scale, one set of potential environmental impacts associated with Alternative 5 will be driven by the scope and duration of the excavation and transportation phases of the work. Using standard emission factors, the pollutants released by the estimated truck miles required to transport contaminated and clean soil to/from the Site will be as shown in Table 5-2. As shown in Table 5-2, an estimated 30,000 tons of criteria pollutants would be generated with the truck traffic, equivalent to the pollutants generated to serve the electrical power needs of a community of about 3,700 people for a year. As shown, the impacts with Alternative 5B (onsite disposal of excavated soil) are about 10 percent of Alternative 5A, showing the significance of the long haul to the landfill(s). The risk of injury or fatal accidents with the truck traffic under both alternatives is also shown in Table 5-2.

As discussed previously, short-term impacts in forested areas will occur when trees are cleared to allow remedial excavations under this alternative. The impacts will include the release of aboveground forest carbon and some release of carbon stored in forest soils. Table 5-3 provides estimates of the release of sequestered carbon (in tons of CO<sub>2</sub> equivalents) due to tree clearing and chipping using general assumptions and emission factors (COLE, 2009). It is estimated that 13,400 tons of CO<sub>2</sub> equivalents will be lost with Alternative 5.

Although difficult to predict due to implementation difficulties, the construction of Alternative 5 may take on the order of three years to complete. It is expected that vegetation establishment will require two growing seasons.

**Alt. 5 – Implementability.** The implementation of excavating soil exceeding the Level 2 PRGs-R will be difficult in OU1, OU2 and OU3 due to the lack of information on COC concentrations and distribution at depth in these areas, the lack of a reliable field-screening technique to separate soil meeting PRGs from soil that does not, and the long turnaround time needed for verification sampling. The likelihood exists that municipal trash, demolition debris and other wastes requiring special characterization and management will be encountered. It is possible that the duration of the excavation and the volume of the excavated soils could significantly exceed estimates that are based on the area of surface soils exceeding the Level 2 PRGs-R and the assumed excavation depths.

As with other alternatives, a challenge will be obtaining access to the properties where excavation will be required. Without access, remedial action obviously cannot proceed. International Paper anticipates significant help from the U.S. EPA in obtaining access if this alternative is selected.

Another challenge will be gaining neighborhood acceptance of construction impacts (dust, traffic, roadway detours, noise) that can be partially, but not completely, mitigated. A challenge for the property owners will be the long-duration of the excavation activities on their property resulting from the approximate 30-day turnaround time on receipt of results from verification sampling. This will present significant challenges to the orderly conduct of the field operations in terms of scheduling for labor and equipment and could cause costs to escalate as a result of schedule interruptions, down time, and repeated mobilization/demobilization activities. The U.S. EPA's requirement that institutional controls be placed on all unremediated properties with soil that exceeds the Level 1 PRGs-R (including an estimated 100 private residential properties in OU7) may have significant implementability issues depending on the nature of the institutional controls contemplated by the U.S. EPA.

The availability of sufficient landfill capacity for the excavated soil (Alternative 5A) is an issue. The estimated volume of soil for disposal is very large under this alternative. It may be difficult to dispose of the soil given the finite capacity of existing landfills. For instance, the landfill previously used to dispose of the soils excavated in the 2004 removal actions on the City property has indicated that contaminated soil volumes over 400,000 cubic yards from the Site would exceed their permitted capacity and significantly impact their primary operation. The availability of other landfills and their willingness to accept the soil is unknown. The necessary specialized equipment and construction expertise will be available. Obtaining community support for the long-term disposal of the contaminated soil onsite (Alternative 5B) is anticipated to be challenging. Preliminary design shows that consolidating the volume of soil to be excavated under this alternative will consume about one-third of OU1, removing this area from future development.

As with all of the alternatives evaluated in this feasibility study, the implementability of this alternative in terms of the groundwater area of concern will depend on the willingness of the City to pass an ordinance not allowing below-ground work in the area of concern without a permit. The willingness of the City to adopt such an ordinance is unknown.

**Alt. 5 – Cost.** Costs associated with excavation, transportation and disposal of the soil, and backfilling the excavations in OU1, OU2, OU3, and OU7 are dependent on the number of properties that need to be remediated and the volume of the soil excavated. The unit costs used in the estimate are based on earlier remedial actions at the Site, more recent landfill and contractor contacts, and professional judgment. Unit costs for landfill disposal used in cost estimates for other alternatives

have been used for this alternative, although the availability of landfill capacity and, therefore, the cost of transportation and disposal, with the large soil volumes in this alternative, is uncertain.

The properties in OU1, OU2, OU3, and OU7 with surface soils exceeding the Level 2 PRGs-R are reasonably well known, based on data collected from previous investigations. Sampling results have been used to make reasonable assumptions regarding the need to remediate unsampled properties that may exceed the Level 2 PRGs-R. Sampling of unsampled properties will be conducted in the remedial design phase following appropriate sampling procedures so that data are available on each property and into the adjacent neighborhoods. Properties that exceed the Level 2 PRGs-R based on the available data are shown on Figure 5-4.

A great deal of uncertainty exists as to the number of properties that exceed the Level 1 PRGs-R and will need institutional controls as directed by the U.S. EPA in comments to the Final Feasibility Study Report. For cost-estimating purposes, it is assumed that sampling will be required to identify these properties. It is estimated that on the order of 100 properties may require these institutional controls.

A great deal of uncertainty also exists regarding the depth of soil contamination exceeding the Level 2 PRGs-R in OU1, OU2 and OU3 due to a lack of data on soil concentrations below a depth of 4 inches or, in some cases, 12 or 24 inches. As described previously, investigations over the past ten years have not been designed to investigate the distribution of COCs with depth. Reasonable assumptions regarding the depth of soil exceeding the Level 2 PRGs-R have been made (Table 3-2 footnote, Table 5-1 and cost tables in Appendix F). Costs associated with re-establishing vegetation, lawns, plantings, gardens, fences, etc. at the properties with soil concentrations exceeding the Level 2 PRGs-R are based on the number and area of the properties, past experience with the 2006 interim action, and information from other sites involving remediation of contaminated soil on residential properties. The costs associated with remediating OU1 and OU2 would be less if the mature trees on property owned by International Paper are not cut to facilitate excavation of soil exceeding PRGs.

Once excavation and restoration are complete, there will be no five-year reviews, monitoring, or maintenance associated with this alternative for the remediated properties. Five-year reviews and enforcement of a municipal ordinance requiring regulatory agency approval of land alteration activities will be required on any property where access for remediation is not provided. For purposes of the cost estimates, it is assumed that access will be provided to all properties.

Costs associated with the excavation, transportation and disposal of the soil exceeding ecological PRGs in OU2 and backfilling the excavation, the uncertainties in those estimates and the sensitivity of the estimating to the eco-risk PRGs are the same as in previous alternatives.

The cost estimate for Alternative 5A is based on the disposal of the excavated soil at an offsite RCRA Subtitle D landfill in Minnesota that was used previously for Site soils. As described above, this landfill cannot accept all of the excavated soil from this alternative. Finding alternative landfill space will be challenging and using alternative landfills may increase the cost. The cost estimate for Alternative 5B is based on the disposal of the excavated soil in an onsite containment cell. Simplifying assumptions were made to estimate the cost of onsite containment of the soil. The onsite containment cell under this alternative will cover about one-third of OU1. It was assumed that soil exceeding the Level 2 PRGs-R beneath the consolidation cell would not be excavated.

The costs for Alternatives 5A and 5B are summarized in the following table. The cost estimates and the assumptions that went into the estimates are in Appendix F.

|                | <b>Present Value Cost</b> | <b>Accuracy Range</b>         |
|----------------|---------------------------|-------------------------------|
| Alternative 5A | \$103 Million             | \$72 Million to \$150 Million |
| Alternative 5B | \$45 Million              | \$32 Million to \$68 Million  |

**5.2.6 Alternative 6 – Excavate Soil Exceeding Level 1 PRGs-R Sitewide, Excavate Soil Exceeding Eco-Risk PRGs and HSCA PCP Level in OU2, Implement Required Institutional and Engineering Controls – Alternative 6A: Offsite Disposal, Alternative 6B: Onsite Disposal**

This alternative is the same as Alternative 5 except soil exceeding the Level 1 PRGs-R will be excavated Site-wide rather than excavation of soil exceeding the Level 2 PRGs-R in Alternative 5. Soil exceeding the HSCA PCP cleanup level in OU2 will be excavated in this alternative rather than covered as in Alternative 5. The details of this alternative are described in Table 5-1 and in the cost tables in Appendix F. The areas that the available data show will be excavated (OU1, OU2, OU3 and OU7) are shown on Figure 5-5. The area with unacceptable risk to below-ground workers is shown on Figure 3-6.

**Alt. 6 – Overall Protection of Human Health and Environment.** Soil exceeding the Level 1 PRGs-R will be excavated from the Site (OU1, OU2, OU3, OU7, railroad north area, residential area north of the railroad, etc.) including the unpaved roads. Clean soil used as backfill will be tested to

be sure it meets the Level 1 PRGs-R. Following property restoration, Alternative 6 would be protective of human health and the environment. The Level 1 PRGs-R are at the low end of the range required by the NCP for the protection of human health and the environment in residential land use settings. Application of these PRGs would require remediation of soils in industrial/commercial areas on the Site to levels significantly lower than the U.S. EPA's targets for acceptable cancer and noncancer risks, and would be inconsistent with the U.S. EPA's and MPCA's approach at other Superfund sites in Minnesota.

If property owners deny access for remedial actions, soil exceeding the Level 1 PRGs-R would still be present at those properties.

Implementation of Alternative 6 will require clearing a large stand of mature trees in OU1 and OU2 that are now providing significant protection of human health and the environment and, as with Alternatives 2 through 5, will have significant permanent adverse effects on habitat and carbon storage provided by the trees. Additionally, there will be significant short-term environmental impacts to clear the forested areas in order to implement remedial actions.

As with Alternatives 2 through 5, excavation of portions of OU2 under Alternative 6 will address unacceptable risks to soil invertebrates, which are the only ecological receptor group for which unacceptable risks were identified in the HHERA. The excavation of soil exceeding the HSCA PCP cleanup level in OU2 that was required to be included in this alternative by the U.S. EPA does not provide any additional protection of the environment.

**Alt. 6 – Compliance with Applicable or Relevant and Appropriate Requirements.** This alternative could be designed and implemented to comply with all chemical-specific, action-specific and location-specific ARARs. No ARAR waivers will be required. Potential ARARs are identified in Tables 2-1 through 2-5.

**Alt. 6 – Long-term Effectiveness and Permanence.** The descriptions of the long-term effectiveness and permanence of the features of Alternative 6 are identical to the descriptions of the long-term effectiveness and permanence of the same features of Alternative 5 with Alternative 6 protective to the Level 1 PRGs-R. Five-year reviews, ongoing operations/maintenance, monitoring or institutional controls will not be required where soil exceeding the Level 1 PRGs-R is excavated.

**Alt. 6 – Reduction of Toxicity, Mobility or Volume through Treatment.** Alternative 6 does not employ soil treatment so there is no reduction in toxicity, mobility or volume of contaminants

through treatment. Since Alternative 6A involves excavation and offsite disposal, the volume of Site-related contaminants at the Site will be reduced under this alternative.

**Alt. 6 – Short-Term Effectiveness.** The volume of soil that is estimated to be excavated and the associated number of truck-trips of excavated soil and backfill required for this alternative are summarized in the following table. This is intended to illustrate the very large community disruption, worker risks, and environmental risks associated with this alternative.

|               | Excavation Volume<br>(cy) |                   | Cover Volume<br>(cy) |                   | Truck-Trips<br>(at 15 cy/truck) |                   |
|---------------|---------------------------|-------------------|----------------------|-------------------|---------------------------------|-------------------|
|               | Alternative<br>6A         | Alternative<br>6B | Alternative<br>6A    | Alternative<br>6B | Alternative<br>6A               | Alternative<br>6B |
| Alternative 6 | 1,157,000                 | 562,000           | --                   | 168,400           | 154,000                         | 48,700            |

The very large number of truck-trips of excavated soil (Alternative 6A) and imported clean backfill (Alternatives 6A and 6B) will have a great effect on the local community under this alternative. In addition, communities along the haul route to the landfill(s) and the haul route to the clean borrow source(s) will be affected by the truck traffic. The local community will be disrupted by construction noise and as roads are excavated and replaced and detours are provided. An estimated 120 property owners in OU7 will be disrupted by excavation on their property. Residents and construction workers could be exposed to contaminated airborne dust particles during dry conditions. Dust-suppressing measures would be required to mitigate this concern. Additional short-term risks to workers include risks associated with construction on hazardous sites and risks associated with equipment and work around excavations. Community and worker risks would be mitigated by a site-specific project health and safety plan meeting OSHA requirements, a traffic and materials handling plan, an air quality monitoring plan, and a Construction Quality Assurance Plan, all developed during remedial design. Potential environmental impacts from soil excavation and backfilling are related largely to the potential for sediment in surface water runoff to enter Cass Lake. These impacts will be mitigated through the use of a Stormwater Pollution Prevention Plan meeting State of Minnesota and local requirements.

On a larger scale, one set of the potential environmental impacts associated with Alternative 6 will be very large due to the scope and duration of the excavation and transportation phases of the work. Using standard emission factors, the pollutants estimated to be released by the truck miles required to transport contaminated and clean soil to/from the Site will be as shown in Table 5-2. As shown, an

estimated 56,000 tons of criteria pollutants will be generated with Alternative 6A, equivalent to the pollutants generated to serve the power needs of a community of about 7,200 people for a year. The criteria pollutants generated by Alternative 6B will be about 7 percent of those generated by Alternative 6A. In addition, the risk of injury or fatal accidents with the truck traffic will be as shown in Table 5-2.

Short-term impacts in forested areas will occur when trees are cleared to allow remedial excavations under this alternative. The impacts will affect carbon storage and sequestration in these ecosystems, and will result in the release of aboveground forest carbon and some release of carbon stored in forest soils. Table 5-3 provides estimates of the total release of sequestered carbon (in tons of CO<sub>2</sub> equivalents) due to tree clearing and chipping using general assumptions and emission factors (COLE, 2009). It is estimated that 25,900 tons of CO<sub>2</sub> equivalents will be released with Alternative 6.

This alternative is estimated to take five years or more to construct if it can be implemented.

**Alt. 6 – Implementability.** There are several significant challenges with the implementation of Alternative 6 due to the number of properties potentially involved in OU7 and the surrounding neighborhood, the likely large volumes of excavated soils, the unknown distribution of those soils in the subsurface, the lack of a reliable field-screening technique and the long turnaround time for verification samples.

As described for Alternative 4, a significant challenge will be obtaining access to the many properties in OU7 where excavation will be required. It was International Paper's experience in the 2006 interim action, that several property owners were hesitant to provide access for the interim actions, a considerable amount of negotiation was required, and still not everyone agreed to provide access. Although the number of properties exceeding the Level 1 PRGs-R in OU7 and the surrounding neighborhood is unknown, this remedial action could involve as many as 120 properties in OU7 and the adjacent area. Without access, remedial action cannot proceed and the Level 1 PRGs-R cannot be met. In OU1, access will be needed from the City and four property owners in addition to the BNSF and International Paper. In OU2, access will be needed from International Paper and in OU3, access will be needed from the City and perhaps others including the U.S. Forest Service.

Another challenge will be gaining community acceptance of related construction impacts (dust, traffic, roadway detours, noise) that will occur. It is possible that the duration of the excavation could be significantly longer than estimated and that the volume of the excavated soils could exceed

estimates that are based on an assumed area of surface soils exceeding Level 1 PRGs-R and assumed excavation depths.

The estimated volume of soil for disposal is very large under this alternative. It may be difficult to dispose of the soil given the finite capacity of existing landfills. As described previously, the landfill previously used to dispose of the soils excavated in the 2004 removal actions on the City property has indicated that soil volumes over 400,000 cubic yards from the Site would exceed their permitted capacity and significantly impact their primary operation. The availability of other landfill capacity is unknown. It is anticipated that the necessary specialized equipment and construction expertise will be available.

Obtaining community support for the long-term disposal of the contaminated soil onsite (Alternative 6B) is anticipated to be a significant challenge. Preliminary design shows that consolidating the volume of soil to be excavated under this alternative will consume more than one-half of OU1, removing this area from future development.

Challenges with restoration of the properties will include dealing with frustrations due to the long time that will be needed to remediate each property, and satisfying the many property owners and occupants that their pre-remediation conditions have been restored.

The above listed challenges have resulted in a determination that Alternative 6 is not likely to be implementable.

**Alt. 6 – Cost.** As with the other alternatives, costs associated with excavation, transportation and disposal of the contaminated soil and backfilling of the excavations are dependent on the volume of soil excavated and the unit costs are based on previous costs experienced at the Site, information from other sites, recent contact with disposal facilities and contractors, and professional judgment. Unit costs per cubic yard will be significantly higher than assumed if soil is encountered that is a hazardous waste. Unit costs for landfill disposal used in cost estimates for other alternatives have been used for this alternative, although the availability of landfill capacity and, therefore, the cost of disposal, is uncertain.

The areas of excavation have been estimated based on surficial soil data collected from previous investigations. Reasonable assumptions have been made regarding the need to excavate areas that have not been sampled. Significant uncertainty exists regarding the depth and lateral extent of soil exceeding the Level 1 PRGs-R in OU1, OU2, OU3 and OU7 due to the lack of data on soil

concentrations below a depth of 4 to 24 inches and, in the case of OU7, a lack of information on residential and potential residential properties outside of the original limits of the operable units. Reasonable assumptions regarding the depth of contamination have been made (Table 3-2 footnote, Table 5-1 and cost tables in Appendix F). The costs associated with remediating OU1 and OU2 would be less if the mature trees on property owned by International Paper are not cut to facilitate excavation of soil exceeding PRGs.

The cost estimates for this alternative are based on the disposal of the excavated soil at an offsite RCRA Subtitle D landfill (Alternative 6A) and onsite in a large consolidation cell in OU1 (Alternative 6B). As described previously, finding landfill capacity for this large volume of excavated soil may be difficult in Minnesota. Transporting the excavated soil to another disposal location may increase the cost. The costs of Alternatives 6A and 6B are summarized in the following table. The cost estimates for this alternative are in Appendix F.

|                | <b>Present Value Cost</b> | <b>Accuracy Range</b>          |
|----------------|---------------------------|--------------------------------|
| Alternative 6A | \$201 Million             | \$140 Million to \$300 Million |
| Alternative 6B | \$82 Million              | \$57 Million to \$123 Million  |

**5.2.7 Alternative 7 – Excavate Soil Exceeding Level 3 PRGs-R in Residential Areas, Cover Soil Exceeding Level 3 PRGs-I/C in Industrial/ Commercial Areas, Excavate Soil Exceeding Eco-Risk PRGs in OU2, Pave Roads, Implement Required Institutional and Engineering Controls – Alternative 7A: Offsite Disposal, Alternative 7B: Onsite Disposal**

This alternative is the same as Alternative 2 except soil will be excavated in residential areas to the Level 3 PRGs-R and covered in industrial/commercial areas to the Level 3 PRGs-I/C. Alternative 2 involved excavation in residential areas to the Level 2 PRGs-R and covering in industrial/commercial areas to the Level 2 PRGs-I/C. The details of this alternative are described in Table 5-1 and in the cost tables in Appendix F. The areas that the available data show will be excavated (OU7) and covered (OU1, OU2, OU3) are shown on Figure 5-6. The area to be excavated in the eco-risk area in OU2 is the same as in Alternatives 2 through 5 and is shown on Figures 3-7 and 5-6. The area with unacceptable risk to below-ground workers is the same as in Alternatives 2 through 6 and is shown on Figure 3-6.

**Alt. 7 – Overall Protection of Human Health and Environment.** The descriptions of the overall protection of human health and the environment of the features in Alternative 7 are the same as the

descriptions of the features in Alternative 2 with Alternative 7 providing overall protection at the Level 3 PRGs-R (residential areas) and the Level 3 PRGs-I/C (industrial/commercial). Soil exceeding the Level 3 PRGs-R will be excavated from OU7, addressing any human health risks presented by this soil identified as unacceptable. Following property restoration, Alternative 7 will be protective of human health in residential areas by eliminating the direct contact pathway and the erosion of soil exceeding the Level 3 PRGs-R. Under Alternative 7, soil in OU1, OU2 and OU3 will be covered to the Level 3 PRGs-I/C. Windblown dust or surface erosion of soil exceeding the Level 3 PRGs-R, but less than the Level 3 PRGs-I/C, could occur, but will be mitigated by the flat topography and the vegetation that has become established in this area. The description of the issues associated with the denial of property access described for Alternatives 2 through 4 are applicable to Alternative 7. The same engineering controls and institutional controls for the industrial/commercial properties described for Alternative 2 will be applicable to Alternative 7 and are described and evaluated in Appendix G.

Following completion of remedial action activities and Site restoration, Alternative 7 will be protective of human health and the environment by eliminating the direct contact pathway for residential or industrial/commercial land use and by eliminating the migration of Site-related contaminants by windblown dust and surface water erosion exceeding residential PRGs except as noted in the discussion of Alternative 2 for OU1. Monitoring and maintenance will be required to ensure the protectiveness of the cover, especially until vegetation is established.

This alternative is inconsistent with one remedial action objective for OU1 but is otherwise consistent with the remedial action objectives for OU1, OU2 and OU3. The multimedia risks with this alternative are the same as the description of the multimedia risks for Alternative 2, but at the Level 3 PRGs.

**Alt. 7 – Compliance with Applicable or Relevant and Appropriate Requirements.** This alternative will be designed and implemented to comply with chemical-specific, action-specific, and location-specific ARARs. No ARAR waivers will be required. Potential ARARS are identified in Tables 2-1 through 2-5.

**Alt. 7 – Long-term Effectiveness and Permanence.** The descriptions of the long-term effectiveness and permanence of the features of Alternative 7 are the same as the descriptions of the long-term effectiveness and permanence of the features of Alternative 2.

**Alt. 7 – Reduction of Toxicity, Mobility or Volume through Treatment.** The descriptions of the reduction of toxicity, mobility or volume through treatment for Alternative 7 are the same as the descriptions for Alternative 2. Alternative 7 does not use soil treatment so there is no reduction in toxicity, mobility or volume of contaminants through treatment. Since Alternative 7A involves excavation and offsite disposal, the volume of Site-related contaminants on the Site will be reduced under this alternative.

**Alt. 7 – Short-Term Effectiveness.** The volume of soil that is estimated to be excavated in OU7, the volume of cover soil required in OU1, OU2 and OU3, and the associated number of truck-trips of excavated soil, backfill and cover soil for Alternative 7 are summarized in the following table. This is intended to illustrate the relative magnitude of community disruption and worker risk associated with these alternatives.

|               | Excavation Volume (cy) | Cover Soil Volume (cy) |                | Truck-Trips (at 15 cy/truck) |                |
|---------------|------------------------|------------------------|----------------|------------------------------|----------------|
|               |                        | Alternative 7A         | Alternative 7B | Alternative 7A               | Alternative 7B |
| Alternative 7 | 27,600                 | 9,200                  | 16,600         | 4,300                        | 2,800          |

The number of trucks and extended time required to excavate and haul soil offsite and to import and place clean fill for backfill and cover will affect the local community under this alternative. The descriptions of these impacts and the required mitigative measures are the same as the descriptions for Alternative 2, at the scale of the Level 3 PRGs.

The potential environmental impacts associated with Alternative 7 will be primarily due to the scope and duration of the transportation phases of the work. Using standard emission factors, the pollutants released by the estimated truck miles required to transport contaminated and clean soil to/from the Site will be as shown in Table 5-2. As shown in Table 5-2, an estimated 1,400 tons of criteria pollutants would be generated with the truck traffic in Alternative 7A, equivalent to the pollutants generated to serve the electrical power needs of a community of about 180 people for a year. The criteria pollutants generated in Alternative 7B would be about 20 percent of the pollutants in Alternative 7A. The risk of injury or fatal accidents with the truck traffic under both alternatives is also shown in Table 5-2.

Although difficult to estimate, Alternative 7 is expected to take on the order of two construction seasons to construct. It is expected that vegetation establishment will require at least two growing seasons.

**Alt. 7 – Implementability.** The descriptions of the implementability issues with Alternative 7 are the same as the descriptions of the implementability issues with Alternative 2. The descriptions of the challenges associated with the implementation of Alternative 7 are the same as the descriptions of the challenges associated with the implementation of Alternative 2.

**Alt. 7 – Cost.** The factors that affect the costs of Alternative 7 are the same as the factors that affect the costs of Alternative 2. The descriptions of the uncertainties associated with the volumes of excavated soil in Alternative 7 are the same as the descriptions of the uncertainties associated with the volume of excavated soil in Alternative 2, at the Level 3 PRGs-R.

The costs of Alternatives 7A and 7B are summarized in the following table. The cost estimates and the assumptions that went into the estimates are in Appendix F.

|                | <b>Present Value Cost</b> | <b>Accuracy Range</b>       |
|----------------|---------------------------|-----------------------------|
| Alternative 7A | \$12.4 Million            | \$9 Million to \$19 Million |
| Alternative 7B | \$10.5 Million            | \$7 Million to \$16 Million |

**5.2.8 Alternative 8 – Excavate Soil Exceeding Level 3 PRGs-R in Residential Areas, Cover Soil Exceeding Level 3 PRGs-R in Industrial/Commercial Areas, Excavate Soil Exceeding Eco-Risk PRGs in OU2, Pave Roads, Implement Required Institutional and Engineering Controls – Alternative 8A: Offsite Disposal, Alternative 8B: Onsite Disposal**

This alternative is the same as Alternative 7 except soil exceeding the Level 3 PRGs-R will be covered in industrial/commercial areas, rather than covering to the Level 3 PRGs-I/C in Alternative 7. The details of this alternative are described in Table 5-1 and in the cost tables in Appendix F. The areas that the available data show will be covered (OU1, OU2, and OU3) and excavated (OU7) are shown on Figure 5-7. The area to be excavated in the eco-risk area in OU2 is shown on Figures 3-7 and 5-7. The area with risk to below-ground workers identified as unacceptable is shown on Figure 3-6.

**Alt. 8 – Overall Protection of Human Health and Environment.** The descriptions of the overall protection of human health and the environment of the features in Alternative 8 are the same as the descriptions of the features in Alternative 7 with protection at the Level 3 PRGs-R in the industrial/commercial areas. Soil exceeding the Level 3 PRGs-R will be excavated from OU7, addressing any human health risks presented by this soil identified as unacceptable. Following property restoration, Alternatives 8 will be protective of human health in residential areas by eliminating the direct contact pathway and the erosion of soil exceeding the Level 3 PRGs-R. Under Alternative 8, soil on OU1, OU2 and OU3 exceeding the Level 3 PRGs-R will be covered. This alternative is consistent with the remedial action objectives for OU1 but covering soil to meet residential PRGs goes beyond the remedial action objectives for OU2 and OU3. The descriptions of the engineering controls and institutional controls for the industrial/commercial properties in Alternative 8 will be the same as the descriptions of the same features in Alternative 7.

If property owners deny access for remedial actions under this alternative, a risk of direct contact with soil above the Level 3 PRGs-R and the erosion of soil above the Level 3 PRGs-R in windblown dust and surface runoff will still be present at those properties.

As with Alternatives 2 through 7, engineering and institutional controls placed in the area of groundwater contamination in OU1 would preclude work in excavations in the area of concern in OU1 without a health and safety plan being followed and protective equipment being used.

As with Alternatives 2 through 7, excavating soil exceeding eco-risk PRGs from the ecological risk area in OU2 to a maximum depth of five feet will eliminate any environmental risks to organisms presented by this soil. Following restoration, this remedial action will be protective of the environment by eliminating soil that exceeds the eco-risk PRGs to a depth of five feet below the ground surface.

Following completion of remedial action activities and Site restoration, Alternative 8 will be protective of human health and the environment. No unacceptable multimedia risks are created with this alternative.

**Alt. 8 – Compliance with Applicable or Relevant and Appropriate Requirements.** This alternative will be designed and implemented to comply with chemical-specific, action-specific and location-specific ARARs. No ARAR waivers will be required. Potential ARARs are identified in Tables 2-1 through 2-5.

