ASSESSMENT PLAN
for the
NATURAL RESOURCE DAMAGE ASSESSMENT
at the
ST. LOUIS RIVER INTERLAKE/DULUTH TAR SITE

9/24/02

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List of Acronyms

AOC - Area of Concern
BIA - Bureau of Indian Affairs
BTEX - Benzene, Toluene, Ethylbenzene, and Xylene compounds
CAC - St. Louis River Citizen Action Committee
CAD - Contained Aquatic Disposal Facility
CAS# - Chemical Abstracts Service (Registry Number)
CDF - Confined Disposal Facility
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
COC - Contaminants of Concern
cPAH - Carcinogen Polycyclic Aromatic Hydrocarbons
CWA - Clean Water Act
DOC - Department of Commerce
DOI - Department of the Interior
EPA - Environmental Protection Agency
FWPCA - Federal Water Pollution Control Act
FWS - U. S. Fish and Wildlife Service
MDH - Minnesota Department of Health
MDNR - Minnesota Department of Natural Resources
MERLA - Minnesota Environmental Response and Liability Act
MOA - Memorandum of Agreement
MPCA - Minnesota Pollution Control Agency
NCP - National Oil and Hazardous Substances Pollution Contingency Plan
NOAA - National Oceanic and Atmospheric Administration
NOI - Notice of Intent
NPL - National Priorities List
NRDA - Natural Resource Damage Assessment
OU - Operable Unit
PAH - Polycyclic Aromatic Hydrocarbons
PAS - Preassessment Screen
PED - Preliminary Estimate of Damages
POTW - Publicly Owned Treatment Works
ppm - parts per million (mg/kg)
ppb - parts per billion (Fg/kg)
R-EMAP - Regional Environmental Monitoring and Assessment Program
QA - Quality Assurance
QAPP - Quality Assurance Project Plan

QC - Quality Control
RCDP - Restoration and Compensation Determination Plan
RI/FS - Remedial Investigation/Feasibility Study
ROD - Record of Decision
RPs - Responsible Parties
SDAR - Supplemental Detailed Analysis Report, Wetland Cap Alternative
SDWA - Safe Drinking Water Act
SedOU - Sediments Operable Unit
SEL - Ontario Severe Effects Level
SLRIDT - St. Louis River/Interlake/Duluth Tar
SOU - Soils Operable Unit
SVOC - Semi-volatile Organic Compounds
tPAH - Total Polycyclic Aromatic Hydrocarbons
VOC - Volatile Organic Compounds

EXECUTIVE SUMMARY

The St. Louis River/Interlake/Duluth Tar (SLRIDT) Superfund Site is located on the St. Louis River in Duluth, Minnesota and Superior, Wisconsin. Due to the release of hazardous substances from industrial activities, the SLRIDT Site was included on the Superfund National Priorities List in 1983 by the United States Environmental Protection Agency. Three units were identified in 1986 for cleanup (remedial) activities: tar seeps, soils, and sediments. Remedial actions have been completed on the tar seeps and soils units; a remedial investigation/feasibility study is currently ongoing to determine cleanup activities for the sediments unit. The Minnesota Pollution Control Agency is acting as the lead response agency for overseeing cleanup activities at the SLRIDT Site.

Under federal regulation, the Federal government, States, and Indian tribes are authorized as ***natural resource trustees*** to recover damages from responsible parties for injuries to natural resources caused by the release of hazardous substances. This process is intended to compensate the public for lost natural resources and to restore services provided by those resources. At the SLRIDT Site, the natural resource trustees include:

- Minnesota Pollution Control Agency
- Minnesota Department of Natural Resources
- Fond du Lac Band of Lake Superior Chippewa
- 1854 Authority (representing the Bois Forte Band and Grand Portage Band of Lake Superior Chippewa
- United States Department of Interior (Fish and Wildlife Service, Bureau of Indian Affairs)
- United States Department of Commerce (National Oceanic and Atmospheric Administration)

The trustees have developed a Memorandum of Agreement that provides a framework for continued cooperation and coordination. The trustees have determined through a Preassessment Screen that further investigation and assessment is warranted at the SLRIDT Site. A Notice of Intent was issued to the responsible parties in December 2001, indicating that the trustees intend to proceed with a **Natural Resource Damage Assessment** (NRDA) for the Site.

The purpose of this Assessment Plan is to guide the actions of the trustees through the NRDA process. Before proceeding, the trustees must document that potentially injured natural resources have been exposed to hazardous substances released from the Site. This confirmation of exposure at the SLRIDT Site focuses primarily on polycyclic aromatic hydrocarbons (PAHs)

and mercury, which are associated with past operations on the Site. PAH and mercury concentrations in sediments and groundwater at the Site are elevated in comparison to other areas of the St. Louis River. Soils were documented to contain semi-volatile organic compounds and mercury. Biological resources have also been exposed to both PAHs and mercury. Benthic invertebrates collected at the Site have been found to contain higher levels of PAHs than those at other locations in the St. Louis River. PAHs have also been detected in aquatic plants, fish, and birds; and mercury has been detected in plankton, aquatic plants, fish, and birds. This exposure indicates that natural resources may have been injured as a result of releases of hazardous substances at the SLRIDT Site. The trustees therefore believe that further assessment of these injuries is warranted.

The recovery period for injured natural resources at the SLRIDT Site is dependent upon the extent to which exposure to hazardous substances, especially PAHs and mercury, is reduced by the cleanup. Currently, four remedial alternatives are under consideration: no action, dredging and in-water containment, wetland capping, and dredging and off-site disposal.

This Assessment Plan outlines the trustees' methods to document and evaluate potentially injured resources at the SLRIDT Site. The trustees intend to focus on the loss of ecological and human use services resulting from injuries to natural resources. Such lost services may include impaired benthic/fish/wildlife habitat, reduced recreational opportunities, lost Native American cultural uses, decreased viability of fish and wildlife, and decreased public use (e.g., consumption) of fish, wildlife, and other natural resources.

The trustees will identify injuries to surface water, biological, ground water, and geologic resources; data and information currently available, as well as that collected by this assessment, will be utilized. The trustees will further analyze the identified natural resource injuries to evaluate the loss of ecological and human use services provided by those resources. The evaluation will focus on baseline services that would have been provided had the hazardous substances not been released at the Site.

- **Surface Water Resources:** The trustees intend to evaluate the extent to which hazardous substances released in surface water resources (including sediments) are injuring a variety of biological resources at the Site. Related services which will be analyzed include the capability of these resources to provide habitat for benthic organisms and aquatic vegetation to grow, survive, and reproduce; as well as the ability of the public to use these resources at the Site for recreational activity opportunities and to enjoy the intrinsic and aesthetic values provided by the area.

- **Biological Resources:** The trustees intend to evaluate injuries to biological resources by determining the effects of released hazardous substances to select species of benthic organisms, aquatic vegetation, fish, and birds; and by determining the bioaccumulation of mercury in tissues of select fish species. Related services which will be analyzed include the capability of these resources to provide habitat for fish and wildlife to grow and reproduce; to serve as sources of sufficient food; as well as the ability of the public to use fish, wildlife and plant resources (e.g., consumption, recreational fishing).

- **Ground water Resources:** The trustees intend to evaluate the extent to which groundwater resources may be injured at the Site, as well as the effects to other natural resources exposed to contaminated groundwater. Related services which will be analyzed include the capability of these resources to provide a source of water for surface water, vegetation and wildlife; as well as the potential use of this resource for drinking water.

- **Geologic Resources:** The trustees intend to evaluate the extent to which hazardous substances in soils at the Site may affect other natural resources. The primary related service which will be analyzed is the capability of soils to filter groundwater to ensure that the quality discharged to surface water resources (including sediments) is sufficient to provide habitat and nutrients for aquatic organisms, as well as to provide human use and enjoyment. These same services are intended to be evaluated as part of the analysis of surface water resources.

The trustees recognize that achievement of baseline restoration at the SLRIDT Site will be dependent on the type of remedy selected at the sediments unit. The trustees will complete a preliminary evaluation of each of the four remedial alternatives currently under consideration to estimate their potential for restoring ecological and human use services to baseline conditions. The analysis will include a ***Comparative Preliminary Estimate of Damages*** (PED) to identify possible alternatives and estimated costs for baseline restoration projects associated with each of the four remedial alternatives. The PED will also contain a comparative analysis of compensatory restoration which is compensation for resource services that are affected until baseline restoration is achieved. The trustees intend to complete the preliminary evaluation of the four remedial alternatives in sufficient time for the information to be utilized in remedial decisions.