**Alt. 8 – Long-term Effectiveness and Permanence.** Alternative 8 is expected to permanently and effectively reduce risks to acceptable levels for existing and potential future residential exposures in OU7 over the long term at the Level 3 PRGs-R. The descriptions of the long-term effectiveness and permanence of those features of Alternative 8 are identical to the descriptions of the long-term effectiveness and permanence of the features of Alternative 7. This is a permanent remedy for the remediated residential properties. Five-year reviews, ongoing maintenance and monitoring and institutional controls will not be required unless access is denied or soil exceeding the residential PRGs is left below a depth of 2 feet. Five-year reviews and institutional controls will be required in the covered properties in OU1, OU2 and OU3 (as with Alternatives 2 through 4 and 7) and for groundwater protection in OU1 (as with all alternatives except Alternative 1). The required institutional controls are described in Appendix G.

**Alt. 8 – Reduction of Toxicity, Mobility or Volume through Treatment.** Alternative 8 does not use soil treatment so there is no reduction in toxicity, mobility or volume of contaminants through treatment although it is recognized that the contaminated soil is a low-level threat waste and soil treatment technologies were screened out early in the feasibility study process. Since Alternative 8A involves excavation and offsite disposal, the volume of Site-related contaminants on the Site will be reduced under this alternative.

**Alt. 8 – Short-Term Effectiveness.** The volume of soil that is estimated to be excavated in Alternative 8 and the associated number of truck-trips of excavated soil and cover soil for the alternative are summarized in the following table. This is intended to illustrate the relative magnitude of community disruption and worker risk associated with this alternative.

|               | Excavation Volume (cy) | Cover Soil Volume (cy) |                | Truck-Trips (at 15 cy/truck) |                |
|---------------|------------------------|------------------------|----------------|------------------------------|----------------|
|               |                        | Alternative 8A         | Alternative 8B | Alternative 8A               | Alternative 8B |
| Alternative 8 | 27,600                 | 103,800                | 111,200        | 10,600                       | 9,300          |

The number of trucks and time required to excavate and haul soil offsite (Alternative 8A) and to import and place clean fill for backfill and cover (Alternatives 8A and 8B) will affect the local community. The descriptions of the impacts to the community and the mitigative measures that would be used under this alternative are the same as the descriptions of the impacts in Alternative 3.

One set of potential environmental impacts associated with Alternative 8 will be driven by the scope and duration of the transportation phases of the work. Using standard emission factors, the pollutants released by the estimated truck miles required to transport contaminated and clean soil to/from the Site will be as shown in Table 5-2. As shown in Table 5-2, an estimated 1,900 tons of criteria pollutants would be generated with the truck traffic in Alternative 8A, equivalent to the pollutants generated to serve the electrical power needs of a community of about 250 people for a year. The criteria pollutants generated by the truck traffic in Alternative 8B would be about one-half of those generated by Alternative 8A. The risk of injury or fatal accidents with the truck traffic under both alternatives is also shown in Table 5-2. The round-trip haul distance to the landfill is estimated to be 300 miles and the round-trip haul distance to the clean borrow soil and topsoil source is anticipated to be 5 to 40 miles.

As with the other alternatives, short-term impacts in forested areas will occur when trees are cleared to construct soil covers in this alternative. The impacts will affect carbon storage and sequestration in these ecosystems, and will result in the release of aboveground forest carbon and some release of carbon stored in forest soils. Table 5-3 provides estimates of the release of sequestered carbon (in tons of CO<sub>2</sub> equivalents) due to tree clearing and chipping using general assumptions and emission factors (COLE, 2009). It is estimated that 5,400 tons of CO<sub>2</sub> equivalents will be released with Alternative 8.

Although difficult to predict, construction of Alternative 8 is expected to take on the order of three years to complete. It is expected that vegetation establishment will require two growing seasons.

**Alt. 8 – Implementability.** The descriptions of the implementability of the features of Alternative 8 are the same as the descriptions of the implementability of those features of Alternative 7. The descriptions of the challenges associated with the implementation of Alternative 8 are the same as the descriptions of the challenges associated with the implementation of Alternatives 7. Sufficient landfill space is available for the soil excavated under this alternative.

**Alt. 8 – Cost.** The factors that affect the costs of Alternative 8 are the same as the factors that affect the costs of Alternative 7. The description of the uncertainties associated with the volumes of excavated soil in Alternative 8 are the same as the descriptions of the uncertainties associated with the volumes of excavated soil in Alternative 7.

The properties that exceed the Level 3 PRGs-R are reasonably well known, based on data collected from previous investigations. Sampling results have been used to make reasonable assumptions

regarding the need to remediate unsampled properties that may exceed the Level 3 PRGs-R. Sampling of unsampled properties will be conducted in the remedial design phase following previously-used sampling procedures so that data are available on each property on the Site and into the adjacent neighborhoods. Properties that exceed the Level 3 PRGs-R based on the available data are shown on Figure 5-7.

Costs associated with the excavation, transportation and disposal of the soil exceeding ecological PRGs in OU2 and backfilling the excavation have been explained previously and are a part of this cost estimate.

The cost estimate for Alternative 8A is based on the disposal of the excavated soil at the offsite RCRA Subtitle D landfill in Minnesota that has been used previously for Site soils. The cost estimate for Alternative 8B is based on the disposal of the excavated soil in a onsite containment cell.

The costs for Alternatives 8A and 8B are summarized in the following table. The cost estimates and the assumptions that went into the estimates are in Appendix F.

|                | <b>Present Value Cost</b> | <b>Accuracy Range</b>        |
|----------------|---------------------------|------------------------------|
| Alternative 8A | \$22.0 Million            | \$15 Million to \$33 Million |
| Alternative 8B | \$19.9 Million            | \$14 Million to \$30 Million |

### 5.3 Comparative Analysis of Alternatives

This section presents a comparative analysis of the remedial alternatives. The purpose of the comparative analysis is to identify the relative advantages/disadvantages of the alternatives within each of the evaluation criteria. The NCP is the basis for the comparative analysis.

Table 5-4 summarizes the comparative analysis of the remedial action alternatives.

#### Overall Protection of Human Health and Environment

The remedial action objectives relating to human health risks with soil exposures on the Site are as follows:

- Prevent unacceptable potential risk to human health from exposure to Site-related contaminants in soil through ingestion, inhalation and dermal adsorption routes of exposure under residential land use (OU7 and properties in OU1 that are converted to residential use).

- Prevent unacceptable potential risk to human health from exposure to Site-related contaminants in soil through ingestion, inhalation and dermal adsorption routes of exposure with industrial/commercial land use (OU1, OU2 and OU3).
- Prevent the future potential transfer of Site-related contaminants through runoff or windblown dust to nearby residential areas and roads (OU1).

All alternatives except Alternative 1 will be protective of human health (considering the selected PRGs) with respect to direct contact with soils by the appropriate use of excavation and/or containment, institutional controls to prevent residential land use in industrial/commercial areas, removal of the pathways to direct contact with soil in residential and industrial/commercial areas, and by assuring that future development in industrial/commercial areas will consider the need for further remediation to avoid a direct pathway for human contact with soil exceeding the appropriate PRGs. Alternatives 3, 4, 5, 6, and 8 will be further protective by mitigating the erosion of Site-related contaminants exceeding residential PRGs in windblown dust and surface runoff. Alternatives 2 and 7 will remediate soils in industrial/commercial areas to industrial/commercial PRGs, allowing the possibility of the erosion of soil exceeding residential PRGs from these areas. This meets the remedial action objectives for OU2 and OU3, but not OU1 where industrial/commercial properties are intertwined with residential properties. The excavation or covering of soil exceeding residential PRGs in industrial/commercial areas in OU2 and OU3 in Alternatives 3, 4, 5, 6 and 8 goes beyond the remedial action objectives for those operable units.

At the direction of the U.S. EPA, the approach to remediation in OU1 is being evaluated for each alternative independent of property ownership or current site conditions (U.S. EPA, 2010). However, an approximately 40-acre portion of OU1 and OU2 are owned by International Paper and existing conditions limit access and reduce exposure risks. A large portion of these areas is fenced and has established vegetation, including significant stands of 20-year-old pine trees. This vegetation limits the potential for human exposure, soil erosion and windblown dust. The viability of the access controls and vegetation impact has been demonstrated for many years. Additionally, there will be significant permanent adverse environmental impacts to habitat and carbon storage and significant short-term environmental impacts to clear the forested areas in order to implement remedial actions. These impacts will be greatest for Alternatives 3, 4, 5 and 6, where virtually all of the trees will be cut to facilitate remediation.

All alternatives (except Alternative 1) involve excavating soils in residential areas to the selected residential PRGs. Alternatives 2, 3, 4, 7 and 8 include excavation to a maximum depth of 2 feet. It is considered unlikely that soil exceeding residential PRGs extends below a depth of 2 feet on residential properties with the possible exception of the portions of the former operations area that are considered residential and part of OU7 for the purposes of this feasibility study. Alternatives 5 and 6 involve excavating soil exceeding residential PRGs in residential areas irrespective of depth.

Alternatives 5 and 6 involve excavating soil in industrial/commercial areas to the selected residential PRGs, while Alternatives 3, 4 and 8 cover industrial/commercial areas to the selected residential PRGs and Alternatives 2 and 7 cover the industrial/commercial areas to the selected industrial/commercial PRGs. The U.S. EPA has concluded that the Site-wide average TEQDF soil concentration following implementation of Alternative 3 and Alternative 5 will be less than the Level 1 PRG-R (10 ng/kg).

Alternatives involving excavation can be viewed as providing somewhat greater long-term protection than those involving covering since excavation alternatives are more permanent and are not reliant on long-term monitoring, maintenance and institutional controls.

Alternatives 5 and 6 provide for possible residential development in the industrial/commercial areas (OU1, OU2 or OU3) although groundwater contamination and remedial systems exist in OU1 and OU3, OU3 is a former municipal dump, a portion of OU1 is railroad right-of-way, and much of OU2 is a contaminated soil containment cell constructed in 1986 which make residential development unlikely in these areas, especially given the availability of other developable land nearby. All alternatives provide for possible future industrial/commercial development in the industrial/commercial areas (OU1, OU2, and OU3) although the constraints listed above exist for industrial/commercial development as well. Future industrial/commercial development in these areas will require consideration of the specific development and its potential risk of exposure to residual contamination and may require additional remediation at the time of development. This process is commonly used and is expected for future development of remediated Superfund sites. The area of potential industrial/commercial development in OU1 is reduced with the on-Site soil containment cell in Alternatives 5B and 6B.

The protection of human health provided with Alternative 6 is similar to the protection provided by the  $1 \times 10^{-6}$  cancer risk residential PRGs and may exceed reasonable requirements for the industrial/commercial areas on the Site. Remediation of industrial/commercial areas to residential

PRGs is also inconsistent with U.S. EPA and MPCA's approach at other Superfund sites in Minnesota.

Alternative 6 will have the greatest impact on the community, to traffic and safety, and on the environment due to the construction activities needed to haul excavated soil from the Site and to deliver backfill, and its associated disruption to the community with truck traffic, dust, noise and inconvenience to property owners. In terms of fuel consumption and emissions, it is estimated that 56,000 tons of criteria pollutants will be released to the environment due to the truck traffic alone in Alternative 6A. This is equivalent to the pollutants generated to serve the power needs of a community of about 7,200 people for a year (Table 5-2). The risks of accidents with this alternative are shown in Table 5-2. The impacts to the community of Alternatives 4 and 5, while somewhat less than the impacts of Alternative 6, are still well above the impacts of Alternatives 2, 3, 7 and 8 based on the volumes of soil being moved on and off the Site (Table 5-2) and the number of properties that will be involved in the remediation.

The extensive excavations in Alternatives 5 and 6 (650,000 cubic yards and 1,200,000 cubic yards) will also have the greatest potential impact on construction workers. Excavation depths with Alternatives 2, 3, 4, 7 and 8 will be a maximum of 2 feet, while maximum excavation depths for Alternatives 5 and 6 will be to the water table which varies from 5 to 20 feet below the ground surface at the Site. Monitoring and mitigative measures will need to be taken. Air monitoring will be important as workers will need to be at the appropriate health and safety level during intrusive activities. Also, emission control techniques, such as the use of dust suppression, will need to be used to minimize adverse effects on workers and the neighborhood. Alternative 6 has the highest short-term risks of all the alternatives evaluated.

Alternatives 4 and 6 have the longest construction times (estimated five years) of any of the alternatives provided they can be implemented. Alternatives 2, 3, 5 and 8 are anticipated to have the next longest construction times (estimated three years) with Alternative 7 being the shortest (two years).

Alternatives involving onsite disposal will rely more heavily on long-term monitoring and maintenance to achieve protectiveness than those involving the transportation of soil to offsite disposal facilities, although the risk of traffic accidents and the environmental impacts due to air emissions both increase with offsite disposal due to the long round-trip haul distance to the landfill that was assumed for the soil from the Site.

Alternatives 2, 3, 4, 7 and 8 will require institutional controls on OU1, OU2, and OU3 since soil exceeding the PRGs will be covered in these alternatives.

Alternative 4 will require institutional controls on residential property (OU7) to ensure the long-term protectiveness of the soil cover assuming that access is not denied or that soil exceeding the selected PRGs is not left below a depth of 2 feet in Alternatives 2, 3, 7 and 8 (institutional controls would be required where this assumption is not met). Institutional controls in Alternative 4 are the most complex due to the number of property owners that will be involved and the fact they will primarily be applied to single-family residential properties.

For groundwater, the remedial action objective is to prevent unacceptable risk from exposure to COCs through ingestion, inhalation and dermal adsorption routes of exposure during below-ground construction by workers in the area of contaminated groundwater. All alternatives (except Alternative 1) will require institutional controls and engineering controls to protect below-ground workers. All alternatives (except Alternative 1) will provide equal protection through warning signs and an ordinance requiring that permits be obtained for below-ground work in the area of concern since the remedial action is the same in each alternative.

The remedial action objective for the eco-risk area in OU2 is to prevent soil organism mortality due to Site-related contaminants. All alternatives (except Alternative 1) are equally protective of the environment since the remedial action is the same in each alternative. The U.S. EPA directed that Alternatives 3, 4 and 5 include covering of soil that exceeds the HSCA PCP cleanup level in OU2 and that Alternative 6 include excavation of such soil. This requirement does not provide any additional protection of the environment.

**Compliance with Applicable or Relevant and Appropriate Requirements.** It is anticipated that all alternatives (other than Alternative 1) will be able to be designed and implemented to comply with chemical, action, and location specific ARARs and that no ARAR waivers will be required.

**Long-Term Effectiveness and Permanence.** All of the alternatives (except Alternative 1) offer satisfactory or better long-term effectiveness and permanence. Covering soil with clean soil, topsoil and vegetation is effective in mitigating the direct contact pathway and the erosion of contaminated soil in industrial/commercial areas. Alternatives involving covering of soils exceeding PRGs (Alternatives 2, 3, 4, 7, and 8) will require more monitoring and maintenance to ensure their long-term effectiveness than will those involving only excavation (Alternatives 5 and 6). The same is also the case for alternatives involving onsite disposal compared to alternatives involving offsite disposal.

Alternatives involving excavation are permanent remedies for the excavated properties, assuming all soil exceeding PRGs is removed. This would apply to residential properties under all alternatives except Alternative 1.

Alternatives that do not include institutional controls to protect the integrity of a cover or prevent exposures to soil exceeding industrial/commercial or residential PRGs (Alternatives 5 and 6) are considered more effective and permanent over the long term than those requiring institutional controls. All of the alternatives (except Alternative 1) are equally effective and permanent for reducing exposure to contaminants by below-ground workers. All of the alternatives (except Alternative 1) are equally effective and permanent in reducing organism exposure to contaminants in the eco-risk area in OU2.

**Reduction of Toxicity, Mobility or Volume through Treatment.** None of the alternatives meet the statutory preference for treatment as a principal element. This is due to the lack of commercially available and permitted technologies to treat dioxins and high-molecular-weight PAHs at the concentrations present at the Site. No principal threat wastes (i.e., source materials) have been identified as part of the soil remedial measures under consideration in this feasibility study, making treatment less critical. The alternatives involving offsite disposal of excavated soil provide a reduction in the volume of contaminants on the Site through excavation and offsite disposal. This benefit is offset by the long-term presence of the soil in offsite landfills and the reduction of landfill capacity for wastes from other sources posing greater risks.

**Short-Term Effectiveness.** All of the alternatives, except Alternative 1, will impact the local community in terms of truck traffic, dust, noise, construction runoff/erosion, and road closings/detours. Alternatives 4, 5 and 6 involve significantly greater excavation or covering than the other alternatives and will impose greater disruptions to the local community than will alternatives involving less covering and less excavation (Alternatives 2, 3, 7 and 8). Alternative 7 involves the least site construction of the alternatives evaluated in this feasibility study and will have the least short-term impacts. Alternatives 4, 5 and 6 will have more truck traffic, longer haul distances, and a longer duration of construction than will the other alternatives. An estimated 30,000 to 56,000 tons of criteria pollutants will be generated by the truck traffic in Alternatives 5A and 6A. Alternatives involving greater and deeper excavation (Alternatives 5 and 6) will have greater short-term potential impacts to construction workers than will alternatives involving covering and less and shallower excavation. Alternatives involving the hauling of larger quantities of contaminated soil to offsite disposal facilities (Alternatives 5A and 6A) will involve greater impacts to the communities on the

several-hundred-mile round-trip haul route to the landfill(s) than will alternatives involving less volume of excavation requiring offsite disposal and alternatives involving onsite disposal.

Alternatives 5A and 6A also have a greater risk of traffic accidents than will alternatives involving onsite disposal. Table 5-2 shows this information for the various alternatives.

All of the alternatives (except Alternative 1) involve some cutting of trees in OU1, OU2 and OU3 to implement the remedial actions. Alternatives 3, 4, 5 and 6 involve cutting virtually all of the trees in OU1 and OU2. Alternatives 3 and 4 will involve cutting trees, grubbing the stumps, grading the land surface, placing a 1-foot thick cover and re-establishing vegetation. These stands of trees limit access and reduce exposure risks, and it is inconsistent with remedial goals to cut them down. The trees and resulting forest cover limits the potential for human exposure, soil erosion and windblown dust. These benefits have been demonstrated for many years. Additionally, there will be significant environmental and habitat impacts associated with clearing the forested areas.

Short-term impacts in forested areas will occur in all alternatives except Alternative 1 when trees are cleared to allow remedial excavations or to construct soil covers. The impacts will affect carbon storage and sequestration in these ecosystems, and will result in the release of aboveground forest carbon and some release of carbon stored in forest soils. The amount of carbon that will be released is difficult to accurately quantify due to the variability in carbon storage associated with different ecosystem types and maturity levels. Table 5-3 provides estimates of the release of sequestered carbon (in tons of CO<sub>2</sub> equivalents) for each alternative due to tree clearing and chipping using general assumptions and emission factors (COLE, 2009). Alternatives 4 and 6 will have the greatest release of CO<sub>2</sub> equivalent with cutting of trees (estimated at 25,900 tons), Alternatives 3 and 5 will have the next highest (estimated at 13,400 tons), and Alternative 7 will have the least (estimated at 1,100 tons) of the alternatives.

**Implementability.** Alternatives involving the excavation of soil in the industrial/commercial areas of the Site (Alternatives 5 and 6) will be much more difficult to implement successfully than will alternatives involving covering (Alternatives 2, 3, 4, 7 and 8). In fact, Alternatives 5 and 6 involving excavation to Level 1 and Level 2 residential PRGs may not be implementable in OU1, OU2 and OU3 due to the complex distribution of Site-related contaminants in the subsurface soils, the lack of a reliable field-screening technique to separate soil meeting PRGs from soil that does not, the long turnaround time needed for verification sampling, and the large disposal area that will be needed onsite if the soils are not transported offsite for disposal or the large volume of landfill capacity needed if the soils are transported offsite. Non-COC-containing wastes (e.g., municipal waste and

demolition debris in OU3) requiring special characterization and management will likely be encountered. Finally, it is uncertain if sufficient offsite landfill space will be available (at least in Minnesota) for the soil anticipated to be excavated in Alternatives 5 and 6 and it may not be a suitable use of limited landfill capacity considering other landfill disposal needs and the difficulty in siting new landfill capacity. Sufficient offsite landfill capacity is available for the volumes of soil anticipated to be excavated in Alternatives 2, 3, 4, 7 and 8.

The high number of properties where access will be required under Alternatives 4 and 6 (unknown but estimated to be 120 in OU7) will present significant challenges. Obtaining access to residential properties for remedial actions has proven to be challenging in the past at this Site. Access is needed for remediation at fewer properties in OU7 in the other alternatives—on the order of ten for Alternatives 2, 3, and 5 and three for Alternatives 7 and 8. Access will likely be needed to the same number of industrial/commercial properties in OU1, OU2 and OU3 under all alternatives (except Alternative 1).

The U.S. EPA's direction that, in Alternatives 3 and 5, institutional controls must be placed on all properties that exceed Level 1 PRGs-R after remediation stating that the properties are unsuitable for unrestricted use will be difficult, if not impossible, to implement depending on the type of institutional control being contemplated by the U.S. EPA. The requirement that institutional controls must be placed on all properties with soil greater than the Level 1 PRGs-R in Alternative 4 to protect the soil cover makes the implementation of that alternative difficult.

**Cost.** Detailed cost estimates for Alternatives 2 through 8 are in Appendix F. The most significant driver for remedial costs will be the selection of the PRG level. Remedial costs for alternatives at the Level 1 PRGs are one and one-half to ten times greater than the cost of alternatives at the Level 2 PRGs. Remedial costs for alternatives at the Level 2 PRGs are up to eight times greater than the cost of alternatives at the Level 3 PRGs. Alternatives involving excavation in residential areas and covering in industrial/commercial areas (Alternatives 2, 3, 4, 7 and 8) will have lower costs (two to five times lower) than alternatives involving only excavation (Alternatives 5 and 6) at similar PRG levels. The costs of the alternatives with excavation in OU1, OU2 and OU3 (Alternatives 5 and 6) are also considered to have much greater uncertainty than the costs of alternatives that involve covering in industrial/commercial areas. This uncertainty could translate to greater short-term impacts, greater implementation difficulties, longer construction schedule, use of more landfill space, and higher costs than anticipated. Finally, the costs of alternatives involving offsite disposal of the volumes of excavated soils expected in Alternatives 2, 3, 4, 7 and 8 (~30,000 cubic yards) are only slightly

higher than the costs of alternatives involving onsite disposal. This is different than the onsite disposal of larger excavation volumes where it is assumed that soil exceeding the selected PRGs will not be excavated from below the onsite consolidation cell. In those alternatives, the cost of the alternative with offsite disposal can be double the cost of the same alternative with onsite disposal (Alternatives 5A and 5B, 6A and 6B).

The least cost alternative (other than Alternative 1) is Alternative 7 involving excavation of soil exceeding the Level 3 PRGs-R in OU7 and covering soil exceeding the Level 3 PRGs-I/C in the industrial/commercial areas (\$12 million). The highest cost alternatives are excavation to Level 1 or Level 2 PRGs-R with offsite disposal (Alternatives 6A and 5A) (\$200 million and \$100 million, respectively) assuming landfill capacity can be found at the unit costs used in the estimate. The costs of the other alternatives are in the range of \$20 million to \$30 million (Alternative 4 ~\$45 million). The costs associated with remediating OU1 and OU2 would be less if the mature trees on property owned by International Paper are not cut to facilitate covering or excavation of soil exceeding PRGs.

None of the alternatives have annual operation and maintenance costs that are significant in comparison to the construction costs as shown in the cost tables in Appendix F.

The costs of excavating the soil in OU2 to meet invertebrate eco-risk PRGs in Table 2-7 is on the order of \$2 million and is included in the cost of all alternatives, except Alternative 1. This cost is estimated to increase to \$8 million if the lowest eco-risk PRGs in Table 2-7 are used. This would add \$6 million to the cost of each alternative (except Alternative 1) evaluated in this feasibility study.

The cost estimates are based on conceptual-level designs and should be considered order-of-magnitude estimates with an accuracy of +50 percent to -30 percent around the present value cost for the assumed scope of the alternative. The excavation volumes used in the cost estimates, and therefore the costs themselves, especially in OU1, OU2 and OU3, are considered to have significant uncertainty. The volume of soil excavated and access negotiations will impact the length of time to implement these alternatives and the costs. The costs of Alternatives 4, 5 and 6 have the greatest uncertainty. The above discussion regarding costs assumes that Alternatives 3, 4, 5 and 6 can be implemented.

## 6.0 Summary

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### 6.1 Introduction

The objective of this feasibility study as directed by the U.S. EPA is to develop and evaluate remedial alternatives that will address human health and environmental risks from Site-related COCs remaining in soils at the St. Regis Paper Company Superfund Site.

The HHERA (Integral; 2007, 2008), the FS-AOC, and U.S. EPA comments to the Draft Alternatives Screening Technical Memorandum, the September 2009 Draft Feasibility Study Report, and the January 2011 Final Feasibility Study Report were used to establish the following target human health-based PRGs for the Site:

- Level 1 – 10 ng/kg TEQ<sub>DF</sub> (LLBO HSCA).
- Level 2 –  $1 \times 10^{-5}$  cancer risk/background for residential land use (63 ng/kg TEQ<sub>DF</sub>/1.6 mg/kg BaP<sub>e</sub>) and  $1 \times 10^{-5}$  cancer risk for industrial/commercial land use (380 ng/kg TEQ<sub>DF</sub>/4.1 mg/kg BaP<sub>e</sub>).

In addition, a detailed analysis was completed of a range of alternatives at the following human health-based PRGs for the Site:

- Level 3 –  $1 \times 10^{-4}$  cancer risk/HI = 1 for non-cancer risks for residential land use (190 ng/kg TEQ<sub>DF</sub>/8.1 mg/kg BaP<sub>e</sub>) and industrial/commercial land use (2,000 ng/kg TEQ<sub>DF</sub>/4.1 mg/kg BaP<sub>e</sub>).

Remediation at most residential locations would address only a relatively small portion of the total intakes of BaP<sub>e</sub> and TEQ<sub>DF</sub> because the majority of BaP<sub>e</sub> and TEQ<sub>DF</sub> exposures occur through the diet under most of the scenarios considered. Soil-related intakes constitute 50 percent or less of the total intake of BaP<sub>e</sub> for the PRGs based on cancer risks of  $1 \times 10^{-6}$  and  $1 \times 10^{-5}$ , whereas they represent more than 50 percent of total intake both for soil background concentrations and the risk-based PRGs at the  $1 \times 10^{-4}$  level. Soil-related intakes constitute less than 50 percent of the total intake of TEQ<sub>DF</sub> for soil background concentrations, the PRGs based on cancer risks of  $1 \times 10^{-6}$  and  $1 \times 10^{-5}$ , and the PRG based on a Hazard Quotient of 1 for noncancer risks. Only in the case of the TEQ<sub>DF</sub> PRG based on a cancer risk of  $1 \times 10^{-4}$ , do soil-related intakes constitute more (and only slightly more) than 50 percent of total intake.

Remedial technologies and process options were screened for the purpose of identifying remedial action alternatives for each of the operable units at the Site (OU1, OU2, OU3, and OU7). Only those technologies or process options that were judged to be effective, implementable, and potentially cost-effective were retained for the development of alternatives.

The screening process failed to identify available technologies or process options that use treatment to permanently and significantly reduce the volume, toxicity or mobility of Site COCs as a principal element and are capable of dealing with the volume and type of contaminants at the Site.

## **6.2 Remedial Action Objectives and Evaluated Alternatives**

The Site-specific remedial action objectives relating to human health risks with soil exposures at the Site are as follows:

- Prevent unacceptable potential risk to human health from exposure to Site-related contaminants in soil through ingestion, inhalation and dermal adsorption routes of exposure in OU7 and in any portion of OU1 where land use may be converted to residential;
- Prevent unacceptable potential risk to human health from exposure to Site-related contaminants in soil through ingestion, inhalation and dermal adsorption routes of exposure with industrial/commercial land use (OU1, OU2 and OU3); and
- Prevent the future transfer of Site-related contaminants through runoff or windblown dust to nearby residential areas and roads (OU1).