The trustee's priority at the SLRIDT Site is to return natural resources to their baseline services condition by focusing on habitat-based projects or other actions that restore, replace, and/or acquire equivalent services lost. After a remedy has been selected and documented in the Record of Decision for the sediments unit, a Restoration and Compensation Determination Plan (RCDP) will be developed to identify alternatives for baseline and compensatory restoration.

The RCDP may serve as the preliminary restoration plan to continue to facilitate coordinated restoration and remediation at the Site.

The trustees encourage public participation in this natural resource damage assessment. Accordingly the trustees accepted public comments on the Draft Assessment Plan during a 30 day comment period which occurred after the Notice of Availability was published in the State and Federal Registers (July 1, July 10 respectively). All public comments were carefully considered prior to finalizing this Assessment Plan. Changes to the Plan were not significant and did not affect the scope or methodologies of the assessment. Comments received during the 30 day review period and responses to those comments, will be included as part of the Report of Assessment to be completed at the conclusion of the assessment.

CHAPTER 1
INTRODUCTION

The Minnesota Pollution Control Agency (MPCA), Minnesota Department of Natural Resources (MDNR), Fond du Lac Band of Lake Superior Chippewa, 1854 Authority (representing the Bois Forte, Grand Portage Bands of Lake Superior Chippewa), United States Department of the Interior (DOI) (Fish and Wildlife Service [FWS], Bureau of Indian Affairs [BIA]), and the United States Department of Commerce (DOC) (National Oceanic and Atmospheric Administration [NOAA]), acting as natural resource trustees (trustees) are preparing to assess damages for injuries to natural resources resulting from releases of hazardous substances at the St. Louis River/Interlake/Duluth Tar (SLRIDT) Superfund Site. This Assessment Plan serves as the guiding document for Natural Resource Damage Assessment (NRDA) activities.

1.1 Authority

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended, (42 U.S.C. §§ 9607) and the Federal Water Pollution Control Act (FWPCA), as amended, (33 U.S.C. § 1321), authorize the Federal Government, States and Indian tribes to recover, on behalf of the public, damages for injuries to natural resources, belonging to, managed by, appertaining to, or otherwise controlled by them. The Minnesota Environmental Response and Liability Act (MERLA) (Minn. Stat.§§ 115B.04, subd. 1, and 115B.17, subd. 7) authorizes the State of Minnesota, as trustee for the air, water and wildlife of the State, to recover damages for injury to, destruction of, or loss of natural resources. Under the authority of CERCLA and FWPCA, the DOI issued regulations (43 CFR Part 11) to guide trustees in the assessment of natural resource injuries and damages to restore resources following the release of hazardous substances. The purpose of these regulations is “to provide standardized and cost-effective procedures for assessing natural resource damages” (43 CFR § 11.11). This Assessment Plan follows the regulations promulgated by DOI at 43 CFR Part 11 in order to most effectively restore natural resources at the SLRIDT Site.

In accordance with 42 U.S.C. 9607(f)(2)(B) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the Commissioners of the MPCA and the MDNR have been designated as co-natural resource trustees by the Governor of Minnesota pursuant to Executive Order #99-17. In their capacity under CERCLA and under Minn. Stat. § 115B.17, subd. 7, the MPCA and MDNR act on behalf of the State as trustee for natural resources, including their supporting ecosystems, within the boundary of Minnesota or belonging to, managed by, controlled by, or appertaining to Minnesota.

In accordance with the NCP, the Chairman of the Fond du Lac Band of Lake Superior Chippewa and the Executive Director of the 1854 Authority act on behalf of the Fond du Lac Band of Lake Superior Chippewa, and the Bois Forte and Grand Portage Bands of Lake Superior Chippewa, respectively, as trustees for natural resources, including their supporting ecosystems, belonging to, managed by, controlled by, or appertaining to the tribes, or held in trust for the benefit of the tribes, or belonging to a member of the tribes if such resources are subject to a trust restriction on alienation.

The NCP, 40 CFR § 300.600, and Executive Order 12580, dated January 23, 1987, designate federal natural resource trustees. Pursuant to the NCP, the Secretary of the DOI acts as a trustee for natural resources and their supporting ecosystems managed or controlled by the DOI. In this matter, the U.S. Fish and Wildlife Service (Service) and the Bureau of Indian Affairs (BIA) are acting on behalf of the Secretary of the DOI as trustees for the natural resources under its jurisdiction. The official authorized to act on behalf of the DOI at the SLRIDT Site is the Regional Director of the Region 3 U.S. Fish and Wildlife Service. The Secretary of the Department of Commerce (DOC) acts as trustee for natural resources and their supporting ecosystems managed or controlled by the DOC and for natural resources and their supporting ecosystems managed or controlled by other federal agencies that are found in, under, or using waters navigable by deep draft vessels, tidally influenced waters, or waters of the contiguous zone, and the exclusive economic zone. The Secretary of the DOC has delegated his authority to act as trustee to the Administrator of the National Oceanic and Atmospheric Administration (NOAA).

1.2 Justification

The trustees completed a Preassessment Screen (PAS) in accordance with 43 CFR §§ 11.23-.25 for the SLRIDT Site in September, 2001. The PAS determined there was a reasonable probability of making a successful claim for damages for injuries to natural resources. Specifically, the PAS concluded:

- Releases of hazardous substances have occurred;

- Natural resources for which the trustees may assert trusteeship under CERCLA and FWPCA have been adversely affected by the discharge or release of hazardous substances;

- The quantity and concentration of the released hazardous substances are sufficient to potentially cause injury to natural resources;

- Data sufficient to pursue an assessment are readily available or likely to be obtained at a reasonable cost; and

- Response actions planned are unlikely to sufficiently restore, replace, or provide compensation for injured natural resources without further action.

Therefore, the trustees determined that further investigation and assessment is warranted at this Site in accordance with Federal Regulations at 43 CFR Part 11, Subparts C and E. The trustees further determined that current information indicates that there is a reasonable probability of making a successful natural resource damage claim pursuant to section 107 of the CERCLA and section 311 of the FWPCA. The trustees have further concluded that the value of damages for restoration determined through an NRDA will exceed their estimate of the potential assessment costs. The existence and availability of relevant data at the SLRIDT Site reduces these potential assessment costs. Therefore the trustees intend to make use of these data, as described in Section 7.3.1, to the maximum extent possible.

1.3 Purpose of the Assessment Plan

The purpose of this Assessment Plan is to document the trustees' basis for conducting a damage assessment, and to organize the approach for determining and quantifying natural resource injuries and calculating the damages, as related to lost natural resource services, associated with those injuries. By developing an Assessment Plan, the trustees can ensure that the NRDA will be completed at a reasonable cost relative to the magnitude of damages sought. The trustees also intend for this Plan to communicate assessment methodologies to the public, including the Responsible Parties (RPs), in an effective manner so they can participate in the assessment process.

1.4 Coordination and Previous Actions of Trustees

Coordination among the trustees is an essential component of a successful damage assessment. To this end, the trustees have developed and signed a Memorandum of Agreement (MOA) that provides a framework for the coordination and cooperation of the trustees and for implementation of activities in furtherance of their natural resource trust responsibilities with regards to releases of hazardous substances and discharges of oil into the St. Louis River Interlake/Duluth Tar Site. Under the MOA, the trustees have created the St. Louis River Trustee Council (Trustee Council) for the purpose of coordinating their efforts in order to effectively and efficiently meet their respective natural resource trustee responsibilities under applicable federal, tribal, and state law. Consistent with the MOA, the Trustee Council created a Technical Workgroup and a Legal Workgroup, which reports to the Council for damage assessment activities at the SLRIDT Site. The trustees have also designated Mr. John Gunther, Regional

Director, Minnesota Department of Natural Resources, as the Lead Authorized Official for this assessment. This Plan is issued, and will be administered, by Mr. Gunther as authorized and directed by the Trustee Council.

The trustees' determination (through the PAS) that further investigation and assessment is warranted at the Site, and the trustees' intention to proceed with an assessment, was relayed to the RPs via a Notice of Intent (NOI) dated December 3, 2001. The trustees or their technical representatives have also met or conferred with the RPs several times to discuss natural resource injury data and restoration issues at the SLRIDT Site. It is the intent of the trustees to implement this Assessment Plan following public review.