The remedial action objective for the groundwater in OU1 evaluated in this feasibility study is to prevent unacceptable risk from exposure to Site-related contaminants in groundwater through ingestion, inhalation and dermal adsorption routes of exposure during below-ground construction work in the area of contaminated groundwater.

The remedial action objective for the soils in the ecological risk area OU2 is to prevent unacceptable risk to soil organisms from exposure to Site-related COECs.

The remedial action objective for the soils in the residential properties in OU7 and adjacent areas is to prevent unacceptable risks from exposure to Site-related contaminants through ingestion, inhalation and dermal adsorption routes of exposure.

The number of properties exceeding the Level 1 residential PRGs (Level 1 PRGs-R) in OU7 and adjacent areas is unknown but may be on the order of 120. It is estimated that on the order of ten properties exceed the Level 2 ( $1 \times 10^{-5}$ ) residential PRGs (Level 2 PRGs-R); and that on the order of three properties exceed the Level 3 (HI = 1) residential PRGs (Level 3 PRGs-R) in OU7.

The following alternatives were developed, evaluated and compared for the Site. Two disposal options for the excavated soil are included in these alternatives:

- Alternative 1 – No Further Action
- Alternative 2 – Excavate Soil Exceeding Level 2 PRGs-R in Residential Areas, Cover Soil Exceeding Level 2 PRGs-I/C in Industrial/ Commercial Areas, Excavate Soil Exceeding Eco-Risk PRGs in OU2, Pave Gravel Roads, Implement Appropriate Institutional and Engineering Controls – Alternative 2A: Offsite Disposal, Alternative 2B: Onsite Disposal
- Alternative 3 – Identical to Alternative 2 Except Soil Exceeding Level 2 PRGs-R will be Covered in Industrial/Commercial Areas, Cover Soil Exceeding HSCA PCP Cleanup Level in OU2, Place Institutional Controls on Properties Exceeding Level 1 PRGs-R – Alternative 3A: Offsite Disposal, Alternative 3B: Onsite Disposal
- Alternative 4 – Identical to Alternative 3 Except Soil Exceeding Level 1 PRGs-R (and Not Excavated) will be Covered Site-wide – Alternative 4A: Offsite Disposal, Alternative 4B: Onsite Disposal
- Alternative 5 – Excavate Soil Exceeding Level 2 PRGs-R Site-wide, Excavate Soil Exceeding Eco-Risk PRGs in OU2, Cover Soil Exceeding the HSCA PCP Cleanup Level in OU2, Place Institutional Controls on Properties Exceeding Level 1 PRGs-R, Implement Other Appropriate Institutional and Engineering Controls – Alternative 5A: Offsite Disposal, Alternative 5B: Onsite Disposal
- Alternative 6 – Identical to Alternative 5 Except Soil Exceeding Level 1 PRGs-R will be Excavated Site-wide and Soil in OU2 Exceeding HSCA PCP Cleanup Level will be Excavated – Alternative 6A: Offsite Disposal, Alternative 6B: Onsite Disposal
- Alternative 7 – Identical to Alternative 2 Except Soil Exceeding Level 3 PRGs-R will be Excavated in Residential Areas and Soil Exceeding Level 3 PRGs-I/C will be Covered in

Industrial/ Commercial Areas – Alternative 7A: Offsite Disposal, Alternative 7B: Onsite Disposal

- Alternative 8 –Identical to Alternative 7 Except Soil Exceeding Level 3 PRGs-R will be Covered in Industrial/Commercial Areas – Alternative 8A: Offsite Disposal, Alternative 8B: Onsite Disposal

These alternatives are described for the purposes of the detailed analysis in Table 5-1.

The detailed analysis of the alternatives includes evaluating the effectiveness, implementability and cost of each evaluation. Evaluation of effectiveness includes the following:

- the ability of the alternative to meet the remedial action objectives,
- the protectiveness of the alternative,
- compliance with ARARs,
- long-term effectiveness and permanence,
- reduction in toxicity, mobility or volume through treatment, and
- short-term effectiveness.

Evaluation of implementability includes evaluating the technical and administrative feasibility of the alternative. Evaluation of cost includes estimating the construction cost, annual operation and maintenance cost, and present value cost of each of the alternatives (Appendix F). The annual operation and maintenance costs of the alternatives evaluated in this feasibility study were estimated but are not significant compared to the construction costs as shown in Appendix F.

### **6.3 Summary of Major Conclusions**

The feasibility study identifies significant implementation difficulties and uncertainties with excavation to residential PRGs in the industrial/commercial areas of the Site (Alternatives 5 and 6). The primary reasons for the uncertainties and implementation difficulties involve the unknown and unpredictable distribution of contaminants in the subsurface soils on the former treating facility and at the City dump, the lack of a reliable field-screening technique to separate soils not meeting PRGs from those that do and the long turnaround time for the analysis of verification samples. The

uncertainties and implementation difficulties could translate to higher costs, greater short-term impacts, and longer implementation time. Depending on the extent of those uncertainties and implementation difficulties, alternatives involving excavation to residential PRGs in industrial/commercial areas may not be implementable.

The alternatives involving large-scale excavation and offsite disposal (Alternatives 5A and 6A) and those involving covering properties exceeding Level 1 PRGs-R (10 ng/kg TEQ<sub>DF</sub>) (Alternative 4) will require 25,000 to 150,000 truck-loads of soil from the Site to the landfills and from the clean soil borrow sources to the Site. This is indicative of the scale of the project and the noise, traffic and other impacts of the work. These alternatives will be very disruptive to the neighborhood and the community, and do not represent sustainable or “green” approaches to a remedy due to their significant potential environmental and safety impacts in terms of criteria pollutant emissions, fuel consumption, and traffic accidents.

All of the alternatives in the Revised Final Feasibility Study Report, except Alternatives 1, 5 and 6, involve institutional controls to protect the integrity of the cover that will be placed over contaminated soil in industrial/commercial areas and in the case of Alternative 4, in residential areas. The institutional controls to protect the integrity of the cover will typically involve restrictive covenants, easements and property notifications/affidavits restricting residential land use and land alteration for industrial/commercial development without U.S. EPA approval and, in the case of Alternative 4, land alteration on covered residential property. These on-property institutional controls could be layered with community ordinances to offer additional protection. In addition, the U.S. EPA has directed that, for Alternatives 3 and 5, institutional controls must be placed on all properties that exceed Level 1 PRGs-R after remediation is complete. The basis for the U.S. EPA’s directive to place institutional controls on properties that exceed the Level 1 PRGs-R in Alternatives 3 and 5 and the type of institutional control being contemplated are unknown. The institutional controls are described and evaluated for each alternative in Appendix G.

All of the alternatives evaluated in this feasibility study (except the No Further Action alternative) include the excavation of soil exceeding residential PRGs in residential areas associated with the Site. This is a permanent remedy for the remediated properties.

At the request of the U.S. EPA, the approach to remediation in OU1 is being evaluated for each alternative independent of the different areas of ownership and current site conditions that exist across OU1 (U.S. EPA, 2010). However, it is believed that the ownership and current conditions for

the approximately 40-acre portion of OU1 and OU2 owned by International Paper represent unique existing advantages that are addressing site exposure risks. The majority of the OU1 area and OU2 is fenced and both areas have established vegetation, which primarily involves 20-year-old pine trees. The long-term presence of this vegetation is addressing concerns with soil erosion or windblown dust from contaminated areas towards residential areas, and the viability of the access controls and vegetation has been demonstrated for many years. Additionally, there will be significant environmental impacts to clear the forested areas in order to implement the excavation or soil covering remedies, such as the loss of sequestered carbon in the trees. Virtually all of the trees in OU1 and OU2 will be cut to facilitate remediation in Alternatives 3, 4, 5 and 6.

The estimated costs of alternatives to meet the Level 3 (HI = 1) PRGs range from approximately \$12 million (excavation to residential PRGs in residential areas and covering to industrial/commercial PRGs in industrial/commercial areas) to \$21 million (excavation to residential PRGs in residential areas and covering to residential PRGs in industrial/commercial areas). The estimated costs of alternatives to meet the Level 2 ( $1 \times 10^{-5}$ ) PRGs range from approximately \$22 million (excavation to residential PRGs in residential areas and covering to industrial/commercial PRGs in industrial/commercial areas) to \$100 million (excavation to residential PRGs Site-wide with offsite disposal). The estimated costs of alternatives to meet the Level 1 PRGs (HSCA dioxin  $TEQ_{DF}$  of 10 ng/kg) range from \$45 million (excavation to residential Level 2 PRGs in residential areas and cover to Level 1 PRGs Site-wide) to \$200 million (excavation to Level 1 PRGs Site-wide with offsite disposal) with a significant likelihood that the costs will be higher due to greater soil volumes in Alternative 6 and longer implementation times in Alternatives 4 and 6. The costs associated with remediating OU1 and OU2 would be less if the mature trees on property owned by International Paper are not cut to facilitate excavation of soil exceeding PRGs.

The costs of alternatives involving excavation in the industrial/commercial areas (Alternatives 5 and 6) are considered to have much greater uncertainty than do the costs of alternatives involving covering in industrial/commercial areas and excavation only in residential areas.

Meeting the requirements imposed on Alternatives 3, 4, 5 and 6 by the U.S. EPA pose significant implementation challenges.

## 7.0 References

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## Tables

**Table 2-1**

**Potential Federal Action-Specific ARARs and TBCs  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| <b>Citation</b>   | <b>Requirement</b>   | <b>Prerequisite</b>   | <b>Standard</b>                    | <b>Potential ARAR /TBC Evaluation</b>                    | <b>Comments</b>   |
|---|--|---|------------------------------------|--|---|
| Federal Environmental Laws (except RCRA)                          |  |   |                                    |  |   |
| CERCLA  | Addresses investigation and remediation of a release of a hazardous substance.   | Release of a hazardous substance.   | 42 USC 9601 et seq.                | Applicable   |   |
| NCP   | Provides organizational structure and procedures for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants. | Release of a hazardous substance.   | 40 CFR 300                         | Applicable   |   |
| Safe Drinking Water Act   | Protects the quality of public drinking water supplies from source to tap.   |   | 42 USC 300f et seq.                | Does not apply to OUs being evaluated in this FS report. | Cass Lake municipal wells are within 1 mile of the site but no wellhead protection areas has been designated.   |
| Clean Water Act   | Establishes structure for regulating discharges of pollutants and regulating surface water quality.  | Activities that affect or may affect surface water.                               | 33 USC 1251 et seq.                | Applicable   | Surface water management would be required during construction activities.  |
| Clean Water Act   | Surface water quality requirements for discharges of pollutants to federally-regulated waters.   | Discharge of pollutants to federally-regulated waters.                            | 33 USC 1342<br>40 CFR 129          | Applicable   | Surface water management would be required during construction activities.  |
| Clean Air Act   | Regulates air emissions from stationary and mobile sources.  | Stationary or mobile source air emissions.  | 42 USC 7401 et seq.                | Applicable   | Only mobile sources will be excavation and trucking equipment. No stationary sources anticipated.   |
| Section 10 (Rivers and Harbors Act of 1899)                       | Applies to activities that will obstruct or alter any navigable water of the United States.  | Construction activities that will potentially obstruct or alter navigable waters. | 33 USC 403                         | Not an ARAR  | No activities are contemplated that would obstruct or alter any navigable waters of the United States.  |
| Resource Conservation and Recovery Act (RCRA) 42 USC 6901 et seq. |  |   |                                    |  |   |
| Onsite waste generation   | Waste generator shall determine if the waste is hazardous waste.   | Generation of waste.  | 40 CFR 261<br>Subparts A through D | Applicable   | Applicable for any operation where waste would be generated. Testing shall be used to evaluate whether the excavated soil is a hazardous waste. It is anticipated that most of the excavated soil at the Site will not be a RCRA hazardous waste. |

**Table 2-1**

**Potential Federal Action-Specific ARARs and TBCs  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| <b>Citation</b>  | <b>Requirement</b>   | <b>Prerequisite</b>   | <b>Standard</b> | <b>Potential ARAR /TBC Evaluation</b>                         | <b>Comments</b>   |
|--|--|---|-----------------|---|---|
| Generators of Hazardous Waste  | Generation of contaminated soils that are characterized as hazardous wastes. | Management of hazardous waste   | 40 CFR 262      | Applicable to contaminated soil that is a hazardous waste.    | Applicable for any operation where hazardous waste would be generated.  |
| Transporters of Hazardous Waste  | Transportation of hazardous waste to off-site facilities.                    | Transportation of hazardous waste to off-site facilities  | 40 CFR 263      | Applicable to contaminated soil that is a hazardous waste.    | Applicable for any operation where hazardous waste would be transported off-site.   |
| Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities | Management of hazardous waste.   | Operations that include the management of hazardous waste.  | 40 CFR 264      | Applicable to contaminated soil that is a hazardous waste.    | Applicable for any operation where hazardous waste would be treated, stored or disposed of. Only the substantive portions would be ARARs. |
| Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities | Management of hazardous waste at interim status facilities.                  | Operations that include the management of hazardous waste at interim status facilities.   | 40 CFR 265      | Applicable to contaminated soil that is a hazardous waste.    | 40 CFR 264 may supersede this regulation.   |
| Management of Specific Hazardous Waste and Specific Types of Facilities            | Management of specific hazardous wastes                                      | Operations involving recyclable materials, reclamation of lead-acid batteries, hazardous waste burned in boilers and industrial furnaces, munitions, or low level mixed wastes. | 40 CFR 266      | Does not apply to OUs being evaluated in this FS report.      | These standards do not apply to contaminated soils at the site.   |
| Land Disposal Restrictions   | Restricts certain hazardous wastes from land disposal.                       | Placement or disposal of soil that is a hazardous waste.  | 40 CFR 268      | Applicable to contaminated soil that is a hazardous waste.    | Applicable to any operation where hazardous waste is land disposed.   |
| Disposal of Solid Waste that is not a Hazardous Waste                              | Generator of RCRA Subtitle D regulated waste.                                | Placement of RCRA Subtitle D waste in a landfill.   | 40 CFR 257      | ARAR for landfill disposal or generated RCRA Subtitle D waste | Applicable to onsite land disposal if RCRA Subtitle D waste is generated.   |

**Table 2-1**

**Potential Federal Action-Specific ARARs and TBCs  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| <b>Citation</b>  | <b>Requirement</b>  | <b>Prerequisite</b>  | <b>Standard</b>   | <b>Potential ARAR /TBC Evaluation</b>                    | <b>Comments</b>   |
|--|---|--|---|--|---|
| <b>U.S. Department of Transportation</b>   |   |  |   |  |   |
| General Information, Regulations and Definitions   | Requirements for packaging, labeling, marking, placarding, and motor vehicles used for transportation of hazardous materials.   | Offering of hazardous materials for transportation.  | 49 CFR 171  | Applicable   | The properties of the contaminated soil will determine which regulations are applicable.  |
| Hazardous Materials Table, special provisions, communications, emergency response, training and security plans | Each person who offers hazardous material for transportation or each carrier that transports it shall mark each package, container, and vehicle in the manner required.             | Offering of hazardous materials for transportation.  | 49 CFR 172  | Applicable   | The properties of the contaminated soil will determine which regulations are applicable.  |
| Requirements for Shipments and Packagings  | Definitions of hazardous materials for transportation purposes; requirements for preparing hazardous materials for shipment   | Shipment of hazardous materials to off-site facilities   | 49 CFR 173  | Applicable   | The properties of the contaminated soil will determine which regulations are applicable.  |
| <b>Occupational Safety and Health Administration (OSHA)</b>  |   |  |   |  |   |
| Work on Contaminated Sites   | Requirements for workers on uncontrolled hazardous waste sites such as training, personal protective equipment, recording and reporting work-related fatalities/injuries/illnesses. | Work on uncontrolled hazardous waste sites, RCRA CA sites, and emergency response sites.       | 29 CFR 1904 - Recording and Reporting Occupational Injuries and Illnesses<br>29 CFR 1910 - Occupational Safety and Health<br>29 CFR 1926 – Safety and Health Regulations for Construction | Applicable   | The remedial action at the Site would involve work on a CERCLA NPL site; therefore, the requirements of these OSHA standards must be met. |
| <b>Management Certain Toxic Substances</b>   |   |  |   |  |   |
| Remediation of release of polychlorinated biphenols  | Requirements governing the remediation, release, and disposal of PCBs must be met.  | Remediation, release, and disposal of PCBs.  | 40 CFR 761  | Does not apply to OUs being evaluated in this FS report. | PCBs are not potential contaminants of concern for the OUs currently under evaluation.  |
| Dibenzo-para-Dioxins/Dibenzofurans   | Requirements governing the testing and reporting of chemical substances containing dibenzo-para-dioxins / dibenzofurans   | Manufacturing (and/or importing), or processing, a chemical substance identified under §766.25 | 40 CFR 766  | Does not apply to OUs being evaluated in this FS report. | Remediation of contaminated soil does not involve the manufacturing or processing of the regulated chemical substances.                   |

**Table 2-1**

**Potential Federal Action-Specific ARARs and TBCs  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Citation   | Requirement  | Prerequisite   | Standard                                  | Potential ARAR /TBC Evaluation | Comments  |
|--|--|--|---|--------------------------------|---|
| Property Use in Superfund Remedial Action Decisions  |  |  |   |                                |   |
| Strategy to Ensure Institutional Control Implementation at Superfund Sites   | Strategy for ensuring that institutional controls are successfully implemented at Superfund sites. | Institutional controls considered as part of a remedy. | OSWER Directive No. 9355.0-106, Sept 2004 | TBC                            | Establishes an institutional control tracking system (ICTS) database that EPA will use to help ensure the long-term durability, reliability, and effectiveness of institutional controls throughout their life-cycle. |
| Institutional Controls: A Citizen's Guide to Understanding Institutional Controls at Superfund, Brownfields, Federal Facilities, Underground Storage Tank and Resource Conservations and Recovery Act Cleanups | Provides information on institutional controls to citizens.  | Institutional controls considered as part of a remedy. | U.S. EPA-540-R-04-003. Feb 2005           | TBC                            | Provides information on institutional controls to citizens.   |

Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that the entire statutes or policies are considered as potential ARARs; only substantive requirements of the specific citations are considered potential ARARs. Specific potential ARARs are addressed in the table below each general heading.

**Table 2-2**

**Potential State and Tribal Action-Specific ARARs and TBCs  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| <b>Citation</b>                                    | <b>Requirement</b>  | <b>Prerequisite</b>  | <b>Standard</b>  | <b>Potential ARAR/TBC Evaluation</b>                     | <b>Comments</b>  |
|--|---|--|--|--|--|
| <b>State Environmental Laws</b>                    |   |  |  |  |  |
| Environmental Response and Liability Act           | Setting standards for potential remedial actions  | Release of hazardous substance(s) from a Minnesota facility requiring remedial decision                              | Minnesota Statute 115B.17 Subd 2a                                | Applicable   | Addresses setting PRGs based on planned use of property and HHERA              |
| Water Pollution Control Act                        | Administration and enforcement of laws relating to the pollution of any waters of the state.                            | Release of pollutants to Minnesota waters.   | Minnesota Statute 115  | Applicable   |  |
| Pollution Control Agency                           | Provides organizational structure and procedures for responding to problems relating to water, air, and land pollution. | Release of hazardous substance in Minnesota.   | Minnesota Statute 116  | Applicable   |  |
| Water Law  | Provides regulations pertaining to any waters of the state, including surface water, wetlands and groundwater.          | Release of pollutants to Minnesota waters or activities that affect bed, banks or cross section of Minnesota waters. | Minnesota Statute 103A, 103B, 103C, 103D, 103E; 103F, 103G, 103H | Applicable   |  |
| <b>Permits and Certifications</b>                  |   |  |  |  |  |
| Permits and certification for regulated activities | General requirements for obtaining MPCA permit for regulated activities.  | Work involving a regulated activity.   | Minn. Rules pts. 7001.0010 through 7001.0210                     | Applicable to regulated activities                       | Substantive permit requirements would need to be met for regulated activities. |
| Hazardous waste facility permit                    | Requirements for hazardous waste facility permit.   | Construction of a hazardous waste management facility in Minnesota.  | Minn. Rules pts. 7001.0500 through 7001.0730                     | Applicable to regulated activities                       | Substantive permit requirements would need to be met for regulated activities. |
| NPDES Permits                                      | Requirements for treatment and monitoring of discharges to waters of the state.   | Discharge of a pollutant to waters of the state.   | Minn. Rules pts. 7001.1000 through 7001.1150                     | Applicable to regulated activities                       | Substantive permit requirements would need to be met for regulated activities. |
| 401 Certifications                                 | Requirements for certification for regulated activities.  | Requirement to obtain certification by section 401 of the Clean Water Act.   | Minn. Rules pts. 7001.1400 through 7001.1470                     | Does not apply to OUs being evaluated in this FS report. |  |
| Solid Waste Management Facility                    | Requirements for permitting a soil waste management facility.   | Construction of a solid waste management facility in Minnesota   | Minn. Rules pts. 7001.3000 through 7001.3550                     | Applicable to regulated activities                       | Substantive permit requirements would need to be met for regulated activities. |

**Table 2-2**

**Potential State and Tribal Action-Specific ARARs and TBCs  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Citation  | Requirement  | Prerequisite  | Standard                                     | Potential ARAR/TBC Evaluation                              | Comments  |
|---|--|---|--|--|---|
| Hazardous Waste Regulations   |  |   |  |  |   |
| Onsite waste generation   | Waste generator shall determine if the waste is hazardous waste.             | Generation of waste.  | Minn. Rules pts. 7045.0102 through 7045.0155 | Applicable   | Applicable for any operation where waste would be generated. Testing shall be used to evaluate whether the excavated soil is a hazardous waste. It is anticipated that most of the excavated soil at the Site would not be a hazardous waste. |
| Generators of Hazardous Waste   | Generation of contaminated soils that are characterized as hazardous wastes. | Management of hazardous waste   | Minn. Rules pts. 7045.0205 through 7045.0325 | Applicable to contaminated soil that is a hazardous waste. | Applicable for any operation where hazardous waste would be generated.  |
| Transporters of Hazardous Waste   | Transportation of hazardous waste to off-site facilities.                    | Transportation of hazardous waste to off-site facilities  | Minn. Rules pts. 7045.0351 through 7045.0397 | Applicable to contaminated soil that is a hazardous waste. | Applicable for any operation where hazardous waste would be transported off-site.   |
| Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities                | Management of hazardous waste.   | Operations that include the management of hazardous waste.  | Minn. Rules pts. 7045.0450 through 7045.0551 | Applicable to contaminated soil that is a hazardous waste. | Applicable for any operation where hazardous waste would be treated, stored or disposed of. Only the substantive portions would be ARARs.   |
| Owners and Operators of Interim Status Hazardous Waste Treatment, Storage and Disposal Facilities | Management of hazardous waste at interim status facilities.                  | Operations that include the management of hazardous waste at interim status facilities.   | Minn. Rules pts. 7045.0552 through 7045.0649 | Applicable to contaminated soil that is a hazardous waste. | Minn. Rules pts 7045.0450 through 7045.0551 may supersede this regulation.  |
| Management of Specific Hazardous Waste and Specific Types of Facilities                           | Management of specific hazardous wastes                                      | Operations involving recyclable materials, reclamation of lead-acid batteries, hazardous waste burned in boilers and industrial furnaces, munitions, or spent or waste household batteries. | Minn. Rules pts. 7045.0652 through 7045.0686 | Does not apply to OUs being evaluated in this FS report.   | These regulations do not apply to contaminated soils at the site.   |

**Table 2-2**

**Potential State and Tribal Action-Specific ARARs and TBCs  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| <b>Citation</b>  | <b>Requirement</b>  | <b>Prerequisite</b>  | <b>Standard</b>                              | <b>Potential ARAR/TBC Evaluation</b>                       | <b>Comments</b>  |
|--|---|--|--|--|--|
| Management of Used Oil   | Management of used oil  | Operations involving management of used oil.                             | Minn. Rules pts. 7045.0692 through 7045.0990 | Does not apply to OUs being evaluated in this FS report.   | These regulations do not apply to contaminated soils at the site.  |
| County Regulation of Hazardous Waste Management                | Procedures for the MPCA's overview of county hazardous waste programs | MPCA approved county ordinance describing their Hazardous Waste Programs | Minn. Rules pts. 7045.1000 through 7045.1030 | Does not apply to OUs being evaluated in this FS report.   | Cass County does not have an MPCA approved county ordinance detailing their hazardous waste programs.  |
| Land Disposal Restrictions                                     | Restricts certain hazardous wastes from land disposal.                | Placement or disposal of soil that is a hazardous waste.                 | Minn. Rules pts. 7045.1390 through 7045.1400 | Applicable to contaminated soil that is a hazardous waste. | Applicable to any operation where hazardous waste is land disposed.  |
| <b>Solid Waste</b>   |   |  |  |  |  |
| General requirements for management of solid waste.            | Requirements and standards for solid waste                            | Generation of a solid waste  | Minn. Rules pts. 7035.0300 through 7035.0605 | Applicable to regulated activities                         | Solid waste requirements would be applicable for storage, transport and disposal of contaminated soils generated during remedial activities. |
| Individual Properties  | Responsibility for management of solid waste                          | Generation of solid waste  | Minn. Rules pts. 7035.0700 through 7035.0805 | Applicable to regulated activities                         | Solid waste requirements would be applicable for storage, transport and disposal of contaminated soils generated during remedial activities. |
| Industrial Solid Waste Land Disposal Facilities                | Requirements for industrial solid waste land disposal facilities      | Generation and management of an industrial solid waste                   | Minn. Rules pts. 7035.1590 through 7035.2500 | Applicable to regulated activities                         | Solid waste requirements would be applicable for storage, transport and disposal of contaminated soils generated during remedial activities. |
| Solid Waste Management Facility General Technical Requirements | Requirements for solid waste management facilities                    | Operations involving management of solid waste                           | Minn. Rules pts. 7035.2525 through 7035.2655 | Applicable to regulated activities                         | Solid waste requirements would be applicable for storage, transport and disposal of contaminated soils generated during remedial activities. |

**Table 2-2**

**Potential State and Tribal Action-Specific ARARs and TBCs  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| <b>Citation</b>   | <b>Requirement</b>  | <b>Prerequisite</b>  | <b>Standard</b>                              | <b>Potential ARAR/TBC Evaluation</b>                     | <b>Comments</b>  |
|---|---|--|--|--|--|
| Solid Waste Management Facilities Financial Requirements        | Requirements for cost estimates and financial assurances documentation  | Construction of a industrial solid waste land disposal facility      | Minn. Rules pts. 7035.2665 through 7035.2805 | Applicable to regulated activities                       | Solid waste requirements would be applicable for storage, transport and disposal of contaminated soils generated during remedial activities. |
| Solid Waste Management Facility Specific Technical Requirements | Requirements for facilities that dispose of mixed municipal solid waste in or on the land.  | Management of a mixed municipal waste landfill                       | Minn. Rules pts. 7035.2815 through 7035.2915 | Does not apply to OUs being evaluated in this FS report. | Soil remediation would not involve management of mixed municipal waste.  |
| Abandonment of motor vehicles and scrap metal                   | Requirement for disposal and reuse of abandoned motor vehicles and other scrap metal  | Disposal and reuse of abandoned motor vehicles and other scrap metal | Minn. Rules pts. 7035.3000 through 7035.3600 | Does not apply to OUs being evaluated in this FS report. | Soil remediation would not involve disposal or reuse of abandoned motor vehicles or scrap metal.   |
| Solid Waste Programs and Projects                               | Requirements for application procedure for grants-in-aid, state requirements, approval of applications, and payments for programs or projects which will encourage both the reduction of the amount of material entering the solid waste stream and the reuse and recycling of solid waste. | Plan for facility meeting requirements                               | Minn. Rules pts. 7035.4000 through 7035.6000 | Does not apply to OUs being evaluated in this FS report. | Soil remediation project would likely meet requirements.   |
| Infectious Waste  | Requirements for owners and operators of facilities, commercial transporters and all infectious waste.  | Generation and management of infectious waste                        | Minn. Rules pts. 7035.9100 through 7035.9150 | Does not apply to OUs being evaluated in this FS report. | Soil remediation would not involve infectious waste.   |