The MPCA is the lead response agency for cleanup of the SLRIDT Site. The MPCA has identified the following persons who are responsible for the releases of hazardous substances at the Site and who are legally liable for remediating the releases: XIK Corporation (formerly known as the Interlake Corporation); Honeywell International, Inc.; Domtar, Inc.; and Beazer East, Inc. These persons are referred to as Responsible Parties or RPs. Trustee coordination with the MPCA Site Response Team has included technical assistance in the development of the original Record of Decision (ROD) proposed in 1999 for the Sediments Operable Unit (SedOU), as well as trustee participation on the Technical Assistance Group formed by MPCA to develop site-related data during the re-opened Remedial Investigation/Feasibility Study (RI/FS) process. The trustees have also made several presentations regarding the NRDA restoration process at the SLRIDT Site through the Community Workgroup forum established by the MPCA to coordinate site activities with the local public.

Copies of this Plan are being made available to the public, the identified RPs for the Site, and to the State of Wisconsin as another potential trustee of affected natural resources. The State of Wisconsin is not participating in the Trustee Council or the MOA. The trustees encourage active participation of the public in this damage assessment. The trustees intend to continue coordination with the MPCA Site Response Team, the RPs, and the general public as this damage assessment proceeds. The trustees note that the RPs and MPCA are currently planning, conducting, and participating in activities that will better characterize environmental conditions in the assessment area and may help to address natural resource injuries. The trustees also recognize that the re-opened RI/FS for the SedOU leading to the selected remedy will affect the extent to which natural resources may be restored.

The RPs have not requested to implement this Plan. Therefore, at this time, no decision has been made to allow, or not to allow, the RPs to implement this Plan. The trustees intend to coordinate this assessment with the work of the MPCA and RPs throughout the RI/FS, as well as during the remedy selection and implementation processes. XIK Corporation has provided the trustees with a timetable of proposed actions related to the RI/FS and remedy selection process. As noted in

Section 5.6 of this Plan, the trustees intend to complete a ***Comparative Preliminary Estimate of Damages***, which identifies alternatives for baseline and compensatory natural resource restoration projects associated with each of the remedial alternatives evaluated in the FS and the estimated costs of such projects, within a timeframe that would allow coordination with the FS process.

Lastly, the trustees note that the St. Louis River Citizens Action Committee (CAC) is coordinating the development of a *Lower St. Louis River Habitat Plan* (SLCAC, 2002) which may be used to guide restoration of natural resources at the SLRIDT Site. The trustees intend to work closely with the CAC to ensure restoration projects address St. Louis River resource conservation goals as identified by the local public.

1.5 Decision to Perform a Type B Assessment

The DOI regulations provide for two types of assessments. A "Type A" assessment is a simplified assessment, requiring minimal field observation. A "Type B" assessment comprises a more comprehensive set of studies and analyses. Use of the Type A model is generally limited to the assessment of relatively minor, short duration discharges or releases that occur in coastal or marine environments or in the Great Lakes. A Type B assessment is warranted when a Type A assessment is not (43 CFR § 11.24 -11.35).

In this case, a number of the conditions that would support the use of a Type A approach are not satisfied, including:

- The discharge or release was not of short duration. In this case, discharges and releases of hazardous substances have occurred over a period of many years.

- The discharge or release was not minor. In this case, discharges and releases of hazardous substances have been in sufficient quantity to have a potentially significant adverse effect on the natural resources within the assessment area.

- The discharge or release was not a single event. In this case, multiple or continuing discharges and releases have occurred.

Therefore, the trustees have determined that a Type B assessment is warranted in this case.

1.6 Organization of the Assessment Plan

This Assessment Plan is organized as follows: Chapter 1 provides an introduction to the natural resource damage assessment at the SLRIDT Site. Chapter 2 presents an overview of the history

of the Site, the location and description of the assessment area, and a listing of the contaminants of concern. Chapter 3 provides confirmation that natural resources have been exposed to hazardous substances. Chapter 4 describes the trustees' preliminary determination of the factors influencing the recovery of natural resources. Chapter 5 describes the methods to document and evaluate injury to the natural resources at the Site, and the impairment of ecological and human use services resulting from those injuries. Chapter 6 describes the proposed methods to quantify the natural resource services lost in order to determine the appropriate type and extent of restoration to compensate for those losses. Chapter 7 identifies the type of information to be included in a Quality Assurance Project Plan (QAPP), and provides an overview of data management procedures for this assessment.

1.7 Public Review and Comment

The trustees encourage public participation in this natural resource damage assessment. Accordingly the trustees accepted public comments on the Draft Assessment Plan during a 30 day comment period which occurred after the Notice of Availability was published in the State and Federal Registers (July 1, July 10 respectively). All public comments were carefully considered prior to finalizing this Assessment Plan. Changes to the Plan were not significant and did not affect the scope or methodologies of the assessment. Comments received during the 30 day review period and responses to those comments, will be included as part of the Report of Assessment to be completed at the conclusion of the assessment.