Table 2-2

Potential State and Tribal Action-Specific ARARs and TBCs  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN

| Citation   | Requirement  | Prerequisite  | Standard  | Potential ARAR/TBC Evaluation                            | Comments  |
|--|--|---|---|--|---|
| Disposal of Dioxin Contaminated Soil in Subtitle D Landfills | Provides conditions for disposal of dioxin contaminated soil in a Minnesota Subtitle D landfill. Dioxin-contaminated soil may be placed in a Minnesota "Subtitle D" facility if $TEQ_{DF} \leq 10 \mu\text{g}/\text{kg}$ . | Disposal of dioxin-contaminated soil in a MPCA-permitted Subtitle D landfill. | MPCA Office Memorandum to Remediation Division from Stephen Thompson and Elizabeth Gawrys. August 29, 2006            | TBC  | MPCA policy statement. None of the soils considered in the FS exceed the $10 \mu\text{g}/\text{kg}$ $TEQ_{DF}$ requirement. In addition, the MPCA concluded that: "If soils are not allowed to be disposed of in a Subtitle D Landfill, the only other viable option is to leave the contamination in place, which makes for more potential future human health exposure as compared to managing the soil in a landfill." |
| Risk-Based Site Evaluation (RBSE) Manual                     | Provides guidance outlining a risk-based approach to decision making.  | Contaminated site   | <a href="http://www.pca.state.mn.us/cleanup/riskbasedoc.html">http://www.pca.state.mn.us/cleanup/riskbasedoc.html</a> | TBC  | Considered for site investigation and remedy selection under the State's Voluntary Investigation and Cleanup (VIC) and Superfund Programs.  |
| Water Supply Regulations                                     |  |   |   |  |   |
| Plumbing Code  | State Plumbing Code (MDH)  | Use of public sewer and water systems and plumbing materials and methods      | Minn. Rules Ch. 4715  | Does not apply to OUs being evaluated in this FS report. | A plumbing connection would not be expected for the remedial activities.  |
| Public Water Resources                                       | Water appropriation permitting, standards and criteria for alterations to structure of public water (DNR).   | Plans to appropriate water or alter structure of public water                 | Minn. Rules Ch. 6115  | Applicable   | No plans to appropriate water. Substantive portions of this statute would be ARAR for the forested wetland.   |
| Wells and Borings  | Well and boring construction, use, maintenance, and sealing information (MDH)  | Water Well Code   | Minn. Rules Ch. 4725  | Does not apply to OUs being evaluated in this FS report. | Wells would not be installed or abandoned as part of remedial activities.   |
| Special Well and Boring Construction Areas                   | Allows for designation of special Well Construction Area (MDH)   | Conditions requiring Special Well Construction Area designation               | Minn. Rules pt. 4725.3650   | Applicable   | A special Well Construction Area could be designated as part of a remedial action.  |

**Table 2-2**

**Potential State and Tribal Action-Specific ARARs and TBCs  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| <b>Citation</b>                 | <b>Requirement</b>  | <b>Prerequisite</b>                                       | <b>Standard</b>                                       | <b>Potential ARAR/TBC Evaluation</b>                     | <b>Comments</b>   |
|---------------------------------|---|---|---|--|---|
| <b>Surface Water Quality</b>    |   |   |   |  |   |
| Water Pollution Control Act     | Regulates point source discharges to waters of the state.   | Point source discharges to waters of the state            | Minnesota Statute 115                                 | Applicable   | Surface runoff would be managed with a Storm Water Pollution Prevention Plan (SWPPP).   |
| Water of the State              | Classifies waters of the state and establishes standards  | Standards for Surface Waters                              | Minn. Rules Ch. 7050                                  | Applicable   | Surface runoff would be managed with a SWPPP.   |
| <b>Groundwater Quality</b>      |   |   |   |  |   |
| Underground Waters              | Nondegradation goal, prohibition of discharge to saturated zone, limitation on discharge to unsaturated zone, remediation requirements. | Discharges to underground waters                          | Minn. Rules Ch. 7060                                  | Applicable   | Best management practices would be applicable during remediation to prevent degradation of groundwater quality.                           |
| Groundwater use or contact      | Establishes human health based groundwater standards (MDH)  | Release of hazardous substances to drinking water aquifer | Minn. Rules pts. 4717.7500 and 4717.7801 to 4717.7900 | Not an ARAR for pathways of concern                      | Groundwater PRGs for utility worker safety established by HHERA (Integral, 2007 and 2008).  |
| <b>Air Quality</b>              |   |   |   |  |   |
| Air emissions                   | Duty to notify and abate excessive or abnormal unpermitted air emissions  | Abnormal unpermitted air emissions                        | Minnesota Statute 116.061                             | Applicable   | These regulations would be applicable in connection with activities that disturb soil and result in emissions during remedial activities. |
| Air emissions                   | Air quality rules   | Air emissions   | Minn. Rules Chs. 7005, 7007, 7017                     | Applicable   | These regulations would be applicable in connection with activities that disturb soil and result in emissions during remedial activities. |
| Emission Inventory Requirements | Standards of performance and emissions inventory  | Stationary emission source                                | Minn. Rules Chs. 7019                                 | Does not apply to OUs being evaluated in this FS report. | These regulations would be applicable to emissions from stationary sources and no stationary source is anticipated with remediation.      |
| Air emissions                   | Air emissions and waste management permits  | Requires permits for air emission sources                 | Minnesota Statute 116.081                             | Does not apply to OUs being evaluated in this FS report. | The remedial actions would not involve the construction or modification of air or waste treatment facilities.                             |

**Table 2-2**

**Potential State and Tribal Action-Specific ARARs and TBCs  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| <b>Citation</b>                                     | <b>Requirement</b>  | <b>Prerequisite</b>   | <b>Standard</b>   | <b>Potential ARAR/TBC Evaluation</b> | <b>Comments</b>  |
|---|---|---|---|--------------------------------------|--|
| Noise Pollution Control                             |   |   |   |                                      |  |
| Noise Pollution Control                             | Standards for noise generated during operations.                      | Generation of noise during site activities  | Minn. Rules Ch. 7030  | Applicable                           | May need a waiver of this requirement since operation of construction equipment would likely exceed noise standards.                       |
| Health and Safety                                   |   |   |   |                                      |  |
| Occupational Safety and Health Standards            | Standards for worker health, safety and training                      | Health and Safety   | Minn. Rules Ch. 5205  | Applicable                           | Requirements would be met for health and safety of workers.  |
| Property Use in Superfund Remedial Action Decisions |   |   |   |                                      |  |
| Property use  | Incorporating property use into cleanup decisions                     | Need for remedial action decision. Use of institutional controls as part of remedial actions. | MPCA Guidance on Incorporation of Planned Property Use into Site Decisions  | TBC                                  | Useful in setting PRGs based on HHERA and in defining the appropriate use of institutional controls.                                       |
| Risk-Based Site Evaluation (RBSE) Manual.           | Provides guidance outlining a risk-based approach to decision making. | Contaminated site   | <a href="http://www.pca.state.mn.us/cleanup/riskbaseddoc.html">http://www.pca.state.mn.us/cleanup/riskbaseddoc.html</a> | TBC                                  | Considered for site investigation and remedy selection under the State's Voluntary Investigation and Cleanup (VIC) and Superfund Programs. |

Table 2-3

Potential Federal Location-Specific ARARs and TBCs  
 Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN

| Citation  | Requirement  | Prerequisite   | Standard   | Potential ARAR /TBC Evaluation | Comments  |
|---|--|--|--|--------------------------------|---|
| National Archaeological and Historical Preservation Act of 1974, 16 USC 469       |  |  |  |                                |   |
| Within area where action may cause irreparable harm, loss, significant artifacts. | Construction on previously undisturbed land would require an archaeological survey to the area.  | Alteration of terrain that threatens significant scientific, prehistoric, historic, or archaeological data.        | Substantive requirements of 36 CFR 65, National Historic Landmarks Program.  | Potentially Applicable         | There are no known archaeological or historical sites located within the Site boundaries.<br><br>Measures would be taken to protect historical artifacts, if exposed during excavation activities.                      |
| Federal National Historic Preservation Act of 1966, 16 USC 470                    |  |  |  |                                |   |
| Historic project owned or controlled by federal agency.                           | Action to preserve historic properties; planning of action to minimize harm to properties listed on or eligible for listing or the National Register of Historic Places.   | Property included or eligible for the National Register of Historic Places.  | Substantive Requirements of 36 CFR 800, Protection of Historic Properties; 16 USC 470  | Potentially Applicable         | There are no known archaeological or historical sites located within the Site boundaries.<br><br>Measures would be taken to protect historical artifacts, if exposed during excavation activities.                      |
| Historical Sites, Buildings, and Antiquities Act of 1906, 16 USC 461-467          |  |  |  |                                |   |
| Historic sites  | Avoid undesirable impacts on landmarks.  | Areas designated as historic sites.  | 16 USC 461-467; 40 CFR 6.3, Requirements for Environmental Information Documents and Third-Party Agreement for EPA Actions Subject to NEPA   | Potentially Applicable         | There are no known archaeological or historical sites located within the Site boundaries.<br><br>Measures would be taken to protect historical artifacts, if exposed during excavation activities.                      |
| Endangered Species Act of 1973, as Amended, 16 USC 1531 et seq.                   |  |  |  |                                |   |
| Critical habitat upon which endangered species or threatened species depend.      | Action to conserve endangered species or threatened species, including consultation with the Department of the Interior. Reasonable mitigation and enhancement measures must be taken, including live propagation, transplanted and habitat acquisition and improvement. | Determination of effect upon endangered or threatened species or its habitat by conducting biological assessments. | 16 USC 1531; 16 USC 1536(a) 50 CFR 81, Conservation of Endangered and Threatened Species of Fish, Wildlife, and Plant – Cooperation with the States<br><br>50 CFR 402, Interagency Cooperation – Endangered Species Action of 1973, as amended | Applicable                     | Pale Moonwort has been reported in the vicinity of OU1/OU7, but there are no records of this or other endangered plant or animal species located on the portions of the Site where remedial actions would be conducted. |

Table 2-3

Potential Federal Location-Specific ARARs and TBCs  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN

| Citation  | Requirement  | Prerequisite   | Standard   | Potential ARAR /TBC Evaluation                                  | Comments   |
|---|--|--|--|---|--|
| National Environmental Protection Act of 1969, 42 USC 4321 et seq.  |  |  |  |   |  |
| Environmental Review Process  | Federal policy, goals and procedures for the protection, maintenance and enhancement of the U.S. environment.  |  | 42 USC 4321 et seq.<br>40 CFR 6  | Applicable  | The Superfund program was established consistent with NEPA.  |
| Migratory Bird Treaty Act of 1972, 16 USC 703   |  |  |  |   |  |
| Migratory bird area   | Protects almost all species of native birds in the U.S. from unregulated "take" which can include poisoning at contaminated sites.                               | Presence of migratory birds.   | 16 USC 703   | Applicable if ground nesting birds present in remediation area. | Construction activities would be limited to areas where it is unlikely that ground nesting birds would be affected. Survey of ground nesting birds will be completed prior to remediation. |
| Wilderness Act of 1964, 16 USC 1131 et seq.   |  |  |  |   |  |
| Wilderness Area   | Area must be administered in such a manner as will leave it unimpaired as wilderness and preserve its wilderness character.                                      | Federally-owned area designated as wilderness area.  | 16 USC 1131 et seq.;<br>50 CFR 35.1 et seq.                            | Not an ARAR   | Remedial actions are not planned in areas located in or adjacent to an area designated as part of the National Wildlife Refuge System.   |
| National Wildlife Refuge System Administration Act of 1966, 16 USC 668dd-668ee  |  |  |  |   |  |
| Wildlife Refuge   | Only actions allowed under the provisions of 16 USC Section 668 dd(c) may be undertaken in areas that are part of the National Wildlife Refuge System.           | Areas designated as part of National Wildlife Refuge System.   | 16 USC 668dd-668ee;<br>50 CFR 27                                       | Not an ARAR   | Remedial actions are not planned in areas located in or adjacent to an area designated as part of the National Wildlife Refuge System.   |
| Fish and Wildlife Coordination Act of 1936, as Amended, 16 USC 661-667e<br>Fish and Wildlife Improvement Act of 1978, 16 USC 742<br>Fish and Wildlife Conservation Act of 1980, 16 USC 2901 |  |  |  |   |  |
| Area affecting stream or other water body   | Provides protection for actions that would affect streams, wetlands, other water bodies or protected habitats. Any action taken should protect fish or wildlife. | Diversion, channeling or other activity that modifies a stream or other water body and affects fish or wildlife. | 16 USC 661;<br>16 USC 662<br>16 USC 742a;<br>16 USC 2901;<br>50 CFR 83 | Applicable  | Measures would be taken to protect water bodies that would be potentially affected.  |

Table 2-3

Potential Federal Location-Specific ARARs and TBCs  
 Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN

| Citation  | Requirement   | Prerequisite   | Standard  | Potential ARAR /TBC Evaluation | Comments  |
|---|---|--|---|--------------------------------|---|
| Procedures for Implementing Requirements of the Council on Environmental Quality on the National Environmental Policy Act and Executive Order 11990, Protection of Wetlands |   |  |   |                                |   |
| Wetland   | Action to minimize the destruction, loss, or degradation of wetlands. Wetlands of primary ecological significance must not be altered so that ecological systems in the wetlands are unreasonably disturbed.  | Wetlands as defined by Executive Order 11990 Section 7.  | 40 CFR 6, Appendix A excluding Sections 6(a)(2), 6(a)(4), 6(a)(6); 40 CFR 6.302 | Applicable                     | There is forested wetland adjacent to OU1.  |
| Upper Mississippi River Management, 33 USC 652  |   |  |   |                                |   |
| To ensure the coordinated development and enhancement of the Upper Mississippi River system.  | Cooperative effort and mutual assistance on the comprehensive planning of the use, protection, growth, and development of the Upper Mississippi River System  | Actions that may affect river reaches that have commercial navigation channels on the Mississippi River. | 33 USC 652  | Applicable                     | Water bodies adjacent to the Site are part of the Upper Mississippi River system. |
| Clean Water Act of 1977, Section 404  |   |  |   |                                |   |
| Wetland   | The degradation Section requires degradation or destruction of wetlands and other aquatic sites to be avoided to the extent possible.<br><br>Dredged or fill material must not be discharged to navigable waters if the activity contributes to the violation of Maryland water quality standards CWA Sec. 307; jeopardizes endangered or threatened species; or violates requirements of the Title III of the Marine Protection, Research and Sanctuaries Act of 1972. | Wetland as defined by Executive Order 11990 Section 7.   | 40 CFR 230.10; 40 CFR 231 231.1, 231.2, 231.7, 231.8)                           | Applicable                     | There is forested wetland adjacent to OU1.  |
| Wild and Scenic Rivers Act of 1968, 16 USC 1271 et seq.   |   |  |   |                                |   |
| Within area affecting national wild, scenic, or recreational rivers.  | Avoid taking or assisting in action that will have direct adverse effect on national, wild or scenic recreational rivers.   | Activities that affect or may affect any of the rivers specified in 16 USC 1276(a).                      | 16 USC 1271 et seq. and Section 7(a); 36 CFR 297; 40 CFR 6.302(e)               | Not an ARAR                    | There are no designated wild, scenic, or recreational areas within the Site.      |

Table 2-3

Potential Federal Location-Specific ARARs and TBCs  
 Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN

| Citation   | Requirement   | Prerequisite   | Standard  | Potential ARAR /TBC Evaluation | Comments  |
|--|---|--|---|--------------------------------|---|
| Coastal Zone Management Act of 1972, 16 USC 1451 et seq.   |   |  |   |                                |   |
| Within coastal zone  | Regulates activities affecting the coastal zone including lands thereunder and adjacent shoreline. The coastal zone is rich in a variety of natural commercial, recreational, ecological, industrial and aesthetic resources of immediate and potential value to the present and future well-being of the Nation. Must conduct activities in a manner consistent with the approved State management programs.   | Activities affecting the coastal zone including lands thereunder and adjacent shoreland. | Section 307(c) of 16 USC 1456(c); 16 USC 1451 et. seq.; 15 CFR 930; 15 CFR 923.45 | Not an ARAR                    | The Site is not located within a designated coastal zone. |
| Coastal Barrier Resources Act of 1982, 16 USC 3504 et seq. |   |  |   |                                |   |
| Within designated coastal barrier                          | Prohibits any new federal expenditure within the Coastal Barrier Resource System. A coastal barrier is defined as habitats providing habitats for migratory birds and other wildlife, habitats which are essential spawning, nursery, nesting, and feeding areas for commercially and recreationally important species of finfish and shellfish, as well as other aquatic organisms such as sea turtles; contain resources of extraordinary scenic, scientific, recreational natural, historic, archaeological, cultural and economic importance; serve as natural storm protective buffers and are generally unsuitable for development. | Activity within the Coastal Barrier Resource System                                      | 16 USC 3504   | Not an ARAR                    | The Site is not located within a designated coastal zone. |

Table 2-3

Potential Federal Location-Specific ARARs and TBCs  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN

| Citation   | Requirement  | Prerequisite   | Standard   | Potential ARAR /TBC Evaluation                           | Comments  |
|--|--|--|--|--|---|
| Navigation and Navigable Waters  |  |  |  |  |   |
| Navigable waters   | Establishes regulations pertaining to activities that affect the navigation of the waters of the United States.                  | Activities affecting navigable waters.   | 33 CFR 320-329<br>33 USC 1341  | Not an ARAR  | Response activities would not affect navigation of waters of the United States.   |
| Magnuson Fishery Conservation and Management Act of 1976, 16 USC 1801, et seq. |  |  |  |  |   |
| Managed Fisheries  | Provides for conservation and management of specified fisheries within specified fishery conservation zones (in federal waters). | Presence of managed fisheries in federal waters.   | 16 USC 1801, et seq.   | Not an ARAR  | Response activities would not affect fisheries.   |
| Hazardous Waste Control Act (HWCA)   |  |  |  |  |   |
| Within 61 meters (200 feet) of a fault displaced in Holocene time              | New treatment, storage or disposal of hazardous waste prohibited.  | Resource Conservation and Recovery Act (RCRA) hazardous waste; treatment, storage or disposal of hazardous waste                                   | 40 CFR 264.18 (a)  | Not an ARAR  | Wastes generated at the Site would be disposed of at a permitted disposal facility. The Site is not known to be within 61 meters of a fault displaced in the Holocene time. |
| Within 100-year floodplain   | Facility must be designed, constructed, operated, and maintained to avoid washout.   | RCRA hazardous waste; treatment, storage, or disposal of hazardous waste.  | 40 CFR 264.18(b)   | Does not apply to OUs being evaluated in this FS report. | Wastes generated at the Site would not be disposed of within a 100-year floodplain.   |
| Within salt dome formation, underground mine, or cave                          | Placement of noncontainerized or bulk liquid hazardous waste prohibited.   | RCRA hazardous waste placement.  | 40 CFR 264.18(c)   | Not an ARAR  | Wastes generated at the Site would be disposed of at a permitted disposal facility. The Site is not located within a salt dome, underground mine, or cave.                  |
| Executive Order 11988, Protection of Floodplains                               |  |  |  |  |   |
| Within floodplain  | Actions taken should avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial values.         | Action that will occur in a floodplain, i.e., lowlands, and relatively flat areas adjoining inland and coastal waters and other flood-prone areas. | 40 CFR 6, Appendix A; excluding Sections 6(a)(2), 6(a)(4), 6(a)(6); 40 CFR 6.302 | Does not apply to OUs being evaluated in this FS report. | While portions of the Site may be within a designated floodplain, the OUs included in this proposed action are not within a designated floodplain.                          |
| Rivers and Harbors Act of 1972, 33 USC 403                                     |  |  |  |  |   |
| Navigable waters   | Permits are required for structures or work affecting navigable waters.  | Activities affecting navigable waters.   | 33 USC 403   | Not an ARAR  | Response activities would not affect navigable waters.  |

**Table 2-4**

**Potential State, Tribal and Local Location-Specific ARARs and TBCs  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Citation  | Requirement  | Prerequisite  | Standard                              | Potential ARAR/TBC Evaluation | Comments   |
|---|--|---|---------------------------------------|-------------------------------|--|
| <b>Endangered Species</b>                       |  |   |                                       |                               |  |
| Endangered, Threatened, Special Concern Species | Protection of endangered species (DNR)   | Endangered, threatened or special concern species                     | Minn. Rules Ch. 6134                  | Applicable                    | Pale Moonwort has been reported in the vicinity of OU1/OU7, but there are no records of this or other endangered plant or animal species located on the portions of the Site that would be remediated. |
| <b>Protected Waters/Water Appropriation</b>     |  |   |                                       |                               |  |
| Public Water Resources                          | Classifies lakes and wetlands, appropriation permitting (DNR)                              | Protected Waters/Water Appropriation                                  | Minn. Rules Ch. 6115                  | Applicable                    | Surface water bodies would be protected during remedial action.  |
| Shoreland and Floodplain Management             | Shoreland alterations or structures (DNR)  | Shoreland Management  | Minn. Rules Ch. 6120                  | Applicable                    | Surface water bodies would be protected during remedial action.  |
| <b>Wetlands Conservation Act</b>                |  |   |                                       |                               |  |
| Wetlands  | Protection of wetlands   | Presence of wetlands  | Minnesota Statute 103G.221-2373       | Applicable                    | There is forested wetland adjacent to OU1.   |
| Wetland Conservation                            | Protection of wetlands, wetland functions for determining public values.                   |   | Minn. Rules 8420                      | Applicable                    | There is forested wetland adjacent to OU1.   |
| <b>State Advisories</b>                         |  |   |                                       |                               |  |
| Fish Consumption Advisories                     | Consumption guidelines for lakes and rivers where fish have been tested for contaminants.  | Advisories established by Minnesota Department of Health              | Fish Consumption Advice (MDH Website) | TBC                           | Fish consumption advisories have been established for Cass Lake and Pike Bay but are not applicable or relevant to remedial actions.   |
| <b>LLBO Ordinances</b>                          |  |   |                                       |                               |  |
| Property Acquisition                            | Property being sold  | Property for sale   | LLBO Property Reacquisition Policy    | Potential ARAR/TBC            | Applicable to property to be placed into Trust with the U.S. Site is not being considered for placement in a Trust.  |
| Hazardous Substances in Environmental Media     | Limits concentrations of hazardous substances allowed in various media on tribal property. | Hazardous substance present in environmental media on tribal property | LLBO Hazardous Substances Control Act | Potential ARAR/TBC            | Considered in development of soil PRGs.  |

**Table 2-4**

**Potential State, Tribal and Local Location-Specific ARARs and TBCs  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| <b>Citation</b>                     | <b>Requirement</b>   | <b>Prerequisite</b>                                | <b>Standard</b>                          | <b>Potential ARAR/TBC Evaluation</b> | <b>Comments</b>   |
|-------------------------------------|--|--|--|--------------------------------------|---|
| <b>Cass County Ordinances</b>       |  |  |  |                                      |   |
| Cass County Wetland Ordinance       | Protection of wetlands   | Project potentially impacts designated wetlands    | Cass County Ordinance No. 1997-03        | Applicable                           | Applies to draining or filling of wetlands. There is forested wetland adjacent to OU1.  |
| Cass County Land Use Ordinance      | Protection of public waters and shorelands of the Mississippi River and Headwaters Lakes it flows through; preservation and protection of waters and related land resources. | Land development in Cass County.                   | Cass County Ordinance No 2005-01         | Applicable                           | Applies to all unincorporated areas of Cass County, Minnesota and incorporated areas by agreement, pursuant to Minnesota Statutes, Chapter 394.32 |
| <b>City of Cass Lake Ordinances</b> |  |  |  |                                      |   |
| Zoning Ordinance                    | Restricts use of property that is inconsistent with the City's designated uses.  | Land development in Cass Lake                      | City of Cass Lake Ordinance, Chapter 118 | Applicable within City of Cass Lake  | Designates land use classifications for the City of Cass Lake – would apply to development on site.   |
| Connection to City Water Service    | All residences must be connected to the City water service.  | Resident of Cass Lake                              | City of Cass Lake Ordinance, Chapter 50  | Applicable within City of Cass Lake  | Would apply to future development on site.  |
| Prohibition on Wells                | Prohibition on water wells in the area south of BNSF railroad tracks and east of Highway 371 in Cass Lake.   | Desire to place a new water well in regulated area | City of Cass Lake Ordinance, Chapter 50. | Applicable within City of Cass Lake  | Prohibits wells in the area of the site.  |

Table 2-5

Potential Federal, State and Tribal Chemical-Specific ARARs and TBCs  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN

| Citation   | Requirement   | Prerequisite  | Standard  | Potential ARAR/TBC Evaluation                            | Comments   |
|--|---|---|---|--|--|
| Soil   |   |   |   |  |  |
| Addressing dioxin in soil at CERCLA and RCRA sites.                              | Recommend preliminary PRGs of starting points for cleanup levels at CERCLA and RCRA sites.    | CERCLA/RCRA site with dioxin contamination.   | OSWER Directive 9200.4-26, April 13, 1998   | Potential ARAR/TBC                                       | Considered in development of PRGs.   |
| Hazardous Substances in Environmental Media                                      | Limits concentrations of hazardous substances allowed in various media on tribal property.    | Hazardous substance present in environmental media on tribal property   | LLBO Hazardous Substances Control Act   | Potential ARAR/TBC                                       | Considered in development of soil PRGs.  |
| Evaluating human health risk caused by exposure to contaminated soil.            | Tier 1 and Tier 2 Soil Reference Values (SRVs)  | Incidental soil ingestion, dermal contact with soil, and inhalation of outdoor vapors and particulates from soil. | Risk-Based Guidance for the Soil – Human Health Pathway, MPCA Risk-Based Site Evaluation Manual<br><a href="http://www.mn.state.mn.us/cleanup/riskbasedoc.html">http://www.mn.state.mn.us/cleanup/riskbasedoc.html</a>      | TBC  | Considered in development of risk-based soil PRGs – superseded by PRGs from site-specific HHERA (Integral, 2007 and 2008), which corresponds to a Tier 3 (Detailed Site-Specific) Risk Characterization. |
| Evaluating the risk to groundwater at sites form the soil-to-groundwater pathway | Tier 1 and Tier 2 Soil Leaching Values (SLVs)   | Contaminants leaching to groundwater and potential exposure to groundwater.                                       | Risk-Based Guidance for Evaluating the Soil Leaching Pathway, MPCA Risk-Based Site Evaluation Manual<br><a href="http://www.mn.state.mn.us/cleanup/riskbasedoc.html">http://www.mn.state.mn.us/cleanup/riskbasedoc.html</a> | TBC  | Considered in development of risk-based soil PRGs.   |
| Groundwater  |   |   |   |  |  |
| Groundwater, public water supplies   | Meet National Primary Standards for maximum contaminant levels (MCLs)                         | Drinking water source at tap  | Safe Drinking Water Act (SDWA); 40 CFR 141<br>40 CFR 142<br>40 CFR 143  | Does not apply to OUs being evaluated in this FS report. | Groundwater investigation and remediation underway under U.S. EPA Consent Order.   |
| Hazardous substances in groundwater  | Establishes human health based groundwater standards (MDH) known as Health Risk Limits (HRLs) | Potential exposure to groundwater   | Minn. Rules pts. 4717.7500 and 4717.7801 to 4717.7900   | Does not apply to OUs being evaluated in this FS report. | Groundwater investigation and remediation underway under U.S. EPA Consent Order.   |

Table 2-5

Potential Federal, State and Tribal Chemical-Specific ARARs and TBCs  
 Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN

| Citation                            | Requirement  | Prerequisite  | Standard  | Potential ARAR/TBC Evaluation                            | Comments   |
|-------------------------------------|--|---|---|--|--|
| Hazardous substances in groundwater | Framework for evaluating groundwater contamination and managing remediation decisions.                           | Use of groundwater for domestic purposes.               | Groundwater Guidance Document, MPCA Risk-Based Site Evaluation Manual<br><br>Drinking Water Criteria Spreadsheet (rev. 9/08)<br><a href="http://www.mn.state.mn.us/cleanup/riskbasedoc.html">http://www.mn.state.mn.us/cleanup/riskbasedoc.html</a> | Does not apply to OUs being evaluated in this FS report. | Groundwater investigation and remediation underway under U.S. EPA Consent Order.                 |
| Surface Water                       |  |   |   |  |  |
| Surface Water                       | Ambient Water Quality Criteria established to protect aquatic life and human consumers of water or aquatic life. | Activities that affect or may affect surface water.     | 40 CFR 131, Water Quality Standards   | Applicable   | Remedial actions need to protect surface waters.   |
| Surface Water Screening Criteria    | Establishes human health-based and ecological surface water criteria   | Activities that affect or may affect the surface water. | Surface Water Pathway Evaluation User's Guide, Tables 1 and 11, MPCA Risk-based Site Evaluation Manual<br><br><a href="http://www.mn.state.mn.us/cleanup/riskbasedoc.html">http://www.mn.state.mn.us/cleanup/riskbasedoc.html</a>                   | TBC  | Considered in development of alternatives. Remedial actions need to protect surface water.       |
| Air                                 |  |   |   |  |  |
| Ambient Air Quality Standards       | Establishes acceptable air concentrations  | Activity affects air quality.                           | Minn. Rules Ch. 7009  | Applicable   | Applies to site activities.  |
| Standards for Stationary Sources    | Compliance with applicable state air pollution control rules for new and existing emission facilities            | Emission from stationary sources.                       | Minn. Rules Ch. 7011 (except pts 7011.0150 and 7011.8010)   | Does not apply to OUs being evaluated in this FS report. | No emission facilities are planned at the Site.  |
| Standards for Stationary Sources    | Limits on visible emissions beyond the property boundary.  | Activities that generate fugitive dust.                 | Minn. Rules pt. 7011.0150   | Applicable   | Implement reasonable measures as necessary to prevent particulate matter from becoming airborne. |

Table 2-5

Potential Federal, State and Tribal Chemical-Specific ARARs and TBCs  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN

| Citation   | Requirement  | Prerequisite   | Standard   | Potential ARAR/TBC Evaluation | Comments   |
|--|--|--|--|-------------------------------|--|
| Standards for Hazardous Air Pollutants: Site Remediation | Establishes emissions limitations and work practice standards for hazardous air pollutants emitted from site remediation activities. | Emission of hazardous air pollutant.                           | Minn. Rules pts. 7011.8010, adopts 40 CFR 63 Subpart GGGGG, by reference   | Not an ARAR                   | Site remediation in not subject to this subpart since the site remediation will be performed under the authority of CERCLA (See 40 CFR 63.7881 (b) (2)). |
| Intrusion Screening Values (ISV) (September 24, 2008)    | For evaluating the potential risks to human health caused by exposure to volatile compounds in buildings                             | Presence of volatile compounds in soil or shallow groundwater. | Risk-Based Guidance for the Vapor Intrusion Pathway, MPCA Risk-Based Site Evaluation Manual<br><a href="http://www.mn.state.mn.us/cleanup/riskbasedoc.html">http://www.mn.state.mn.us/cleanup/riskbasedoc.html</a>         | TBC                           | Pathway evaluated in HHERA. No unacceptable risks identified.  |
| All Media  |  |  |  |                               |  |
| Carcinogenic PAHs in media                               | Estimating health risks from carcinogenic PAHs.  | Potential PAH exposure to humans                               | MDH guidance Document, July 2, 2004.   | TBC                           | Considered in development of risk-based soil PRGs and site-specific HHERA (Integral, 2007 and 2008).   |
| Dioxin-like compounds in media                           | Estimating health risks from dioxin- like compounds.   | Potential dioxin-like compound exposure to humans              | MDH Guidance Document October 2006.  | TBC                           | Considered in development of risk-based soil PRGs and site-specific HHERA (Integral, 2007 and 2008).   |
| Hazardous substances in media                            | Guidelines and criteria for screening human health and ecological risks.   | Potential hazardous substance exposure to humans and ecology   | April 26, 1996 Working Site Screening Evaluation Guidelines. MPCA Risk-Based Site Evaluation Manual<br><a href="http://www.mn.state.mn.us/cleanup/riskbasedoc.html">http://www.mn.state.mn.us/cleanup/riskbasedoc.html</a> | TBC                           | Considered in development of risk-based soil PRGs – and site-specific HHERA (Integral, 2007 and 2008).   |
| Certification of Environmental Laboratories              | Laboratory accreditation requirements for the State of Minnesota (MDH).  | Requirement that analyses be conducted by a certified lab.     | Minnesota Statute 144.97 through 144.98<br>Minn. Rules Ch. 4740<br>Minn. Rules pts. 4740.2010 through 4740.2040  | Applicable                    | Laboratories that provide services for this project would be accredited for the appropriate testing methods.   |

**Table 2-6  
Preliminary Remediation Goals for Chemicals of Concern and Chemicals of Ecological Concern  
Revised Final Feasibility Study, St. Regis Paper Company Site - Cass Lake, MN**

| Location,<br>Environmental<br>Medium, and Exposure<br>Scenario | Site-Specific Remedial Action<br>Objective   | Preliminary Remediation Goals (PRGs) for COCs/COECs |                                 |                                  |      |             |     |
|--|--|---|---------------------------------|----------------------------------|------|-------------|-----|
|  |  | Basis/Source  | Dioxin TEQ <sub>DF</sub>        | BaP <sub>e</sub>                 | HPAH | Naphthalene | PCP |
| OU1 Soil   | Prevent unacceptable potential risk to human health from future exposure to Site-related COCs in OU1 soil through ingestion of soil and garden produce, inhalation of soil and indoor dust and dermal adsorption routes of exposure at residential properties in OU1 with possible future residential land use.<br><br>Prevent the potential for the future transfer of Site-related COCs in OU1 surface soil to present an unacceptable risk to human health through runoff and/or windblown dust to nearby residential property and roads. | 1 x 10 <sup>-4</sup> cancer risk                    | 630 ng/kg                       | 8 mg/kg                          | --   | --          | --  |
|  |  | 1 x 10 <sup>-5</sup> cancer risk                    | 63 ng/kg                        | 0.8 mg/kg<br>(Below Background)  | --   | --          | --  |
|  |  | 1 x 10 <sup>-6</sup> cancer risk                    | 6.3 ng/kg<br>(Below Background) | 0.08 mg/kg<br>(Below Background) | --   | --          | --  |
|  |  | HI = 1  | 190 ng/kg                       | N/A                              | --   | --          | --  |
|  |  | U.S. EPA (2009)<br>interim draft dioxin<br>PRGs     | 72 ng/kg                        | N/A                              | --   | --          | --  |
|  |  | HSCA  | 10 ng/kg                        | N/A                              | --   | --          | --  |
|  |  | Background  | 7.5 ng/kg                       | 1.6 mg/kg                        | --   | --          | --  |
| Industrial/Commercial  | Prevent unacceptable potential risk to human health from future exposure to Site-related COCs in OU1 soil through ingestion, inhalation of soil and indoor dust and dermal adsorption routes of exposure with industrial/commercial land.  | 1 x 10 <sup>-4</sup> cancer risk                    | 3,800 ng/kg                     | 41 mg/kg                         | --   | --          | --  |
|  |  | 1 x 10 <sup>-5</sup> cancer risk                    | 380 ng/kg                       | 4.1 mg/kg                        | --   | --          | --  |
|  |  | 1 x 10 <sup>-6</sup> cancer risk                    | 38 ng/kg                        | 0.41 mg/kg<br>(Below Background) | --   | --          | --  |
|  |  | HI = 1  | 2,000 ng/kg                     | N/A                              | --   | --          | --  |
|  |  | U.S. EPA (2009)<br>interim draft dioxin             | 950 ng/kg                       | N/A                              | --   | --          | --  |
|  |  | HSCA  | 10 ng/kg                        | N/A                              | --   | --          | --  |
|  |  | Background  | 7.5 ng/kg                       | 1.6 mg/kg                        | --   | --          | --  |

**Table 2-6  
Preliminary Remediation Goals for Chemicals of Concern and Chemicals of Ecological Concern  
Revised Final Feasibility Study, St. Regis Paper Company Site - Cass Lake, MN**

| Location,<br>Environmental<br>Medium, and Exposure<br>Scenario | Site-Specific Remedial Action<br>Objective   | Preliminary Remediation Goals (PRGs) for COCs/COECs |                          |                  |                                 |   |                |
|--|--|---|--------------------------|------------------|---------------------------------|---|----------------|
|  |  | Basis/Source  | Dioxin TEQ <sub>DF</sub> | BaP <sub>e</sub> | HPAH                            | Naphthalene   | PCP            |
| <b>OU1 Groundwater</b>   |  |   |                          |                  |                                 |   |                |
| Below-Ground Utility<br>Worker Exposure to<br>Groundwater      | Potential future exposure to Site-related COCs in OU1 groundwater through ingestion, inhalation and dermal adsorption routes of exposure if an unprotected construction worker encounters contaminated groundwater in the former operations area.    | HI = 1  | --                       | --               | --                              | Naphthalene + Pentachlorophenol HI ≤ 1<br>See Appendix C for Derivation |                |
| <b>OU2 Soil</b>  |  |   |                          |                  |                                 |   |                |
| Ecological Receptors   | Prevent unacceptable risks to organisms from exposure to Site-related COECs in OU2 soil.   | EcoSSL (soil invertebrates)                         | --                       | --               | 18 mg/kg                        | --  | 31 mg/kg       |
|  |  | EcoSSL (avian)                                      | --                       | --               | --                              | --  | 2.1 mg/kg      |
|  |  | EcoSSL (mammalian meadow vole)                      | --                       | --               | 39 mg/kg                        | --  | 16 mg/kg       |
|  |  | EcoSSL (mammalian shrew)                            | --                       | --               | 1.1 mg/kg<br>(Below Background) | --  | 2.8 mg/kg      |
|  |  | Background  | --                       | --               | 3.7 mg/kg                       | --  | not calculated |
| Industrial/Commercial  | Prevent unacceptable potential risk to human health from future exposure to Site-related COCs in OU2 soil through ingestion, inhalation of soil and indoor dust and dermal adsorption routes of exposure with future industrial/commercial land use. | See OU1 Soil - Industrial/Commercial                |                          |                  |                                 |   |                |

**Table 2-6  
Preliminary Remediation Goals for Chemicals of Concern and Chemicals of Ecological Concern  
Revised Final Feasibility Study, St. Regis Paper Company Site - Cass Lake, MN**

| Location,<br>Environmental<br>Medium, and Exposure<br>Scenario | Site-Specific Remedial Action<br>Objective   | Preliminary Remediation Goals (PRGs) for COCs/COECs |                          |                  |      |             |     |
|--|--|---|--------------------------|------------------|------|-------------|-----|
|  |  | Basis/Source  | Dioxin TEQ <sub>DF</sub> | BaP <sub>e</sub> | HPAH | Naphthalene | PCP |
| <b>OU3 Soil</b>  |  |   |                          |                  |      |             |     |
| Industrial/Commercial  | Prevent unacceptable potential risk to human health from future exposure to Site-related COCs in OU3 soil through ingestion, inhalation of soil and indoor dust and dermal adsorption routes of exposure with future industrial/commercial land use.           | See OU1 Soil - Industrial/Commercial                |                          |                  |      |             |     |
| <b>OU7 Soil</b>  |  |   |                          |                  |      |             |     |
| Residential  | Prevent unacceptable potential risk to human health from future exposure to Site-related COCs in OU7 soil through ingestion of soil and garden produce, inhalation of soil and indoor dust and dermal adsorption routes of exposure at residential properties. | See OU1 Soil - Future Residential                   |                          |                  |      |             |     |

Notes

"N/A": Not Applicable

"--": Not a COC/COEC for this operable unit, environmental medium, and exposure scenario

Background concentrations calculated as explained in Section 2.4.1 and Appendix B.

Table 2-7

PRG Levels Evaluated in the Detailed Analysis of Remedial Alternatives  
 Revised Final Feasibility Study, St. Regis Paper Company Site - Cass Lake, MN

| PRG Level                                       | Residential PRGs (PRGs-R)                |   |                                      | Commercial/Industrial PRGs (PRGs-I/C)     |   |                                      |
|---|--|---|--------------------------------------|---|---|--------------------------------------|
|   | TEQDF<br>[ng/kg]                         | BaPE-adj<br>[mg/kg]                                 | Cum. CR <sup>(1)</sup><br>[unitless] | TEQDF<br>[ng/kg]                          | BaPE-adj<br>[mg/kg]                       | Cum. CR <sup>(1)</sup><br>[unitless] |
| Level 1   | 10<br>[HSCA]                             | 1.6 mg/kg<br>[Background-unadjusted] <sup>(2)</sup> | Not Used                             | Not Used                                  | Not Used                                  | Not Used                             |
| Level 2   | 63<br>[1 x 10 <sup>-5</sup> cancer risk] | 1.6 mg/kg<br>[Background-unadjusted] <sup>(2)</sup> | 1.E-05                               | 380<br>[1 x 10 <sup>-5</sup> cancer risk] | 4.1<br>[1 x 10 <sup>-5</sup> cancer risk] | 1.E-05                               |
| Level 3   | 190<br>[HI = 1]                          | 8.1<br>[1 x 10 <sup>-4</sup> cancer risk]           | 1.E-04                               | 2,000<br>[HI = 1]                         | 41<br>[1 x 10 <sup>-4</sup> cancer risk]  | 1.E-04                               |
|   | <b>HPAHs</b><br>[mg/kg]                  | <b>PCP</b><br>[mg/kg]                               |                                      |   |   |                                      |
| Eco-Risk - Invertebrates<br>(Detailed Analysis) | 18<br>[EcoSSL - invertebrates]           | 31<br>[EcoSSL - invertebrates]                      |                                      |   |   |                                      |
| Eco-Risk - Lowest<br>(Sensitivity Analysis)     | 3.7<br>[Background] <sup>(2)</sup>       | 2.8<br>[EcoSSL - avian]                             |                                      |   |   |                                      |

<sup>(1)</sup> Cumulative cancer risk was calculated by summing the cancer risk for TEQDF and BaPE-adj. BaPE-adj = BaPE x 2.3.

<sup>(2)</sup> Background concentration calculations explained in Section 2.4.1 and Appendix B.

Table 3-1

Properties Moved In and Out of OU1 and OU7 Boundaries For Purpose of Feasibility Study  
 Revised Final Feasibility Study, St. Regis Paper Company Site - Cass Lake, MN

| Property ID  | Legal Description   |
|--|---|
| <b>Properties recategorized into OU7 (zoned residential in OU1)</b>        |   |
| Allen-C  | West Cass Lake, Lots 1 thru 6, Block 19   |
| RES-8  | Original Plat, Lots 1 thru 10, Block 22 and N1/2 of adj vac alley & E1/2 of adj vac 1ST ave W, O P  |
| RES-20   | Original Plat, Lots 13 thru 15, Block 22 and N1/2 of adj vac. Alley O P and Original Plat, Lots 11 thru 12, Block 22 and S1/2 of adj vac. Alley O P |
|  | West Cass Lake, Lots 1 thru 24, Block 17  |
|  | Original Plat, Lots 1 thru 23, Block 17   |
| <b>Property categorized into OU7 at direction of U.S. EPA</b>              |   |
| DRM Site   | Parcels 29-016-4104, 29-01604105  |
| <b>Properties recategorized into OU1 (commercial property owned by IP)</b> |   |
| RES-37   | West Cass Lake, Lots 6 thru 12, Block 27  |
| RES-38   | West Cass Lake, Lots 14 thru 17, Block 22   |

**Table 3-2  
Estimated Contaminated Soil Areas and Volumes Associated with Preliminary Remediation Goals and Remedial Action Objectives  
Final Feasibility Study, St. Regis Paper Company Site - Cass Lake, MN**

| Environmental Media and Location | Site-Specific Remedial Action Objective   | Preliminary Remediation Goals                      |                                      |                                     |                                      |                                     |                                      |                                     |                                      |                                     |                                      | Characteristics   |
|----------------------------------|---|--|--------------------------------------|-------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------|---|
|                                  |   | Level 1 PRGs-R                                     |                                      | Level 2 – PRGs-R                    |                                      | Level 3 PRGs-R                      |                                      | Level 2 - PRGs-I/C                  |                                      | Level 3 - PRGs-I/C                  |                                      |   |
| OU1                              |   | Estimated Area <sup>1</sup> (Acres)                | Estimated Volume <sup>1,2</sup> (CY) | Estimated Area <sup>1</sup> (Acres) | Estimated Volume <sup>1,2</sup> (CY) | Estimated Area <sup>1</sup> (Acres) | Estimated Volume <sup>1,2</sup> (CY) | Estimated Area <sup>1</sup> (Acres) | Estimated Volume <sup>1,2</sup> (CY) | Estimated Area <sup>1</sup> (Acres) | Estimated Volume <sup>1,2</sup> (CY) |   |
| Soil                             | Prevent unacceptable potential risk to human health from future exposure to Site-related COCs in OU1 soil through ingestion of soil and garden produce, inhalation of soil and indoor dust and dermal adsorption routes of exposure at residential properties in OU with possible future residential land use.<br><br>Prevent the potential for the future transfer of Site-related COCs in OU1 surface soil to present an unacceptable risk to human health through runoff and/or windblown dust to nearby residential property and roads. | 100  | 785,000                              | 72                                  | 491,000                              | 50                                  | 270,000 (Not used)                   |                                     |                                      |                                     |                                      | Sandy soil with dioxin concentrations in shallow soil ranging from 0.78 to 2,700 ng/kg TEQDF and BaPE concentrations ranging from 0.027 to 1,400 mg/kg. Remediation will need to work around a few buildings. |
| Soil                             | Prevent unacceptable potential risk to human health from future exposure to Site-related COCs in OU1 soil through ingestion, inhalation of soil and indoor dust and dermal adsorption routes of exposure with industrial/commercial land use in the former operations area.   |  |                                      |                                     |                                      |                                     |                                      | 38                                  | 153,000 (Not used)                   | 4                                   | 6,500 (Not used)                     | Sandy soil with dioxin concentrations in shallow soil ranging from 0.78 to 2,700 ng/kg TEQDF and BaPE concentrations ranging from 0.027 to 1,400 mg/kg. Remediation will need to work around a few buildings. |
|                                  |   | Area Shown on Figure 3-6<br>Estimated Area (Acres) |                                      |                                     |                                      |                                     |                                      |                                     |                                      |                                     |                                      |   |
| Groundwater                      | Potential future exposure to Site-related COCs in OU1 groundwater through ingestion, inhalation and dermal adsorption routes of exposure if an unprotected construction worker encounters contaminated groundwater in the former operations area.   | 24   |                                      |                                     |                                      |                                     |                                      |                                     |                                      |                                     |                                      | Groundwater depth varies from 5 feet to 15 feet in sandy soil - area contains wells, piping, electrical associated with groundwater remediation system.   |

**Table 3-2**  
**Estimated Contaminated Soil Areas and Volumes Associated with Preliminary Remediation Goals and Remedial Action Objectives**  
**Final Feasibility Study, St. Regis Paper Company Site - Cass Lake, MN**

| Environmental Media and Location | Site-Specific Remedial Action Objective   | Preliminary Remediation Goals       |                                      |                                     |                                      |                                     |                                      |                                     |                                      |                                     |                                      | Characteristics   |
|----------------------------------|---|-------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------|---|
|                                  |   | Level 1 PRGs-R                      |                                      | Level 2 – PRGs-R                    |                                      | Level 3 PRGs-R                      |                                      | Level 2 - PRGs-I/C                  |                                      | Level 3 - PRGs-I/C                  |                                      |   |
| OU2                              |   | Estimated Area <sup>1</sup> (Acres) | Estimated Volume <sup>1,2</sup> (CY) | Estimated Area <sup>1</sup> (Acres) | Estimated Volume <sup>1,2</sup> (CY) | Estimated Area <sup>1</sup> (Acres) | Estimated Volume <sup>1,2</sup> (CY) | Estimated Area <sup>1</sup> (Acres) | Estimated Volume <sup>1,2</sup> (CY) | Estimated Area <sup>1</sup> (Acres) | Estimated Volume <sup>1,2</sup> (CY) |   |
| Soil                             | Prevent unacceptable potential risk to human health from future exposure to Site-related COCs in OU2 soil through ingestion of soil and garden produce, inhalation of soil and indoor dust and dermal adsorption routes of exposure at potential future residential properties. Applicable to residential or potential residential properties but shown for entire OU2 to provide areas and volumes used in Final FS Report | 20                                  | 123,100                              | 11                                  | 37,000                               | 4.6                                 | 11,000 (Not used)                    |                                     |                                      |                                     |                                      | Sandy soil with dioxin concentrations in shallow soil ranging from 0.78 to 2,700 ng/kg TEQDF and BaPe concentrations ranging from 0.027 to 1,400 mg/kg. Remediation will need to work around a few buildings. |
|                                  |   |                                     |                                      |                                     |                                      |                                     |                                      |                                     |                                      |                                     |                                      |   |
|                                  | Prevent unacceptable potential risk to human health from future exposure to Site-related COCs in OU2 soil through ingestion, inhalation of soil and indoor dust and dermal adsorption routes of exposure with future industrial/commercial land use.  |                                     |                                      |                                     |                                      |                                     |                                      | 5.2                                 | 11,800 (Not used)                    | 0                                   | 0                                    | Sandy soil with dioxin concentrations in shallow soil ranging from 0.78 to 2,700 ng/kg TEQDF and BaPe concentrations ranging from 0.027 to 1,400 mg/kg. Remediation will need to work around a few buildings. |
|                                  |   |                                     |                                      |                                     |                                      |                                     |                                      |                                     |                                      |                                     |                                      |   |
|                                  |   | Eco-PRGs - Invertebrates            |                                      | Eco-PRGs - Lowest                   |                                      |                                     |                                      |                                     |                                      |                                     |                                      |   |
|                                  |   | Estimated Area <sup>1</sup> (Acres) | Estimated Volume <sup>1,2</sup> (CY) | Estimated Area <sup>1</sup> (Acres) | Estimated Volume <sup>1,2</sup> (CY) |                                     |                                      |                                     |                                      |                                     |                                      |   |
|                                  | Prevent unacceptable risks to organisms from exposure to Site-related COECs in OU2 soil.  | 2.1                                 | 10,300                               | 8.4                                 | 41,000                               |                                     |                                      |                                     |                                      |                                     |                                      | Sandy soil with PCP concentrations up to 160 mg/kg and PAH concentrations of up to 320 mg/kg. Area is forested in pine.   |

**Table 3-2  
Estimated Contaminated Soil Areas and Volumes Associated with Preliminary Remediation Goals and Remedial Action Objectives  
Final Feasibility Study, St. Regis Paper Company Site - Cass Lake, MN**

| Environmental Media and Location | Site-Specific Remedial Action Objective  | Preliminary Remediation Goals       |                                      |                                     |                                      |                                     |                                      |                                     |                                      |                                     |                                      | Characteristics   |
|----------------------------------|--|-------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------|---|
|                                  |  | Level 1 PRGs-R                      |                                      | Level 2 – PRGs-R                    |                                      | Level 3 PRGs-R                      |                                      | Level 2 - PRGs-I/C                  |                                      | Level 3 - PRGs-I/C                  |                                      |   |
| OU3                              |  | Estimated Area <sup>1</sup> (Acres) | Estimated Volume <sup>1,2</sup> (CY) | Estimated Area <sup>1</sup> (Acres) | Estimated Volume <sup>1,2</sup> (CY) | Estimated Area <sup>1</sup> (Acres) | Estimated Volume <sup>1,2</sup> (CY) | Estimated Area <sup>1</sup> (Acres) | Estimated Volume <sup>1,2</sup> (CY) | Estimated Area <sup>1</sup> (Acres) | Estimated Volume <sup>1,2</sup> (CY) |   |
| Soil                             | Prevent unacceptable potential risk to human health from future exposure to Site-related COCs in OU3 soil through ingestion, inhalation of soil and indoor dust and dermal adsorption routes of exposure with future residential land use.<br><br>Not applicable but shown to provide areas and volumes used in Final FS Report. | 26                                  | 123,000                              | 5                                   | 48,400                               | 5                                   | 48,400 (Not used)                    |                                     |                                      |                                     |                                      | Unknown dump materials including demolition debris, municipal soils wastes, possible industrial waste, junk, automobiles, etc. possible methane, hydrogen sulfide, VOCs, etc. |
|                                  |  |                                     |                                      |                                     |                                      |                                     |                                      |                                     |                                      |                                     |                                      |   |
|                                  | Prevent unacceptable potential risk to human health from future exposure to Site-related COCs in OU3 soil through ingestion, inhalation of soil and indoor dust and dermal adsorption routes of exposure with future industrial/commercial land use.   |                                     |                                      |                                     |                                      |                                     |                                      | 5                                   | 48,400 (Not used)                    | 2                                   | 13,000 (Not used)                    | Unknown dump materials including demolition debris, municipal soils wastes, possible industrial waste, junk, automobiles, etc. possible methane, hydrogen sulfide, VOCs, etc. |

**Table 3-2  
 Estimated Contaminated Soil Areas and Volumes Associated with Preliminary Remediation Goals and Remedial Action Objectives  
 Final Feasibility Study, St. Regis Paper Company Site - Cass Lake, MN**

| Environmental Media and Location | Site-Specific Remedial Action Objective  | Preliminary Remediation Goals          |   |  |   |  |   |  |   |  |   | Characteristics   |
|----------------------------------|--|--|---|--|---|--|---|--|---|--|---|---|
|                                  |  | Level 1 PRGs-R                         |   | Level 2 – PRGs-R                       |   | Level 3 PRGs-R                         |   | Level 2 - PRGs-I/C                     |   | Level 3 - PRGs-I/C                     |   |   |
| OU7                              |  | Estimated Area <sup>1</sup><br>(Acres) | Estimated Volume <sup>1,2</sup><br>(CY) | Estimated Area <sup>1</sup><br>(Acres) | Estimated Volume <sup>1,2</sup><br>(CY) | Estimated Area <sup>1</sup><br>(Acres) | Estimated Volume <sup>1,2</sup><br>(CY) | Estimated Area <sup>1</sup><br>(Acres) | Estimated Volume <sup>1,2</sup><br>(CY) | Estimated Area <sup>1</sup><br>(Acres) | Estimated Volume <sup>1,2</sup><br>(CY) |   |
| Soil                             | Prevent unacceptable potential risk to human health from future exposure to Site-related COCs in OU7 soil through ingestion of soil and garden produce, inhalation of soil and indoor dust and dermal adsorption routes of exposure at residential properties. | 77                                     | 115,400                                 | 10.8                                   | 21,000                                  | 6.2                                    | 6,700<br>(Not used)                     |  |   |  |   | Sandy soil with dioxin concentrations in shallow soil ranging from 0.78 to 2,700 ng/kg TEQDF and BaPe concentrations ranging from 0.027 to 1,400 mg/kg. Remediation will need to work around numerous buildings and other structures, sidewalks, etc. |

**Table 3-2 (end notes)**  
**Estimated Contaminated Soil Areas and Volumes Associated with Preliminary Remediation Goals and Remedial Action Objectives**  
**Final Feasibility Study, St. Regis Paper Company Site - Cass Lake, MN**

<sup>1</sup> See cost tables in Appendix F for basis of area and volume estimates

<sup>2</sup> See following table for assumptions regarding depth of contaminated soil as a function of PRG and Opera

| PRGs             | OU1            |                |                | OU2-I/C | OU3 (Dump) | OU3-CNF | OU7<br>[ft] <sup>a</sup> | OU7 (Res<br>North of RR)<br>[ft] |
|------------------|----------------|----------------|----------------|---------|------------|---------|--------------------------|----------------------------------|
|                  | Area 1<br>[ft] | Area 2<br>[ft] | Area 3<br>[ft] |         |            |         |                          |                                  |
| Level 1 PRGs-R   | 4              | 6              | 8              | 4       | 8          | 0.67    | 1                        | 0.67                             |
| Level 2 PRGs-R   | 3              | 4              | 6              | 2       | 6          | 0.67    | 0.67                     | --                               |
| Level 3 PRGs-R   | 2              | 3              | 6              | 1       | 6          | 0.67    | 0.67                     | --                               |
| Level 2 PRGs-I/C | 2              | 2              | 4              | 1       | 6          | 0.67    | 0.67                     | --                               |
| Level 3 PRGs-I/C | 1              | 1              | 4              | 0.5     | 4          | 0.67    | 0.67                     | --                               |
| Eco-PRGs (all)   | --             | --             | --             | 3       | --         |         | --                       | --                               |

<sup>a</sup> Except for properties originally in OU1 where OU1-Area 1 depths will apply

Area 1 - Industrial/commercial property in OU1 not owned by International Paper and BNSF = 26 acres

Area 2 - Property in OU1 owned by BNSF = 35 acres

Area 3 - Property in OU1 owned by International Paper = 33 acres

**Table 3-3  
Site-Specific Remedial Action Objectives, General Response Actions and Remedial Technologies/Process Options  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Environmental Media/Location | Site-Specific Remedial Action Objective   | General Response Action   | Remedial Technology/<br>Process Option  |
|------------------------------|---|---|---|
| <b>OU1</b>                   |   |   |   |
| Soil                         | Prevent unacceptable potential risk to human health from future exposure to site-related contaminants through ingestion, inhalation and dermal adsorption routes of exposure if land use is converted to residential use in the future. | 1. No Action  | —   |
|                              |   | 2. Institutional Controls to Prevent Conversion to Residential Use                  | Real property notification/affidavits, environmental restrictive covenants, easements, City ordinances, zoning and building permits |
|                              |   | 3. In-Situ Treatment to Reduce Concentrations Below Residential PRGs                | Biological, chemical oxidation, physical or thermal technologies  |
|                              |   | 4. Excavation of Soil Above Residential PRGs and Replacement with Clean Soil        |   |
|                              |   | - with ex-situ treatment/disposal   | Thermal treatment   |
|                              |   | - with offsite disposal   | RCRA Subtitle D landfill, RCRA Subtitle C landfill  |
|                              |   | - with onsite disposal outside of potential residential area                        | Containment cell, RCRA Subtitle D cell  |
|                              | Prevent transfer of site-related contaminants through surface water runoff and/or wind-blown dust from the former operations area to nearby residential property and roads.   | 1. No Action  | —   |
|                              |   | 2. Containment to Prevent Generation of Dust and Erosion Exceeding Residential PRGs | Horizontal barriers, clean soil cover, low permeability cover, dust suppressant, topsoil/vegetation cover                           |
|                              |   | 3. In-Situ Treatment to Reduce Concentrations Below Residential PRGs                | Biological, chemical oxidation, physical or thermal technologies  |
|                              |   | 4. Excavation of Soil Above Residential PRGs and Replacement with Clean Soil        |   |
|                              |   | - with ex-situ treatment/disposal   | Thermal treatment   |
|                              |   | - with offsite disposal   | RCRA Subtitle D landfill, RCRA Subtitle C landfill  |
|                              |   | - with onsite disposal  | Containment cell, RCRA Subtitle D cell  |

**Table 3-3  
Site-Specific Remedial Action Objectives, General Response Actions and Remedial Technologies/Process Options  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Environmental Media/Location | Site-Specific Remedial Action Objective  | General Response Action  | Remedial Technology/<br>Process Option   |
|------------------------------|--|--|--|
|                              | Prevent unacceptable potential risk to human health from future exposure to site-related contaminants through ingestion, inhalation and dermal adsorption routes of exposure with industrial/commercial land use.                  | 1. No Action<br>2. Institutional Controls to Prevent Industrial/Commercial Development Without Consideration of the Need for Additional Remediation<br>3. Containment to Prevent Exposure to Soil Contaminants Above Industrial/Commercial PRGs<br>4. In-Situ Treatment to Reduce Concentrations Below Industrial/Commercial PRGs<br>5. Excavation of Soil Exceeding Industrial/Commercial PRGs and Replacement with Clean Soil<br>-----<br>- with ex-situ treatment/disposal<br>-----<br>- with offsite disposal<br>-----<br>- with onsite disposal | —<br>Real property notification/affidavits, environmental restrictive covenants, easements, City ordinances, zoning and building and land alteration permits<br>Horizontal barriers, clean soil cover, low permeability cover, topsoil/vegetation cover<br>Biological, chemical oxidation, physical or thermal technologies<br>Thermal treatment<br>RCRA Subtitle D landfill, RCRA Subtitle C landfill<br>Containment cell, RCRA Subtitle D cell |
| Groundwater                  | Prevent unacceptable risk from exposure to site-related contaminants in groundwater through ingestion, inhalation of vapors and dermal adsorption routes of exposure if a construction worker encounters contaminated groundwater. | 1. No Action<br>2. Institutional Controls<br>3. Engineering Controls<br>4. Groundwater Removal/Treatment   | —<br>City ordinances not allowing excavations without a permit<br>Warning signs advising of need for worker protection<br>In situ treatment to reduce groundwater concentrations below PRGs  |

**Table 3-3  
Site-Specific Remedial Action Objectives, General Response Actions and Remedial Technologies/Process Options  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Environmental Media/Location      | Site-Specific Remedial Action Objective   | General Response Action   | Remedial Technology/<br>Process Option  |
|-----------------------------------|---|---|---|
| <b>OU2</b>                        |   |   |   |
| Soil                              | Prevent organism mortality due to site-related contaminants.  | 1. No Action  | —   |
|                                   |   | 2. In-Situ Treatment to Reduce Concentrations Below Ecological PRGs   | Biological, chemical oxidation, physical or thermal technologies  |
|                                   |   | 3. Containment  | Clean soil cover to raise organism habitat out of contaminated soil   |
|                                   |   | 4. Excavation of Soil Exceeding PRGs and Replacement with Clean Soil  |   |
|                                   |   | - With ex-situ treatment/disposal   | Thermal treatment   |
|                                   |   | - With offsite disposal   | RCRA Subtitle D landfill, RCRA Subtitle C landfill  |
|                                   | - With onsite disposal  | Containment cell, RCRA Subtitle D Cell  |   |
|                                   | Prevent unacceptable potential risk to human health from future exposure to site-related contaminants through ingestion, inhalation and dermal adsorption routes of exposure with industrial/commercial land use. | 1. No Action  | —   |
|                                   |   | 2. Institutional Controls to Prevent Industrial/Commercial Development Without Consideration of the Need for Additional Remediation | Real property notification/affidavits, environmental restrictive covenants, easements, City ordinances, zoning and building and land alteration permits |
|                                   |   | 3. Containment to Prevent Exposure to Soil Contaminants Above Industrial/Commercial PRGs  | Horizontal barriers, clean soil cover, low permeability cover, topsoil/vegetation cover   |
|                                   |   | 4. In-Situ Treatment to Reduce Concentrations Below Industrial/Commercial PRGs  | Biological, chemical oxidation, physical or thermal technologies  |
|                                   |   | 5. Excavation of Soil Exceeding Industrial/Commercial PRGs and Replacement with Clean Soil  |   |
| - with ex-situ treatment/disposal |   | Thermal treatment   |   |
| - with offsite disposal           | RCRA Subtitle D landfill, RCRA  |   |   |

**Table 3-3  
Site-Specific Remedial Action Objectives, General Response Actions and Remedial Technologies/Process Options  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Environmental Media/Location | Site-Specific Remedial Action Objective   | General Response Action  | Remedial Technology/<br>Process Option  |
|------------------------------|---|--|---|
|                              |   | - with onsite disposal   | Subtitle C landfill<br>-----<br>Containment cell, RCRA Subtitle D cell  |
| <b>OU3</b>                   |   |  |   |
| Soil                         | Prevent unacceptable potential risk to human health from future exposure to site-related contaminants through ingestion, inhalation and dermal adsorption routes of exposure with industrial/commercial land use. | 1. No Action<br>2. Institutional Controls to Prevent Industrial/Commercial Development Without Consideration of the Need for Additional Remediation<br>3. Containment to Prevent Exposure to Soil Contaminants Above Industrial/Commercial PRGs<br>4. In-Situ Treatment to Reduce Concentrations Below Industrial/Commercial PRGs<br>5. Excavation of Soil Exceeding Industrial/Commercial PRGs and Replacement with Clean Soil<br>-----<br>- with ex-situ treatment/disposal<br>-----<br>- with offsite disposal<br>-----<br>- with onsite disposal | —<br>Real property notification/affidavits, environmental restrictive covenants, easements, City ordinances, zoning and building and land alteration permits<br>Horizontal barriers, clean soil cover, low permeability cover, topsoil/vegetation cover<br>Biological, chemical oxidation, physical or thermal technologies<br>-----<br>Thermal treatment<br>-----<br>RCRA Subtitle D landfill, RCRA Subtitle C landfill<br>-----<br>Containment cell, RCRA Subtitle D cell |

**Table 3-3  
Site-Specific Remedial Action Objectives, General Response Actions and Remedial Technologies/Process Options  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Environmental Media/Location   | Site-Specific Remedial Action Objective  | General Response Action  | Remedial Technology/<br>Process Option   |
|--------------------------------|--|--|--|
| <b>OU7</b>                     |  |  |  |
| Soil                           | Prevent unacceptable potential risks from exposure to Site-related contaminants through ingestion, inhalation and dermal exposure routes of exposure.  | 1. No action   | —  |
|                                |  | 2. In-Situ Treatment to Reduce Soil Concentrations Below Residential PRGs        | Biological, chemical oxidation, physical or thermal technologies   |
|                                |  | 3. Excavation of Soil Exceeding Residential PRGs and Replacement with Clean Soil |  |
|                                |  | - with ex-situ treatment/disposal  | Thermal treatment  |
|                                |  | - with offsite disposal  | RCRA Subtitle D landfill, RCRA Subtitle C landfill   |
|                                |  | - with onsite disposal outside of residential area                               | Containment cell onsite on industrial/commercial portion of the Site, RCRA Subtitle D cell onsite on industrial/commercial portion of the Site |
| 4. Purchase and Demolish Homes | Convert land use to commercial/industrial and implement appropriate remedial technology/process option to achieve industrial/commercial PRGs or remove pathway to industrial/commercial exposure |  |  |

Table 3-4

**Remedial Technology and Technology Process Option Screening  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Remedial Technology           | Technology Process Option   | Description  | Treated Compounds | Limitations  | Effectiveness  | Implementability                             | Relative Cost Range <sup>1</sup> | Screening Comment   |
|-------------------------------|---|--|-------------------|--|--|--|----------------------------------|---|
| <b>Soils</b>                  |   |  |                   |  |  |  |                                  |   |
| No Action                     |   |  |                   |  |  |  |                                  |   |
|                               | None  | No further action to address affected soils.   | None              | No action; typically does not achieve the RAOs or PRGs.  | None   | Implementable                                | Zero                             | Required by CERCLA for comparison.                                |
| <b>Institutional Controls</b> |   |  |                   |  |  |  |                                  |   |
| Land Use/Access Restrictions  | Real Property Notification/Affidavit<br><br>(See Appendix G for further evaluation) | Affidavit filed with county recorder or register of titles disclosing contamination on the property.<br><br>Deed notice placed on properties to restrict future residential or industrial/commercial, to specify any appropriate construction limitations, etc.  | None              | Real property notification/affidavits will need to be applied to City and privately-owned land and will require owner's permission.<br><br>Typically not applicable to residential land use scenarios.       | Good for disclosing contamination if property ownership changes.<br><br>Does not prevent contaminant migration or reduce contaminant concentrations.   | Easily implemented if property owner agrees. | Low                              | Retained for use in scenarios not involving residential land use. |
|                               | Environmental Restrictive Covenant<br><br>(See Appendix G for further evaluation)   | A transfer of interest in real property to MPCA.<br><br>Used to limit site activities (e.g., land use, building, construction, etc.) to assure protectiveness of remedial action.<br><br>Covenant will include enforcement mechanisms to assure that it is enforceable by the appropriate jurisdiction.<br><br>Requires enrollment of property in MPCA VIC program with future industrial/commercial | None              | Environmental restrictive covenants will need to be applied to BNSF/IP/City and privately-owned land and will require owner's permission.<br><br>Typically not applicable to residential land use scenarios. | Good for preventing changes in land use that will affect the effectiveness of the remedial action.<br><br>Does not prevent contaminant migration or reduce contaminant concentrations but helps maintain remedial action objectives. | Easily implemented if property owner agrees. | Low                              | Retained for use in scenarios not involving residential land use. |

Table 3-4

**Remedial Technology and Technology Process Option Screening  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Remedial Technology | Technology Process Option                           | Description  | Treated Compounds | Limitations   | Effectiveness  | Implementability                                | Relative Cost Range <sup>1</sup> | Screening Comment   |
|---------------------|---|--|-------------------|---|--|---|----------------------------------|---|
|                     |   | development.<br>Assumes subsequent owners are aware of and bound by the restrictions.<br>Recorded with county recorder or register of titles, MPCA, and municipal officials.<br>May involve tracking with Site Status Update form.                               |                   |   |  |   |                                  |   |
|                     | Easement<br>(See Appendix G for further evaluation) | A transfer of interest in property to MPCA.<br>Assures the MPCA access to the property to inspect or operate remedial actions.<br>Assures that subsequent owners are aware of and bound by the easement.<br>Recorded with county recorder or register of titles. | None              | Easements will need to be applied to BNSF/IP, City and privately-owned property and will require owner's permission.<br>Typically not applicable to residential land use scenarios.         | Good for allowing regulatory agencies access to inspect remedial actions.<br>Does not prevent contaminant migration or reduce contaminant concentrations but helps maintain effectiveness of remedial actions. | Easily implemented if property owner agrees.    | Low                              | Retained for use in scenarios not involving residential land use.   |
|                     | City and Tribal Zoning Ordinances                   | Commercial/industrial zoning to restrict residential use in industrial/commercial areas.<br>Ordinance to restrict new commercial/ industrial development without appropriate construction limitations, etc.  | None              | Applicable to former operations area now zoned commercial/ industrial.<br>Zoning needs to be enforced.<br>Applicable to OU2 and OU3 which are outside City boundaries.<br>Not applicable to | Would require action by the City government to enforce existing zoning.<br>Would require action by Township for areas outside of City.<br>Does not prevent   | Easily implemented if City and Township agrees. | Low                              | Retained for further evaluation in scenarios not involving residential land use as a back-up to other land use/access restrictions. |

Table 3-4

Remedial Technology and Technology Process Option Screening  
 Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN

| Remedial Technology | Technology Process Option  | Description  | Treated Compounds  | Limitations  | Effectiveness   | Implementability  | Relative Cost Range <sup>1</sup>  | Screening Comment   |
|---------------------|--|--|--|--|---|---|---|---|
|                     |  |  |  | residential land use scenarios.  | contaminant migration or reduce contaminant concentrations.<br><br>EPA indicates that different jurisdictions may raise claims to competing authorities to establish, enforce and record institutional controls within an Indian Reservation. |   |   |   |
| Containment         |  |  |  |  |   |   |   |   |
| Horizontal Barriers | Clean Soil Cover   | Soil exceeding PRGs covered with 1 foot of clean soil and revegetated to prevent direct contact and erosion. This includes grading as a means of drainage improvement/control. | A cover is applicable to the full range of contaminants at the Site. No treatment provided.        | Would need to be used in conjunction with institutional controls.<br><br>Not applicable to residential land use scenarios. | Effective if future development or erosion does not result in breaching of the cover and if leaching of contaminants from soil is not an issue.   | Easily implementable in undeveloped and non-forested portions of OU1, OU2 and OU3 and in a cleared OU7.<br><br>More difficult to implement in developed areas.<br><br>Not implementable in forested areas without removal of trees. | Low to moderate depending on cover thickness.<br><br>Covers are generally the least expensive engineering approach to effectively managing human health direct contact risks. | Retained for further evaluation in scenarios not involving residential land use.      |
|                     | Low Permeability Cover (clay, synthetic membrane, asphalt, concrete) | Soil exceeding PRGs capped with any one of a variety of low permeability cap materials to prevent direct contact, erosion and leaching.  | A low permeability cover is applicable to the full range of contaminants at the Site. No treatment | Would need to be used in conjunction with institutional controls.<br><br>Not applicable to residential land use            | Effective if future site development or erosion does not result in breaching of the cap.  | Easily implementable in undeveloped and non-forested portions of OU1, OU2 and OU3 and in a cleared OU7.   | Moderate to low depending on cover and membrane thickness.<br><br>Low   | Low permeability features are not necessary since the Site COCs are not mobile in the |

Table 3-4

**Remedial Technology and Technology Process Option Screening  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Remedial Technology | Technology Process Option       | Description  | Treated Compounds  | Limitations  | Effectiveness   | Implementability   | Relative Cost Range <sup>1</sup>  | Screening Comment   |
|---------------------|---------------------------------|--|--|--|---|--|---|---|
|                     |                                 |  | provided.  | scenarios.   | Needed if leaching of contaminants from the soil is an issue. Not necessary at Site to protect groundwater because dioxin and BaP <sub>e</sub> are not mobile to leaching. PCP and mobile PAHs not considered a leaching risk (see Appendix C). | More difficult to implement in developed areas.<br>Not implementable in forested areas without removal of trees. | permeability covers are a higher cost method than clean soil covers to effectively manage the human health direct exposure risks. | subsurface.<br>Not retained. A clean soil cover is more easily implemented and equally effective at this Site.  |
|                     | Application of Dust Suppressant | Dust suppressant added to soil exceeding PRGs to reduce erosion and transport. | Dust suppressant is applicable to the contaminants at the Site. No treatment provided. | Would need to be used in conjunction with institutional controls.<br>Does not provide a comprehensive or permanent solution to erosion control.<br>Does not reduce direct contact risk.<br>Not applicable to residential land use scenarios. | Demonstrated to be effective on roads at the Site.<br>Effective at mitigating erosion if future actions do not disturb the soil below the dust suppressant.<br>Repeated application will be required to maintain effectiveness.                 | Implementable.   | Low   | Not retained for further evaluation as a stand-alone technology since it is not a permanent remedy for erosion and is not effective at limiting exposure to surface soil contamination.<br>Retained as part of any excavation technology to enhance this technology's short-term effectiveness. |

Table 3-4

**Remedial Technology and Technology Process Option Screening  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Remedial Technology | Technology Process Option                                | Description  | Treated Compounds   | Limitations  | Effectiveness  | Implementability   | Relative Cost Range <sup>1</sup>                               | Screening Comment  |
|---------------------|--|--|---|--|--|--|--|--|
|                     | Establish Topsoil and Vegetation Cover (Grass and Trees) | Soil exceeding PRGs covered with topsoil and revegetated to prevent erosion and reduce exposure. This includes grading as a means of drainage improvement/control. | Vegetation cover can be established at the Site. No treatment provided.                               | Would need to be used in conjunction with institutional controls.<br><br>Vegetation would need to be maintained.   | Effective if vegetation is established and if soil is not disturbed. Areas of erosion would need to be repaired.<br><br>This has been successfully demonstrated in the former operations area of the Site by International Paper.<br><br>This technology requires long-term maintenance to ensure effectiveness. | Easily implemented.  | Low  | Retained for further evaluation in scenarios not involving residential land use. |
| <b>Excavation</b>   |  |  |   |  |  |  |  |  |
| Excavation          | Backhoe, front-end loader, trucks, scraper               | Excavation of soils exceeding PRGs using ordinary construction equipment (backhoes, dozers, front-end loaders, trucks) under a project health and safety plan.     | Excavation is applicable to the full range of contaminants at the Site.<br><br>No treatment provided. | Fugitive emissions such as dust can be a problem during operations but mitigative measures can be taken.<br><br>Worker safety will need to be ensured during intrusive activities. | Very effective because all contaminants are removed and remaining soil can be sampled following excavation to verify that PRGs are met.  | Easily implemented as long as excavation limits can be reasonably predicted and determined.<br><br>There is some uncertainty at predicting and determining excavation limits at lower COC concentrations.<br><br>Excavation is relatively simple, well-proven, and | Low (\$20-\$30/cy to excavate and load, \$15/cy for backfill). | Retained for further evaluation for all land use scenarios.                      |

Table 3-4

**Remedial Technology and Technology Process Option Screening  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Remedial Technology | Technology Process Option                | Description  | Treated Compounds   | Limitations  | Effectiveness   | Implementability  | Relative Cost Range <sup>1</sup>   | Screening Comment   |
|---------------------|--|--|---|--|---|---|--|---|
|                     |  |  |   |  |   | readily applied.<br>Was successfully used in interim response actions at the Site.  |  |   |
| Disposal            |  |  |   |  |   |   |  |   |
| Offsite Disposal    | RCRA Subtitle C Hazardous Waste Landfill | Non-liquid hazardous wastes are permanently disposed of in a RCRA Subtitle C permitted landfill. | Disposal at a RCRA Subtitle C permitted landfill may be applicable to some Site contaminants but pretreatment may be required to meet land disposal restrictions. | Disposal costs would be high and pretreatment of dioxins/furans to meet land disposal restrictions, if required, may be difficult.<br>Large volumes of soil would take up valuable Subtitle C landfill volume. | Very effective. Permitted landfills are rigorously designed and operated to contain disposed hazardous waste. | RCRA Subtitle C-permitted landfills are available although transportation distances are greater than to local Subtitle D landfills.<br>Land ban issues with dioxin-containing wastes may preclude disposal without pretreatment.<br>Pretreatment of dioxins (other than incineration) may not be commercially available | Moderate to very high.<br>Cost per ton for disposal varies depending on waste classification, quantity, distance to landfill, and pretreatment requirements. | Retained for contingent use in all land use scenarios if contaminated soil that is a hazardous waste is encountered.<br>RCRA Subtitle D disposal is equally effective for soil that is not a hazardous waste. |

Table 3-4

**Remedial Technology and Technology Process Option Screening  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Remedial Technology | Technology Process Option  | Description   | Treated Compounds  | Limitations   | Effectiveness   | Implementability   | Relative Cost Range <sup>1</sup>  | Screening Comment   |
|---------------------|--|---|--|---|---|--|---|---|
|                     | RCRA Subtitle D Solid Waste Landfill                                   | Non-liquid nonhazardous wastes are permanently disposed of in a RCRA Subtitle D-permitted landfill. | Disposal in a permitted RCRA Subtitle D solid waste landfill is applicable to all Site contaminants as long as the soils are not a hazardous waste. No treatment provided. | Disposal in Minnesota needs to comply with MPCA policy on disposal of dioxin-contaminated soil in Subtitle D landfills.<br><br>Landfill space for high excavation volumes may not be available within reasonable haul distance. | Very effective. Permitted landfills are rigorously designed and operated to contain disposed waste.   | Implementable. Minnesota landfills are available for volumes up to 400,000 c.y. Additional volume may be difficult to find within a reasonable haul distance.<br><br>Subtitle D landfill used to dispose of soil removed during interim removal actions with contaminant concentrations higher than anticipated in most remaining soils. | Cost per cubic yard for disposal is low, but overall cost will depend on distance to landfill.<br><br>Higher (or lower) fuel prices in the future may cause higher (or lower) transportation costs. | Retained for further evaluation in all land use scenarios.                        |
| Onsite Disposal     | Onsite disposal cell designed to RCRA Subtitle D landfill requirements | Contaminated soil permanently disposed of in a designed landfill on Site.                           | Applicable to all Site contaminants as long as soils are not a hazardous waste. No treatment provided.   | May be difficult to locate and build a RCRA Subtitle D landfill on Site.<br><br>Not appropriate for location in residential areas.  | Effectively eliminates exposure to contained materials.<br><br>Leachate disposal may be required.<br><br>Effectiveness monitoring will be required. | May be difficult to implement at the Site due to siting issues and due to Site limitations.<br><br>Site size not conducive for constructing a large onsite RCRA Subtitle D landfill.<br><br>Long-term O&M would be needed.   | Low without leachate treatment.<br><br>Moderate with leachate treatment.  | Retained for further evaluation but need to locate in industrial/commercial area. |
|                     | Onsite containment cell (cover but no liner).                          | Contaminated soil consolidated and permanently placed onsite under a clean soil cover.              | Applicable to all Site contaminants as long as soils are not a hazardous waste. No treatment provided.   | May be difficult to locate a consolidation cell on Site.<br><br>Not appropriate for location in residential areas.  | Effectively eliminates exposure to contained materials.<br><br>Effectiveness monitoring will be required.   | May be difficult to implement at the Site due to siting issues.  | Low   | Retained for further evaluation—need to locate in industrial/commercial area.     |

Table 3-4

**Remedial Technology and Technology Process Option Screening  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Remedial Technology  | Technology Process Option  | Description   | Treated Compounds  | Limitations   | Effectiveness  | Implementability   | Relative Cost Range <sup>1</sup> | Screening Comment  |
|--|--|---|--|---|--|--|----------------------------------|--|
|  | Existing onsite containment cell in OU2.   | Remove cover from existing contaminated soil containment cell in OU2. Place contaminated soil in cell and construct new cover.                          | Applicable to all Site contaminants as long as soils are not a hazardous waste. No treatment provided. | Difficult to reopen a "closed unit."<br><br>Limited capacity available for additional soil (13,000 CY).   | Effectively eliminates exposure to contained materials. Leachate disposal and monitoring already provided.   | Administratively difficult to open a closed facility.<br><br>Insufficient capacity for excavated soil. | Low                              | Not retained for further evaluation due to insufficient capacity and difficulty reopening a closed facility. |
| <b>Groundwater (underground construction worker scenario only)</b> |  |   |  |   |  |  |                                  |  |
| Institutional Controls   | City and Tribal Ordinances Not Allowing Underground Work in Area of Unacceptable Risk to Unprotected Construction Workers without a Permit | City and/or tribal ordinances.<br><br>not allowing underground work in areas of unacceptable risk to unprotected construction workers without a permit. | None   | Requirements need to be applied to BNSF/IP property and to City property.<br><br>Only applicable to underground worker scenarios.<br><br>Needs to be compatible with future development.<br><br>Different jurisdictions may raise claims to competing authorities to establish, enforce and record institutional controls within an Indian Reservation. | Would require action by City and tribal governments to implement and enforce new ordinances/ regulations to not allow underground work without a permit.<br><br>Does not prevent contaminant migration or reduce contaminant concentrations. | Easily implemented if City and tribe agree.  | Low                              | Retained for further evaluation in mitigating risk to underground workers in OU1.                            |

Table 3-4

**Remedial Technology and Technology Process Option Screening  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Remedial Technology  | Technology Process Option | Description   | Treated Compounds | Limitations   | Effectiveness   | Implementability                                     | Relative Cost Range <sup>1</sup> | Screening Comment   |
|----------------------|---------------------------|---|-------------------|---|---|--|----------------------------------|---|
| Engineering Controls | Warning Signs.            | Warning signs installed around areas of unacceptable risk to unprotected underground workers. | None              | Signs may need to be periodically replaced.<br>An ongoing mechanism (e.g., enforceable agreement, etc.) is required to ensure the integrity of the engineering controls is not compromised over time. | Signs are good for making underground workers aware of need for protection. | Signage easily implemented if property owners agree. | Low                              | Signage retained for further evaluation in mitigating risk to underground workers in OU1. |

**Note:** Effectiveness is the ability to perform as part of an overall alternative that can meet the objectives under conditions and limitations that exist onsite. Implementability is the likelihood that the process could be implemented as part of the remedial action plan under the physical, regulatory, technical, and schedule constraints. Relative cost is for comparative purposes only and it is judged relative to the other processes and technologies that involve similar functions.

<sup>1</sup> Relative Costs: Costs are assigned “low” if less than \$30,000/acre or \$50/c.y.  
 Costs are assigned “moderate” if above the low threshold but less than \$100,000/acre or \$100/c.y.  
 Costs are assigned “high” if above the moderate threshold but less than \$500,000/acre or \$400/c.y.  
 Costs are assigned “very high” if above \$500,000/acre or \$400/c.y.

**Table 5-1**

**Description of Alternatives Subject to Detailed Analysis  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Alternative Description   | Further Definition to Form the Basis for Detailed Analysis/Cost Estimates  |
|---|--|
| <p><b><u>Alternative 1</u></b></p> <p>Consists of taking no further action at the Site with respect to soils and groundwater risks to underground workers. The NCP requires that a no-action alternative be retained throughout the feasibility study process as a baseline for comparison to the other approaches.</p>   | <p><b>Residential and Commercial/Industrial Properties (OU1, OU2, OU3 and OU7)</b></p> <p>No further action would be taken to excavate or cover contaminated soil exceeding residential or commercial/industrial PRGs. Extensive soil removal actions were completed at OU1 in 1985, 1986, 2004 and 2005 as described in Section 1.0 of this Final Feasibility Study Report. Existing institutional controls that help protect human health and the environment under residential land use scenarios in OU1 consist of the City's existing small-scale industrial zoning for the properties and an affidavit on the deed to a portion of OU1 (Appendix H). Extensive interim remedial actions were taken for many of the residential properties in OU7 in 2006, also as described in Section 1.0 of this Final Feasibility Study Report. Interim remedial actions to periodically clean the houses are continuing for some of the properties in OU7. Interim remedial actions would cease under this alternative (as well as under all alternatives).</p> <p><b>Eco-Risk Area in OU2</b></p> <p>No action would be taken to remove or otherwise mitigate the impacts of contaminated soil in OU2 that was toxic to earthworms in soil toxicity testing conducted for the HHERA (Integral, 2007; 2008).</p> <p><b>Groundwater</b></p> <p>No action would be taken to protect future below-ground workers over the plume of contaminated groundwater in OU1. The area of the plume where groundwater concentrations have been concluded to present an unacceptable risk to below-ground workers in OU1 is estimated to be 24 acres and is shown on Figure 3-6. The groundwater is from 5 to 15 feet below-ground surface in this area.</p> |
| <p><b><u>Alternative 2</u></b></p> <p>Alternative 2 is described as follows:</p> <p>Place a 12-inch thick clean soil cover (composed of at least 6 inches of topsoil) on commercial/industrial properties exceeding Level 2 PRGs-I/C in OU1, OU2, and OU3. Establish vegetation on the cover and maintain the vegetation cover. Place a highly visible, permanent and permeable geotextile to demarcate the base of the cover soils. Place institutional controls on these properties to protect the integrity of the cover</p> | <p><b>Residential Properties (OU7)</b></p> <p>During remedial design, residential and potential residential properties in OU7 that have not been sampled will be sampled for TEQ<sub>DF</sub> and BaP<sub>e</sub>. Sampling of residential and potential residential properties will extend away from the boundaries of OU7 until the limits of the residential and potential residential properties exceeding the Level 2 PRGs-R have been established. Samples may be taken in various portions of the properties to clearly identify areas that exceed the Level 2 PRGs-R. For properties that exceed the PRGs and agree to be included in the remediation, the property owner and the remediation design team will complete an inventory of the plantings, retaining walls, gardens and other landscaping features that will</p>   |

**Table 5-1**

**Description of Alternatives Subject to Detailed Analysis  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Alternative Description  | Further Definition to Form the Basis for Detailed Analysis/Cost Estimates   |
|--|---|
| <p>and prevent exposure to contaminated soil and groundwater.</p> <p>Excavate soil on residential and potential residential properties in OU7 exceeding Level 2 PRGs-R to a depth no greater than 2 feet. Place a permeable geotextile to demarcate the base of the excavation if soil exceeding the PRGs is left in place. Backfill the excavated area with clean backfill to existing grade. Re-establish vegetation and property features in the excavated areas.</p> <p>Pave the heavy machinery area at Cass Forest Products and the unpaved roads in the residential and commercial/industrial areas.</p> <p>Excavate soil in excess of the eco-risk PRGs in the ecological risk area in OU2 and replace with clean backfill. Re-establish vegetation in the excavated area.</p> <p>Monitor the water quality in the forested wetland area east of OU1 for site-related COCs.</p> <p>Alternative 2A will involve disposal of the excavated soil offsite at a permitted RCRA Subtitle D landfill. Alternative 2B will involve disposal of the excavated soil onsite in OU1.</p> | <p>be removed during construction. A preconstruction survey will be performed of each property to allow excavation and restoration to be completed to the appropriate grade and slope. Utilities within the excavation area will be marked and protected as necessary to safely conduct the work. Fencing will be removed, as appropriate, to allow construction equipment into the required areas.</p> <p>It is anticipated that on the order of ten properties in OU7 will exceed the Level 2 PRGs-R after the boundaries of OU7 and OU1 are modified as described in Section 3.2 of this Revised Final Feasibility Study Report (Figure 5-1).</p> <p>The anticipated average depth of excavation to reach the Level 2 PRGs-R is 8 inches based on existing data. The average depth of excavation is anticipated to be greater on the residential properties that are part of the former operations area of the Site and were moved within the boundaries of OU7 for this feasibility study. Data on the depth of soil exceeding the Level 2 PRGs-R will be collected during remedial design.</p> <p>Soil exceeding the Level 2 PRGs-R will be excavated within lawns, play areas, gardens, unpaved parking areas, and planting beds to a depth where the concentrations are below the PRGs or 2 feet, whichever is less. The horizontal extent of the excavations will be defined by the property boundaries and permanent structures, such as buildings, sidewalks or paved areas or by a subsampled area as appropriate. Excavations will be carried into the road right-of-way to the edge of the driving surface. Areas beneath permanent structures, such as buildings or paved areas, will not be excavated and the excavation will have a safe slope (e.g., 1:1) away from these structures. Excavation will proceed to the design depth or 2 feet, whichever is less, with sampling to verify that the Level 2 PRGs-R are met in the underlying soil. The design depth will be based on the results of samples collected during the remedial design phase of the work. If the depth of soil exceeding the Level 2 PRGs-R is left below a depth of 2 feet, a highly-visible permanent and permeable geotextile will be placed at the base of the excavation to demarcate the limits of the clean fill.</p> <p>Once excavation in a residential property(ies) is completed and verified by confirmation sampling, clean fill and topsoil will be placed to return the property to the original grade. After restoration, the yard will be seeded. Replacement plants will be planted, landscaping features will be replaced, and fences will be reinstalled or replaced unless otherwise directed by the</p> |

**Table 5-1**

**Description of Alternatives Subject to Detailed Analysis  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Alternative Description | Further Definition to Form the Basis for Detailed Analysis/Cost Estimates   |
|-------------------------|---|
|                         | <p>property owner. At the completion of restoration, the property owner will sign a form agreeing that the property has been appropriately restored.</p> <p>Institutional controls will be required for residential properties where property owners deny access. The most likely institutional control will be adoption of a City ordinance requiring regulatory agency approval of land alteration activities on those properties since it is assumed that property owners unwilling to provide access will be unwilling to allow a real property notification/affidavit, an easement and an environmental restrictive covenant to be placed on their property. Institutional controls will also be needed on residential properties where soil exceeding the Level 2 PRGs-R is left in place below a depth of 2 feet. This institutional control will include the City ordinance referenced above and a real property notification/affidavit and an environmental restriction covenant to provide multiple layers of protection if the property owner is willing. Institutional controls for this alternative are described and evaluated in more detail in Appendix G.</p> <p><b>Commercial/Industrial Properties (OU1, OU2 and OU3)</b><br/>The approach described above for residential properties will be followed to gain access, sample and inventory the commercial/industrial properties in OU1, OU2 and OU3 that exceed the Level 2 PRGs-I/C.</p> <p>The commercial/industrial properties in OU1, OU2 and OU3 that will be covered with clean fill and topsoil will be prepared as follows: Trees will be cut, stumps will be grubbed, and the ground will be graded smooth and to provide drainage. A design will be prepared to temporarily protect, remove or raise items such as fire hydrants, fences, signs, etc., that are in the area to be covered. Grading of the area will be designed so as not to move soil exceeding the PRGs to a clean area or soil less than the PRGs to a contaminated area. The cover design will match the grade of the covered area to adjacent uncovered areas and to roadways. Drainage from the covered areas will be maintained. Gravel driveways and parking areas will be covered with 12 inches of fill and gravel (no topsoil) (except for the heavy machinery area at Cass Forest Products that will be paved with asphalt). Roads that are used during construction of all features of this alternative will be maintained by grading and adding gravel to keep them usable for construction and normal use. The design of the cover will be coordinated with each property owner through an access agreement. The property owner will be asked to sign a form at the end of the project agreeing that the cover has been placed and that restoration has been</p> |

**Table 5-1**

**Description of Alternatives Subject to Detailed Analysis  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Alternative Description | Further Definition to Form the Basis for Detailed Analysis/Cost Estimates   |
|-------------------------|---|
|                         | <p>completed as agreed and as designed (Figure 5-1).</p> <p>Institutional controls will be placed over OU1, OU2 and OU3 to preclude future residential use. These institutional controls will include real property notifications/affidavits, easements and environmental restrictive covenants on the properties. These institutional controls will be layered with the current commercial/industrial zoning of OU1. The institutional controls are described and evaluated in Appendix G.</p> <p>Institutional controls will also be placed on the covered portions of OU1, OU2 and OU3 to preclude industrial/commercial development without consideration of further remediation appropriate for the specific future development and as directed and approved by U.S. EPA and MPCA. These institutional controls will include real property notifications/affidavits, easements and environmental restrictive covenants on the properties and will be layered with the City of Cass Lake zoning ordinance in OU1 and a new ordinance requiring agency approval for land alteration activities in the covered areas (Appendix G).</p> <p><b>Eco-Risk Area in OU2</b></p> <p>Trees will be cut and stumps will be grubbed in the portion of OU2 exceeding eco-risk PRGs. Sampling will be completed during remedial design to be sure the area in OU2 exceeding eco-risk PRGs is well defined. Soil that exceeds eco-risk PRGs will be excavated to a maximum depth of 5 feet (based on the conclusion that soil organisms are unlikely to live below that depth with suitable habitat above that depth). Verification sampling will be used to show that all soil exceeding the eco-risk PRGs has been excavated. The excavation will be backfilled with clean soil, graded to provide surface water drainage, and revegetated with grasses and trees. The specifications for the clean soil backfill will require that the soil be suitable to re-establish the appropriate organism and plant communities. The objective will be to create a stable vegetated land surface. The invertebrate eco-risk PRGs were used as the basis for the cost estimate for this alternative. It is estimated that the area requiring excavation is 2 acres (Figure 3-7).</p> <p><b>Groundwater</b></p> <p>Engineering controls in the form of warning signs will be used over the portion of OU1 where shallow groundwater exceeds the preliminary remediation goals for below-ground workers to alert workers planning to excavate that the area is covered by an ordinance not allowing</p> |

**Table 5-1**

**Description of Alternatives Subject to Detailed Analysis  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Alternative Description  | Further Definition to Form the Basis for Detailed Analysis/Cost Estimates  |
|--|--|
|  | <p>underground work without a permit, the need to wear personal protective equipment and the need to follow a site-specific PHASP when conducting underground work. Twenty signs over the 24-acre area have been assumed (area in Figure 3-6). Institutional controls will be implemented in the form of a City ordinance not allowing future below-ground work without a permit in the same area. BNSF and International Paper would have the right to work underground on their property but this work would be done under OSHA regulations for work on hazardous sites, a site-specific PHASP and protective equipment.</p> <p><b>Unpaved Roads</b><br/>At the direction of U.S. EPA, all public unpaved roads in OU1 and OU7 will be paved with asphalt (see cost tables for assumptions).</p> <p><b>Soil Disposal</b><br/>Alternative 2A will involve disposing of the excavated soil at an offsite permitted RCRA Subtitle D landfill in Minnesota. Alternative 2B will involve consolidation of the excavated soil onsite. For the purposes of the detailed analysis of Alternative 2B, it is assumed that the excavated soil will be consolidated under a two-foot-thick clean soil cover in OU1. The cell will be an average of about 10 feet high (approximately 15 feet maximum height). The area of the cell will be about 2.3 acres with this alternative. The side slopes of the cell will be 5:1. The base of the consolidation cell will be constructed above the 100-year frequency flood level of Cass Lake. The use of a two-foot thick soil cover is consistent with MPCA solid waste rules for industrial waste landfills. The lack of a liner and leachate collection system or a low-permeability cap is based on the low contaminant leaching potential of the soil. The consolidation cell will be surrounded by a security fence. An alternative involving an onsite RCRA Subtitle D disposal cell is not evaluated directly as it will fall within the range of Alternatives 2A and 2B.</p> |
| <p><b>Alternative 3</b><br/>Alternative 3 is the same as Alternative 2 except the 12-inch thick soil cover will be placed on industrial/commercial properties exceeding the Level 2 PRGs-R in OU1, OU2 and OU3 (rather than the Level 2 PRGs-I/C in Alternative 2). In comments to the Final Feasibility Study Report, U.S. EPA directed that institutional controls be placed on all properties</p> | <p><b>Residential Properties (OU7)</b><br/>Further definition is identical to Alternative 2 (Figure 5-2) with the additional institutional controls described in the Alternative Description for Alternative 3.</p> <p><b>Commercial/Industrial Properties (OU1, OU2 and OU3)</b><br/>Identical design features as Alternative 2 with the area exceeding the Level 2 PRGs-R covered with 12 inches of clean soil (6 inches of topsoil) (Figure 5-2) and the additional institutional</p>   |

**Table 5-1**

**Description of Alternatives Subject to Detailed Analysis  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Alternative Description   | Further Definition to Form the Basis for Detailed Analysis/Cost Estimates   |
|---|---|
| <p>that exceed the Level 1 PRGs-R after remediation. This could include as many as 100 properties in OU7 and properties owned by International Paper, BNSF, City of Cass Lake, U.S. Forest Service and Cass Forest Products in OU1, OU2 and OU3. Also, at the direction of the U.S. EPA in comments to the Final Feasibility Study Report, areas in OU2 that exceed the HSCA cleanup level for PCP and are not otherwise remediated must be covered with a 12-inch thick clean soil cover (made up of at least 6 inches of topsoil).</p> <p>Alternative 3 is described as follows:</p> <p>Place a clean soil cover and institutional controls on commercial/industrial properties exceeding the Level 2 PRGs-R in OU1, OU2, and OU3 consistent with the design of the soil cover elements in Alternative 2. Excavate soil on residential and potential residential properties in OU7 in excess of the Level 2 PRGs-R consistent with the excavation elements in Alternative 2. Re-establish vegetation and property features in the excavated areas. Place institutional controls on property exceeding the Level PRGs-R after remediation is complete. Pave the heavy machinery area at Cass Forest Products and the unpaved roads in the residential and commercial/industrial areas. Excavate soil in excess of the eco-risk PRGs in the ecological risk area in OU2 and replace with clean backfill consistent with the elements of Alternative 2. Cover soil in OU2 that exceeds the HSCA PCP cleanup level.</p> <p>Re-establish vegetation in the excavated and covered areas. Monitor the water quality of the forested wetland area east of OU1 for site-related COCs.</p> <p>Alternative 3A will involve disposal of the excavated soil offsite at a permitted RCRA Subtitle D landfill. Alternative 3B will</p> | <p>controls described in the Alternative Description for Alternative 3.</p> <p><b>Eco-Risk Area in OU2</b><br/>Further definition is identical to Alternative 2 (Figure 3-7) with the additional clean soil cover described in the Alternative Description for Alternative 3.</p> <p><b>Groundwater</b><br/>Further definition is identical to Alternative 2 (Figure 3-6).</p> <p><b>Unpaved Roads</b><br/>Further definition is identical to Alternative 2.</p> <p><b>Soil Disposal</b><br/>Further definition is identical to the design features in Alternative 2.</p> |

**Table 5-1**

**Description of Alternatives Subject to Detailed Analysis  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Alternative Description  | Further Definition to Form the Basis for Detailed Analysis/Cost Estimates   |
|--|---|
| involve disposal of the excavated soil onsite.   |   |
| <p><b>Alternative 4</b></p> <p>Alternative 4 is the same as Alternative 3 except the 12-inch thick soil cover will be placed on all properties Site-wide that exceed the Level 1 PRGs-R and are not excavated (rather than the Level 2 PRGs-R only in the industrial/commercial areas in Alternative 3). Alternative 4 is described as follows:</p> <p>Excavate soil on residential and potential residential properties in OU7 in excess of the Level 2 PRGs-R consistent with the excavation elements in Alternatives 2 and 3. Re-establish vegetation and property features in the excavated areas. Place a 12-inch thick clean soil cover on all property exceeding the Level 1 PRGs-R in OU1, OU2, OU3 and OU7 consistent with the elements of soil cover in Alternatives 2 and 3. Place institutional controls on these properties (including OU7) to protect the integrity of the cover and prevent exposure to contaminated soil and groundwater. Pave the heavy machinery area at Cass Forest Products and the unpaved roads in the residential and commercial areas. Excavate soil in excess of the eco-risk PRGs in the ecological risk area in OU2 and replace with clean backfill. At the direction of the U.S. EPA in comments to the Final Feasibility Study Report, areas in OU2 that exceed the HSCA cleanup level for PCP and are not otherwise remediated must be covered with a 12-inch thick clean soil cover (made up of at least 6 inches of topsoil). Re-establish vegetation in the excavated and covered areas. Monitor the water quality in the forested wetland area east of OU1 for site-related COCs.</p> <p>Alternative 4A will involve disposal of the excavated soil offsite at a permitted RCRA Subtitle D landfill. Alternative 4B will</p> | <p><b>Residential Properties (OU7)</b><br/>Excavation of soil is identical to Alternatives 2 and 3 with the addition of a cover with design features equal to the cover in the industrial/commercial areas in Alternatives 2 and 3 in areas with soils greater than the Level 1 PRGs-R and less than the Level 2 PRGs-R (Figure 5-3). It is estimated that as many as 120 properties in OU7 could exceed the Level 1 PRGs-R.</p> <p><b>Commercial/Industrial Properties (OU1, OU2 and OU3)</b><br/>Identical design features as Alternatives 2 and 3 with soil exceeding the Level 1 PRGs-R covered with 12 inches of clean soil (6 inches of topsoil). It is anticipated that virtually all of OU1 and OU2 exceed the Level 1 PRGs-R and that property in the Chippewa National Forest could exceed the Level 1 PRGs-R in OU3 (Figure 5-3).</p> <p><b>Eco-Risk Area in OU2</b><br/>Further definition is identical to Alternative 3 (Figure 5-3).</p> <p><b>Groundwater</b><br/>Further definition is identical to Alternatives 2 and 3 (Figure 3-6).</p> <p><b>Unpaved Roads</b><br/>Further definition is identical to Alternatives 2 and 3.</p> <p><b>Soil Disposal</b><br/>Further definition is identical to the design features in Alternatives 2 and 3.</p> |

**Table 5-1**

**Description of Alternatives Subject to Detailed Analysis  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Alternative Description  | Further Definition to Form the Basis for Detailed Analysis/Cost Estimates   |
|--|---|
| involve disposal of the excavated soil onsite.   |   |
| <p><b>Alternative 5</b></p> <p>Excavate soil Site-wide (without a 2-foot depth limitation) that exceeds Level 2 PRGs-R and replace the excavated soil to existing grade with clean soil (Figure 5-5). Excavate soil in excess of eco-risk PRGs in the ecological risk area in OU2 and replace with clean soil, covering areas in OU2 that exceed the HSCA cleanup level for PCP and are not otherwise remediated with a 12-inch thick clean soil cover (made up of at least 6 inches of topsoil). Re-establish vegetation in the backfilled and covered areas. Place institutional controls on all properties that exceed the Level 1 PRGs-R after remediation. This could include as many as 100 properties in OU7 and properties owned by International Paper, BNSF, City of Cass Lake, the U.S. Forest Service and Cass Forest Products in OU1, OU2 and OU3.</p> <p>Place institutional controls on the Site as needed to prevent exposure to contaminated groundwater. Replace excavated roads with clean fill and a gravel surface.</p> <p>Alternative 5A will involve disposal of the excavated soil offsite at a permitted RCRA Subtitle D landfill. Alternative 5B will involve disposal of the excavated soil onsite.</p> | <p><b>Residential and Commercial/Industrial Properties (OU1, OU2, OU3 and OU7)</b><br/>Identical to the design features for the excavation in the residential areas in Alternatives 2, 3 and 4, except the excavation depth will not be limited to the upper 2 feet. Excavation will proceed to the water table if concentrations below the Level 2 PRGs-R are not reached. The water table is typically present at depths ranging from 5 to 20 feet below the ground surface, depending on location (Figure 5-4).</p> <p><b>Eco-Risk Area in OU2</b><br/>Further definition is identical to Alternatives 3 and 4 (Figure 5-4).</p> <p><b>Groundwater</b><br/>Further definition is identical to Alternatives 2 through 4 (Figure 3-6).</p> <p><b>Unpaved Roads</b><br/>Gravel roads will be excavated to the Level 2 PRGs-R. Excavations will be backfilled with compacted clean fill and the roadbed will be re-established with gravel. For the purpose of the cost estimate for this alternative, the costs of excavating soil and restoring the roads were included in the costs of excavating and restoring the property. The cost of gravel surfacing was assumed to be equal to the cost of topsoil and vegetation.</p> <p><b>Soil Disposal</b><br/>Identical to the design features in Alternatives 2 through 4. The large excavated soil volumes under this alternative means that the on-Site consolidation cell will cover an area of about 32 acres in OU1 with an average height of about 9 feet.</p> |
| <p><b>Alternative 6</b></p> <p>Alternative 6 is the same as Alternative 5 except soil exceeding the Level 1 PRGs-R will be excavated Site-wide (rather than the Level 2 PRGs-R in Alternative 5). Alternative 6 is described as follows:</p> <p>Excavate soil on the Site that exceeds the Level 1 PRGs-R consistent with the excavation elements of Alternative 5.</p>  | <p><b>Residential and Commercial/Industrial Properties (OU1, OU2, OU3 and OU7)</b><br/>Identical to the design features in Alternative 5 with excavation to the Level 1 PRGs-R. The properties (except gravel roads) that would be excavated in this alternative are the same as the properties that would either be excavated or covered in Alternative 4 (Figure 5-5).</p> <p><b>Eco-Risk Area in OU2</b><br/>Further definition is identical to Alternatives 3 through 5 (Figure 5-5) except the area exceeding the HSCA PCP cleanup value will be excavated rather than covered.</p>  |

**Table 5-1**

**Description of Alternatives Subject to Detailed Analysis  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| Alternative Description   | Further Definition to Form the Basis for Detailed Analysis/Cost Estimates   |
|---|---|
| <p>Excavate soil in excess of eco-risk PRGs in the ecological risk area in OU2 and replace with clean soil, excavate areas in OU2 that exceed the HSCA cleanup level for PCP and are not otherwise remediated. Re-establish vegetation in the backfilled areas. Place institutional controls on the Site as needed to prevent exposure to contaminated groundwater. Replace excavated roads with clean fill and a gravel surface.</p> <p>Alternative 6A will involve disposal of the excavated soil offsite at a permitted RCRA Subtitle D landfill. Alternative 6B will involve disposal of the excavated soil onsite.</p>   | <p><b>Groundwater</b><br/>Further definition is identical to Alternatives 2 through 5 (Figure 3-6).</p> <p><b>Unpaved Roads</b><br/>Further definition is identical to design features in Alternative 5 with roads excavated to the Level 1 PRGs-R.</p> <p><b>Soil Disposal</b><br/>Identical to the design features in Alternative 5 with a greater volume of soil. The area of the on-Site cell will be about 56 acres or more than one-half of OU1, again with an average height of about 9 feet.</p>  |
| <p><b><u>Alternative 7</u></b></p> <p>Alternative 7 is the same as Alternative 2 except residential properties exceeding the Level 3 PRGs-R will be excavated and industrial/commercial properties exceeding the Level 3 PRGs-I/C will be covered (rather than the Level 2 PRGs-R and Level 2 PRGs-I/C in Alternative 2). Alternative 7 is described as follows:</p> <p>Place a clean soil cover on commercial/industrial property exceeding the Level 3 PRGs-I/C in OU1, OU2 and OU3 consistent with the covering elements of Alternative 2. Place institutional controls on these properties to protect the integrity of the cover and on all of OU1, OU2 and OU3 as appropriate to prevent exposure to contaminated soil and groundwater. Excavate soil on residential and potential residential properties in OU7 exceeding the Level 3 PRGs-R to a maximum depth of 2 feet consistent with excavation elements in Alternatives 2 through 4. Pave the heavy machinery area at Cass Forest Products and the unpaved roads in the residential and commercial/industrial areas that exceed a <math>1 \times 10^{-4}</math> cancer risk/HI=1 level of protection. Excavate soil in excess of the eco-risk PRGs in the ecological risk area in OU2 and replace</p> | <p><b>Residential Properties (OU7)</b><br/>Identical to excavation elements in Alternative 2 with excavation of soil exceeding the Level 3 PRGs-R. It is estimated that three properties would be remediated in OU7 under this alternative.</p> <p><b>Commercial/Industrial Properties (OU1, OU2 and OU3)</b><br/>Identical to the design features in Alternative 2 with covering of soil exceeding the Level 3 PRGs-I/C (Figure 5-6).</p> <p><b>Eco-Risk Area in OU2</b><br/>Further definition is identical to Alternative 2 (Figure 3-7).</p> <p><b>Groundwater</b><br/>Further definition is identical to Alternatives 2 through 6 (Figure 3-6).</p> <p><b>Unpaved Roads</b><br/>Identical to the design features in Alternatives 2 through 4. For the purpose of the cost estimate for this alternative, it was assumed that the same percentage of the public, unpaved roads in OU1 and OU7 would be paved as was used for covering OU1 under this alternative.</p> <p><b>Soil Disposal</b><br/>The features of the on-Site disposal cell are identical to the design features in Alternatives 2 through 4 with about the same area, volume and average height.</p> |

**Table 5-1**

**Description of Alternatives Subject to Detailed Analysis  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| <b>Alternative Description</b>   | <b>Further Definition to Form the Basis for Detailed Analysis/Cost Estimates</b>   |
|--|--|
| <p>with clean backfill as in Alternative 2.</p> <p>Monitor the water quality of the forested wetland area east of OU1 for Site-related COCs as in Alternatives 2 through 4.</p> <p>Alternative 7A will involve disposal of the excavated soil offsite at a permitted RCRA Subtitle D landfill. Alternative 7B will involve disposal of the excavated soil onsite.</p>  |  |
| <p><b><u>Alternative 8</u></b></p> <p>Alternative 8 is the same as Alternative 7 except the clean soil cover will be placed over industrial/commercial properties exceeding the Level 3 PRGs-R in OU1, OU2 and OU3 (rather than the Level 3 PRGs-I/C in Alternative 7). Alternative 8 is described as follows:</p> <p>Place a clean soil cover on commercial/industrial property exceeding the Level 3 PRGs-R in OU1, OU2 and OU3 consistent with the covering elements of Alternative 7. Place institutional controls on these properties to protect the integrity of the cover and on all of OU1, OU2 and OU3 as appropriate to prevent exposure to contaminated soil and groundwater. Excavate soil on residential properties in OU7 in excess of the Level 3 PRGs-R consistent with excavation elements in Alternatives 2 through 4 and 7. Pave the heavy machinery area at Cass Forest Products and the unpaved roads in the residential and commercial/industrial areas that exceed a <math>1 \times 10^{-4}</math> cancer risk/HI=1 level of protection. Excavate soil in excess of the eco-risk PRGs in the ecological risk area in OU2 and replace with clean backfill as in Alternative 2.</p> <p>Monitor the water quality of the forested wetland area east of OU1 for Site-related COCs as in Alternatives 2 through 4 and 7.</p> <p>Alternative 8A will involve disposal of the excavated soil offsite</p> | <p><b>Residential Properties (OU7)</b><br/>Identical to excavation elements in Alternative 2 excavation of soil exceeding the Level 3 PRGs-R. It is estimated that three properties would be remediated in OU7 under this alternative.</p> <p><b>Commercial/Industrial Properties (OU1, OU2 and OU3)</b><br/>Identical to the design features in Alternative 2 with covering of soil exceeding the Level 3 PRGs-R (Figure 5-7).</p> <p><b>Eco-Risk Area in OU2</b><br/>Further definition is identical to Alternative 2 (Figure 3-7).</p> <p><b>Groundwater</b><br/>Further definition is identical to Alternatives 2 through 7 (Figure 3-6).</p> <p><b>Unpaved Roads</b><br/>Identical to the design features and areas paved in Alternative 7.</p> <p><b>Soil Disposal</b><br/>The design features of the on-Site cell are identical to the design features in Alternatives 2 through 4 and 7 with the same volume as Alternative 7.</p> |

**Table 5-1**

**Description of Alternatives Subject to Detailed Analysis  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

| <b>Alternative Description</b>   | <b>Further Definition to Form the Basis for Detailed Analysis/Cost Estimates</b> |
|--|--|
| at a permitted Subtitle D landfill. Alternative 8B will involve disposal of the excavated soil onsite. |  |



**Table 5-2  
Environmental and Safety Impacts of Alternatives  
Revised Final Feasibility Study - St. Regis Paper Company Site - Cass Lake, MN**

| Alternative                          | Excavated Soil   | Cover Soil     | Clean Soil     | Truck-Loads Disposal | Truck-Loads Clean Soil | Total Truck-Loads | Truck-Miles Disposal | Truck-Miles Clean Soil | Total Miles       | CO <sub>2</sub>  | CH <sub>4</sub>  | N <sub>2</sub> O | CO <sub>2</sub> Equivalent | Equivalent Power | Equivalent Home Usage | Truck-related Fatalities | Truck-related Injuries | PM10      | CO        | NOx       | SOx       | CO <sub>2</sub> | CH <sub>4</sub> | Criteria Pollutants |  |
|--------------------------------------|------------------|----------------|----------------|----------------------|------------------------|-------------------|----------------------|------------------------|-------------------|------------------|------------------|------------------|----------------------------|------------------|-----------------------|--------------------------|------------------------|-----------|-----------|-----------|-----------|-----------------|-----------------|---------------------|--|
|                                      | Estimated [CY]   | [CY]           | Estimated [CY] | Estimated            | Estimated              | Estimated         | Estimated [miles]    | Estimated [miles]      | Estimated [miles] | Estimated [Tons] | Estimated [Tons] | Estimated [Tons] | Estimated [Tons]           | Estimated [MWh]  | Estimated             | Estimated                | Estimated              | Estimated | Estimated | Estimated | Estimated | Estimated       | Estimated       | Estimated           |  |
| <b>Alternative 5B</b>                |                  |                |                |                      |                        |                   |                      |                        |                   |                  |                  |                  |                            |                  |                       |                          |                        |           |           |           |           |                 |                 |                     |  |
| OU1-Excavate Soils > Level 2 PRGs-R  | 248,000          | 0              | 248,000        | 0                    | 16,533                 | 16,533            | 0                    | 661,333                | 661,333           | 1,392            | 3.7E-03          | 3.5E-03          | 1,394                      | 1,677            | 180                   | 1.7E-02                  | 2.9E-01                | 6.6E-01   | 4.2E+00   | 1.4E+01   | 1.3E-02   | 1.4E+03         | 5.0E-02         | 1.411               |  |
| OU1-Cover Soils (Consolidation Cell) | 0                | 110,900        | 110,900        | 0                    | 7,393                  | 7,393             | 0                    | 295,733                | 295,733           | 623              | 1.7E-03          | 1.6E-03          | 623                        | 750              | 81                    | 7.4E-03                  | 1.3E-01                | 3.0E-01   | 1.9E+00   | 6.2E+00   | 5.9E-03   | 6.2E+02         | 2.3E-02         | 631                 |  |
| OU2-Excavate Soils > Eco-PRGs        | 10,300           | 12,400         | 22,700         | 0                    | 1,513                  | 1,513             | 0                    | 60,533                 | 60,533            | 127              | 3.4E-04          | 3.2E-04          | 128                        | 153              | 17                    | 1.5E-03                  | 2.7E-02                | 6.0E-02   | 3.9E-01   | 1.3E+00   | 1.2E-03   | 1.3E+02         | 4.6E-03         | 129                 |  |
| OU2-Excavate Soils > Level 2 PRGs-R  | 37,000           | 0              | 37,000         | 0                    | 2,467                  | 2,467             | 0                    | 98,667                 | 98,667            | 208              | 5.5E-04          | 5.2E-04          | 208                        | 250              | 27                    | 2.5E-03                  | 4.4E-02                | 9.8E-02   | 6.3E-01   | 2.1E+00   | 2.0E-03   | 2.1E+02         | 7.5E-03         | 211                 |  |
| OU3-Excavate Soils > Level 2 PRGs-R  | 48,400           | 0              | 48,400         | 0                    | 3,227                  | 3,227             | 0                    | 129,067                | 129,067           | 272              | 7.2E-04          | 6.8E-04          | 272                        | 327              | 35                    | 3.2E-03                  | 5.7E-02                | 1.3E-01   | 8.3E-01   | 2.7E+00   | 2.6E-03   | 2.7E+02         | 9.8E-03         | 275                 |  |
| OU7-Excavate Soils > Level 2 PRGs-R  | 19,700           | 0              | 19,700         | 0                    | 1,313                  | 1,313             | 0                    | 52,533                 | 52,533            | 111              | 2.9E-04          | 2.8E-04          | 111                        | 133              | 14                    | 1.3E-03                  | 2.3E-02                | 5.2E-02   | 3.4E-01   | 1.1E+00   | 1.1E-03   | 1.1E+02         | 4.0E-03         | 112                 |  |
| <b>Alternative 5B - Totals</b>       | <b>363,400</b>   | <b>123,300</b> |                |                      |                        | <b>32,447</b>     |                      |                        |                   |                  |                  |                  |                            | <b>3,291</b>     | <b>354</b>            | <b>3.2E-02</b>           | <b>5.8E-01</b>         |           |           |           |           |                 |                 | <b>2,769</b>        |  |
| <b>Alternative 6A</b>                |                  |                |                |                      |                        |                   |                      |                        |                   |                  |                  |                  |                            |                  |                       |                          |                        |           |           |           |           |                 |                 |                     |  |
| OU1-Excavate Soils > Level 1 PRGs-R  | 785,000          | 0              | 785,000        | 52,333               | 52,333                 | 104,667           | 15,700,000           | 2,093,333              | 17,793,333        | 37,462           | 1.0E-01          | 9.4E-02          | 37,493                     | 45,113           | 4,851                 | 4.4E-01                  | 7.9E+00                | 1.8E+01   | 1.1E+02   | 3.7E+02   | 3.6E-01   | 3.7E+04         | 1.4E+00         | 37,968              |  |
| OU2-Excavate Soils > Eco-PRGs        | 10,300           | 0              | 10,300         | 687                  | 687                    | 1,373             | 206,000              | 27,467                 | 233,467           | 492              | 1.3E-03          | 1.2E-03          | 492                        | 592              | 64                    | 5.8E-03                  | 1.0E-01                | 2.3E-01   | 1.5E+00   | 4.9E+00   | 4.7E-03   | 4.9E+02         | 1.8E-02         | 498                 |  |
| OU2-Excavate Soils > Level 1 PRGs-R  | 123,400          | 0              | 123,400        | 8,227                | 8,227                  | 16,453            | 2,468,000            | 329,067                | 2,797,067         | 5,889            | 1.6E-02          | 1.5E-02          | 5,894                      | 7,092            | 763                   | 7.0E-02                  | 1.2E+00                | 2.8E+00   | 1.8E+01   | 5.9E+01   | 5.6E-02   | 5.9E+03         | 2.1E-01         | 5,968               |  |
| OU3-Excavate Soils > Level 1 PRGs-R  | 122,600          | 0              | 122,600        | 8,173                | 8,173                  | 16,347            | 2,452,000            | 326,933                | 2,778,933         | 5,851            | 1.6E-02          | 1.5E-02          | 5,856                      | 7,046            | 758                   | 6.9E-02                  | 1.2E+00                | 2.8E+00   | 1.8E+01   | 5.8E+01   | 5.6E-02   | 5.9E+03         | 2.1E-01         | 5,930               |  |
| OU7-Excavate Soils > Level 1 PRGs-R  | 115,700          | 0              | 115,700        | 7,713                | 7,713                  | 15,427            | 2,314,000            | 308,533                | 2,622,533         | 5,521            | 1.5E-02          | 1.4E-02          | 5,526                      | 6,649            | 715                   | 6.6E-02                  | 1.2E+00                | 2.6E+00   | 1.7E+01   | 5.5E+01   | 5.3E-02   | 5.5E+03         | 2.0E-01         | 5,596               |  |
| <b>Alternative 6A - Totals</b>       | <b>1,157,000</b> | <b>0</b>       |                |                      |                        | <b>154,267</b>    |                      |                        |                   |                  |                  |                  | <b>66,491</b>              | <b>7,150</b>     | <b>6.6E-01</b>        | <b>1.2E+01</b>           |                        |           |           |           |           |                 |                 | <b>55,960</b>       |  |
| <b>Alternative 6B</b>                |                  |                |                |                      |                        |                   |                      |                        |                   |                  |                  |                  |                            |                  |                       |                          |                        |           |           |           |           |                 |                 |                     |  |
| OU1-Excavate Soils > Level 1 PRGs-R  | 190,000          | 0              | 190,000        | 0                    | 12,667                 | 12,667            | 0                    | 506,667                | 506,667           | 1,067            | 2.8E-03          | 2.7E-03          | 1,068                      | 1,285            | 138                   | 1.3E-02                  | 2.3E-01                | 5.1E-01   | 3.2E+00   | 1.1E+01   | 1.0E-02   | 1.1E+03         | 3.9E-02         | 1,081               |  |
| OU1-Cover Soils (Consolidation Cell) | 0                | 168,400        | 168,400        | 0                    | 11,227                 | 11,227            | 0                    | 449,067                | 449,067           | 945              | 2.5E-03          | 2.4E-03          | 946                        | 1,139            | 122                   | 1.1E-02                  | 2.0E-01                | 4.5E-01   | 2.9E+00   | 9.4E+00   | 9.0E-03   | 9.5E+02         | 3.4E-02         | 958                 |  |
| OU2-Excavate Soils > Eco-PRGs        | 10,300           | 0              | 10,300         | 0                    | 687                    | 687               | 0                    | 27,467                 | 27,467            | 58               | 1.5E-04          | 1.5E-04          | 58                         | 70               | 7                     | 6.9E-04                  | 1.2E-02                | 2.7E-02   | 1.8E-01   | 5.7E-01   | 5.5E-04   | 5.8E+01         | 2.1E-03         | 59                  |  |
| OU2-Excavate Soils > Level 1 PRGs-R  | 123,400          | 0              | 123,400        | 0                    | 8,227                  | 8,227             | 0                    | 329,067                | 329,067           | 693              | 1.8E-03          | 1.7E-03          | 693                        | 834              | 90                    | 8.2E-03                  | 1.5E-01                | 3.3E-01   | 2.1E+00   | 6.9E+00   | 6.6E-03   | 6.9E+02         | 2.5E-02         | 702                 |  |
| OU3-Excavate Soils > Level 1 PRGs-R  | 122,600          | 0              | 122,600        | 0                    | 8,173                  | 8,173             | 0                    | 326,933                | 326,933           | 688              | 1.8E-03          | 1.7E-03          | 689                        | 829              | 89                    | 8.2E-03                  | 1.5E-01                | 3.3E-01   | 2.1E+00   | 6.8E+00   | 6.6E-03   | 6.9E+02         | 2.5E-02         | 698                 |  |
| OU7-Excavate Soils > Level 1 PRGs-R  | 115,700          | 0              | 115,700        | 0                    | 7,713                  | 7,713             | 0                    | 308,533                | 308,533           | 650              | 1.7E-03          | 1.6E-03          | 650                        | 782              | 84                    | 7.7E-03                  | 1.4E-01                | 3.1E-01   | 2.0E+00   | 6.5E+00   | 6.2E-03   | 6.5E+02         | 2.4E-02         | 658                 |  |
| <b>Alternative 6B - Totals</b>       | <b>562,000</b>   | <b>168,400</b> |                |                      |                        | <b>48,693</b>     |                      |                        |                   |                  |                  |                  | <b>4,938</b>               | <b>531</b>       | <b>4.9E-02</b>        | <b>8.7E-01</b>           |                        |           |           |           |           |                 |                 | <b>4,156</b>        |  |
| <b>Alternative 7A</b>                |                  |                |                |                      |                        |                   |                      |                        |                   |                  |                  |                  |                            |                  |                       |                          |                        |           |           |           |           |                 |                 |                     |  |
| OU1-Cover Soils > Level 3 PRGs-I/C   | 0                | 6,000          | 6,000          | 0                    | 400                    | 400               | 0                    | 16,000                 | 16,000            | 34               | 9.0E-05          | 8.4E-05          | 34                         | 41               | 4                     | 4.0E-04                  | 7.1E-03                | 1.6E-02   | 1.0E-01   | 3.3E-01   | 3.2E-04   | 3.4E+01         | 1.2E-03         | 34                  |  |
| OU2-Excavate Soils > Eco-PRGs        | 10,300           | 0              | 10,300         | 687                  | 687                    | 1,373             | 206,000              | 27,467                 | 233,467           | 492              | 1.3E-03          | 1.2E-03          | 492                        | 592              | 64                    | 5.8E-03                  | 1.0E-01                | 2.3E-01   | 1.5E+00   | 4.9E+00   | 4.7E-03   | 4.9E+02         | 1.8E-02         | 498                 |  |
| OU2-Cover Soils > Level 3 PRGs-I/C   | 0                | 0              | 0              | 0                    | 0                      | 0                 | 0                    | 0                      | 0                 | 0                | 0.0E+00          | 0.0E+00          | 0                          | 0                | 0                     | 0.0E+00                  | 0.0E+00                | 0.0E+00   | 0.0E+00   | 0.0E+00   | 0.0E+00   | 0.0E+00         | 0.0E+00         | 0                   |  |
| OU3-Cover Soils > Level 3 PRGs-I/C   | 0                | 3,200          | 3,200          | 0                    | 213                    | 213               | 0                    | 8,533                  | 8,533             | 18               | 4.8E-05          | 4.5E-05          | 18                         | 22               | 2                     | 2.1E-04                  | 3.8E-03                | 8.5E-03   | 5.5E-02   | 1.8E-01   | 1.7E-04   | 1.8E+01         | 6.5E-04         | 18                  |  |
| OU7-Excavate Soils > Level 3 PRGs-R  | 17,300           | 0              | 17,300         | 1,153                | 1,153                  | 2,307             | 346,000              | 46,133                 | 392,133           | 826              | 2.2E-03          | 2.1E-03          | 826                        | 994              | 107                   | 9.8E-03                  | 1.7E-01                | 3.9E-01   | 2.5E+00   | 8.2E+00   | 7.9E-03   | 8.3E+02         | 3.0E-02         | 837                 |  |
| <b>Alternative 7A - Totals</b>       | <b>27,600</b>    | <b>9,200</b>   |                |                      |                        | <b>4,293</b>      |                      |                        |                   |                  |                  |                  | <b>1,648</b>               | <b>177</b>       | <b>1.6E-02</b>        | <b>2.9E-01</b>           |                        |           |           |           |           |                 |                 | <b>1,387</b>        |  |
| <b>Alternative 7B</b>                |                  |                |                |                      |                        |                   |                      |                        |                   |                  |                  |                  |                            |                  |                       |                          |                        |           |           |           |           |                 |                 |                     |  |
| OU1-Cover Soils > Level 3 PRGs-I/C   | 0                | 6,000          | 6,000          | 0                    | 400                    | 400               | 0                    | 16,000                 | 16,000            | 34               | 9.0E-05          | 8.4E-05          | 34                         | 41               | 4                     | 4.0E-04                  | 7.1E-03                | 1.6E-02   | 1.0E-01   | 3.3E-01   | 3.2E-04   | 3.4E+01         | 1.2E-03         | 34                  |  |
| OU1-Cover Soils (Consolidation Cell) | 0                | 7,400          | 7,400          | 0                    | 493                    | 493               | 0                    | 19,733                 | 19,733            | 42               | 1.1E-04          | 1.0E-04          | 42                         | 50               | 5                     | 4.9E-04                  | 8.8E-03                | 2.0E-02   | 1.3E-01   | 4.1E-01   | 4.0E-04   | 4.2E+01         | 1.5E-03         | 42                  |  |
| OU2-Excavate Soils > Eco-PRGs        | 10,300           | 0              | 10,300         | 0                    | 687                    | 687               | 0                    | 27,467                 | 27,467            | 58               | 1.5E-04          | 1.5E-04          | 58                         | 70               | 7                     | 6.9E-04                  | 1.2E-02                | 2.7E-02   | 1.8E-01   | 5.7E-01   | 5.5E-04   | 5.8E+01         | 2.1E-03         | 59                  |  |
| OU2-Cover Soils > Level 3 PRGs-I/C   | 0                | 0              | 0              | 0                    | 0                      | 0                 | 0                    | 0                      | 0                 | 0                | 0.0E+00          | 0.0E+00          | 0                          | 0                | 0                     | 0.0E+00                  | 0.0E+00                | 0.0E+00   | 0.0E+00   | 0.0E+00   | 0.0E+00   | 0.0E+00         | 0.0E+00         | 0                   |  |
| OU3-Cover Soils > Level 3 PRGs-I/C   | 0                | 3,200          | 3,200          | 0                    | 213                    | 213               | 0                    | 8,533                  | 8,533             | 18               | 4.8E-05          | 4.5E-05          | 18                         | 22               | 2                     | 2.1E-04                  | 3.8E-03                | 8.5E-03   | 5.5E-02   | 1.8E-01   | 1.7E-04   | 1.8E+01         | 6.5E-04         | 18                  |  |
| OU7-Excavate Soils > Level 3 PRGs-R  | 15,700           | 0              | 15,700         | 0                    | 1,047                  | 1,047             | 0                    | 41,867                 | 41,867            | 88               | 2.3E-04          | 2.2E-04          | 88                         | 106              | 11                    | 1.0E-03                  | 1.9E-02                | 4.2E-02   | 2.7E-01   | 8.8E-01   | 8.4E-04   | 8.8E+01         | 3.2E-03         | 89                  |  |
| <b>Alternative 7B - Totals</b>       | <b>26,000</b>    | <b>16,600</b>  |                |                      |                        | <b>2,840</b>      |                      |                        |                   |                  |                  |                  | <b>288</b>                 | <b>31</b>        | <b>2.8E-03</b>        | <b>5.1E-02</b>           |                        |           |           |           |           |                 |                 | <b>242</b>          |  |
| <b>Alternative 8A</b>                |                  |                |                |                      |                        |                   |                      |                        |                   |                  |                  |                  |                            |                  |                       |                          |                        |           |           |           |           |                 |                 |                     |  |
| OU1-Cover Soils > Level 3 PRGs-R     | 0                | 78,800         | 78,800         | 0                    | 5,253                  | 5,253             | 0                    | 210,133                | 210,133           | 442              | 1.2E-03          | 1.1E-03          | 443                        | 533              | 57                    | 5.3E-03                  | 9.4E-02                | 2.1E-01   | 1.3E+00   | 4.4E+00   | 4.2E-03   | 4.4E+02         | 1.6E-02         | 448                 |  |
| OU2-Excavate Soils > Eco-PRGs        | 10,300           | 0              | 10,300         | 687                  | 687                    | 1,373             | 206,000              | 27,467                 | 233,467           | 492              | 1.3E-03          | 1.2E-03          | 492                        | 592              | 64                    | 5.8E-03                  | 1.0E-01                | 2.3E-01   | 1.5E+00   | 4.9E+00   | 4.7E-03   | 4.9E+02         | 1.8E-02         | 498                 |  |
| OU2-Cover Soils > Level 3 PRGs-R     | 0                | 17,000         | 17,000         | 0                    | 1,133                  | 1,133             | 0                    | 45,333                 | 45,333            | 95               | 2.5E-04          | 2.4E-04          | 96                         | 115              | 12                    | 1.1E-03                  | 2.0E-02                | 4.5E-02   | 2.9E-01   | 9.5E-01   | 9.1E-04   | 9.5E+01         | 3.5E-03         | 97                  |  |
| OU3-Cover Soils > Level 3 PRGs-R     | 0                | 8,000          | 8,000          | 0                    | 533                    | 533               | 0                    | 21,333                 | 21,333            | 45               | 1.2E-04          | 1.1E-04          | 45                         | 54               | 6                     | 5.3E-04                  | 9.5E-03                | 2.1E-02   | 1.4E-01   | 4.5E-01   | 4.3E-04   | 4.5E+01         | 1.6E-03         | 46                  |  |
| OU7-Excavate Soils > Level 3 PRGs-R  | 17,300           | 0              | 17,300         | 1,153                | 1,153                  | 2,307             | 346,000              | 46,133                 | 392,133           | 826              | 2.2E-03          | 2.1E-03          | 826                        | 994              | 107                   | 9.8E-03                  | 1.7E-01                | 3.9E-01   | 2.5E+00   | 8.2E+00   | 7.9E-03   | 8.3E+02         | 3.0E-02         | 837                 |  |
| <b>Alternative 8A - Totals</b>       | <b>27,600</b>    | <b>103,800</b> |                |                      |                        | <b>10,600</b>     |                      |                        |                   |                  |                  |                  | <b>2,288</b>               | <b>246</b>       | <b>2.3E-02</b>        | <b>4.0E-01</b>           |                        |           |           |           |           |                 |                 | <b>1,926</b>        |  |
| <b>Alternative 8B</b>                |                  |                |                |                      |                        |                   |                      |                        |                   |                  |                  |                  |                            |                  |                       |                          |                        |           |           |           |           |                 |                 |                     |  |
| OU1-Cover Soils > Level 3 PRGs-R     | 0                | 78,800         | 78,800         | 0                    | 5,253                  | 5,253             | 0                    | 210,133                | 210,133           | 442              | 1.2E-03          | 1.1E-03          | 443                        | 533              | 57                    | 5.3E-03                  | 9.4E-02                | 2.1E-01   | 1.3E+00   | 4.4E+00   | 4.2E-03   | 4.4E+02         | 1.6E-02         | 448                 |  |
| OU1-Cover Soils (Consolidation Cell) | 0                | 7,400          | 7,400          | 0                    | 493                    | 493               | 0                    | 19,733                 | 19,733            | 42               | 1.1E-04          | 1.0E-04          | 42                         | 50               | 5                     | 4.9E-04                  | 8.8E-03                |           |           |           |           |                 |                 |                     |  |

**Table 5-2**  
**Environmental and Safety Impacts of Alternatives**  
**Revised Final Feasibility Study, St. Regis Paper Company Site - Cass Lake, MN**

**Notes:**

- Truck load is 15 cubic yards (22 tons)
- Haul distance to landfill is 300 miles (roundtrip) (assumed)
- Haul distance for clean soil is 40 miles (roundtrip) (assumed)
- Truck-related Fatalities: 2.5 fatalities per 100 million vehicle miles traveled (USDOT 2009)
- Truck-related Injuries: 44.5 persons injured per 100 million vehicle miles traveled (USDOT 2009)

**Reference:**

USDOT 2009. *Large Truck and Bus Crash Facts 2007*, US DOT Analysis Division, Federal Motor Carrier, Safety Administration, January 2009

**Emissions Factors for Criteria Pollutants**

|      |         |       |   |
|------|---------|-------|---|
| PM10 | 0.00200 | lb/mi |   |
| CO   | 0.01282 | lb/mi |   |
| NOx  | 0.04185 | lb/mi | California Air Resources Board's EMFAC2007, Heavy-Heavy-Duty Diesel Trucks (33,001-60,000 lbs), Year 2009, Model years 1965-2009<br>( <a href="http://www.aqmd.gov/CEQA/handbook/onroad/onroad.html">http://www.aqmd.gov/CEQA/handbook/onroad/onroad.html</a> ) |
| SOx  | 0.00004 | lb/mi |   |
| CO2  | 4.21081 | lb/mi |   |
| CH4  | 0.00015 | lb/mi |   |

**Emission Factors for Greenhouse Gases**

|     |         |                   |  |
|-----|---------|-------------------|--|
| CO2 | 4.21    | lb/mi (@ 5.3 mpg) | The Climate Registry General Reporting Protocol, May 2008, Table 13.1, Diesel Fuel |
| CH4 | 1.1E-05 | lb/mi             |  |
| N2O | 1.1E-05 | lb/mi             |  |

**CO2-equivalent Factors for Greenhouse Gases**

|     |     |  |   |
|-----|-----|--|---|
| CO2 | 1   |  | The Climate Registry General Reporting Protocol, May 2008, Appendix B - Global Warming Potentials |
| CH4 | 21  |  |   |
| N2O | 310 |  |   |

**Typical Energy Usage**

|   |                      |   |
|---|----------------------|---|
| Average emissions from a MN electricity provider: | 1,662.30 lb CO2/MWh. | MPCA General Guidance for Carbon Footprint Development in Environmental Review, Table 5   |
| Electricity used by typical US home:              | 9300 kWh/yr          | ( <a href="http://www.homeenergy.org/archive/hem.dis.anl.gov/eehem/93/930509.html">http://www.homeenergy.org/archive/hem.dis.anl.gov/eehem/93/930509.html</a> ) |

**Table 5-3**  
**Estimate of Lost Carbon Sequestration from Tree Clearing**  
**Revised Final Feasibility Study, St. Regis Paper Company Site - Cass Lake, MN**

| Alternative | Estimated Area of 20-yr-old Trees Cleared (Acres) |     |     | Estimated Area of 50-yr-old Trees Cleared (Acres) |     | Estimated Total Carbon Lost from Sequestration (tons of CO <sub>2</sub> equivalents Lost)* |
|-------------|---|-----|-----|---|-----|--|
|             | OU1   | OU2 | OU3 | Forest in OU3                                     | OU7 |  |
| 2           | 3   | 6   | 5   | 0   | 0   | 4,000  |
| 3           | 23  | 18  | 5   | 0   | 0   | 13,400   |
| 4           | 23  | 18  | 8   | 18  | 17  | 25,900   |
| 5           | 23  | 18  | 5   | 0   | 0   | 13,400   |
| 6           | 23  | 18  | 8   | 18  | 17  | 25,900   |
| 7           | 0   | 2   | 2   | 0   | 0   | 1,100  |
| 8           | 3   | 11  | 5   | 0   | 0   | 5,400  |

\*Assumptions include red pine trees, loamy soil, mineral, reforestation for Emission Factors from COLE, 2009.

**Table 5-4**

**Comparative Analysis Summary  
Revised Final Feasibility Study, St. Regis Paper Company Site – Cass Lake, MN**

|  | <b>Alternative<br/>1</b> | <b>Alternative<br/>2</b> | <b>Alternative<br/>3</b> | <b>Alternative<br/>4</b> | <b>Alternative<br/>5</b> | <b>Alternative<br/>6</b> | <b>Alternative<br/>7</b> | <b>Alternative<br/>8</b> |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Overall Protection of Public Health and the Environment      | 1                        | 2                        | 3                        | 3                        | 4                        | 4                        | 2                        | 3                        |
| Compliance with ARARs  | 1                        | 4                        | 4                        | 4                        | 4                        | 4                        | 4                        | 4                        |
| Long-Term Effectiveness and Permanence                       | 1                        | 3                        | 3                        | 3                        | 4                        | 4                        | 3                        | 3                        |
| Reduction of Toxicity, Mobility and Volume through Treatment | 1                        | 1                        | 1                        | 1                        | 1                        | 1                        | 1                        | 1                        |
| Short-Term Effectiveness                                     | 4                        | 2                        | 2                        | 1                        | 1                        | 1                        | 3                        | 2                        |
| Implementability   | 4                        | 2                        | 1                        | 1                        | 1                        | 1                        | 3                        | 2                        |
| Cost (\$ Million)  | \$0                      | \$21M                    | \$29M                    | \$45M                    | \$45M-100M               | \$80M-200M               | \$12M                    | \$21M                    |

1 = Poor

2 = Satisfactory

3 = Better than satisfactory

4 = Good