The trustees will also solicit public comments following completion of other major planning documents and/or reports. Each comment period will last at least 30 days after the Notice of Availability is published in the State and Federal Registers.

The Coordinator for the Trustee Council (Coordinator) will act as a central contact point for the trustee parties and will disseminate public comments as appropriate. Comments may be submitted in writing or by e-mail to the Coordinator:

Marilyn Danks
Department of Natural Resources
Division of Ecological Services
500 Lafayette Road
St. Paul, MN 55155-4025
e-mail: marilyn.danks@dnr.state.mn.us

1.8 Modifications to the Assessment Plan

This Assessment Plan may be modified at any stage of the assessment as new information becomes available. Significant modifications to the Plan will be made available for review by

RPs, any other affected natural resource trustees, other affected Federal or State agencies or Indian tribes, and any other interested members of the public for a period of at least 30 calendar days, with reasonable extensions granted as appropriate, before tasks in the modified Plan are begun. Non-significant modifications shall be made available for review by RPs, any other affected natural resource trustees, other affected Federal or State agencies or Indian tribes, and any other interested members of the public, but the implementation of such modification need not be delayed as a result of the review.

CHAPTER 2
BACKGROUND INFORMATION

2.1 Lower St. Louis River Area

The lower portion of the St. Louis River on which the Site is located runs between the urbanized areas of the cities of Duluth, Minnesota and Superior, Wisconsin. Previously a large, marshy estuary, this part of the river has been modified over the years into one of the largest ports on the Great Lakes. Depths originally averaged 5 to 8 feet; they are now as deep as 27 feet in dredged channels which extend for six miles or more upstream of Lake Superior. Before the shipping industry was established in the mid-1800's, there were vast shallow areas dotted with floating islands; there are now vast areas of fill on which are situated a variety of facilities. It is estimated that since 1861, over 4000 acres of shoreline and open water in the harbor have been filled (DeVore, 1978). The entire river system from Lake Superior to Cloquet (over 30 miles upstream) has been designated a Great Lakes Area of Concern (AOC) by the International Joint Commission to address a variety of environmental problems related to degraded water quality (MPCA and WDNR, 1992). While the lower St. Louis River area reflects many aspects of an industrial waterway, there still remains significant areas of high quality habitat for fish and wildlife.

There is archaeological evidence that the lower St. Louis estuary has been inhabited since at least 7000 B.C. Early semi-nomadic hunters and gatherers established permanent villages around 1000 B.C., as increasingly stable food supplies such as fish and wild rice eliminated the need for a nomadic way of life. When early European explorers arrived in the region in the 1600's, the area was inhabited by the Dakota Sioux, but by 1776, they were displaced by the Ojibwe (Chippewa) who were migrating westward from the St. Lawrence region under pressure from the Iroquois. Many families erected their wigwams on the islands of the St. Louis River, near its outlet to the lake for greater security, and established a village (Fond du Lac) on the Minnesota shoreline, actively participating in the growing fur trade industry. Today, the Ojibwe bands are the predominant native people in the region.

In the early days at Fond du Lac, wild rice was gathered in the St. Louis River, fish and game were abundant, ducks were hunted around the islands, and other game was hunted in the dense forests. There are historical accounts, unconfirmed, of a summer encampment near Stryker Bay (Peacock, 1998). The Ojibwe continued to live in the village, including the islands, until the Treaty of La Pointe in 1854, which established the Fond du Lac Reservation in Cloquet, Minnesota. Under the Treaty of 1854, the Fond du Lac Reservation along with the Bois Forte and Grand Portage Reservations retained the right to hunt, fish, and gather in the 1854 Ceded Territory of northeastern Minnesota. Tribal members historically utilized the resources of the 1854 Ceded Territory, including the St. Louis River, and continue to do so today.

Historical accounts of the fishery of the St. Louis River describe abundant catches of a variety of species which continue to live in the estuary, as well as lake whitefish and lake sturgeon. Both fish species disappeared from the river during the last century however, lake sturgeon are now the focus of re-introduction efforts. The Ojibwe subsistence fishery depended primarily upon three species of river-spawning fish: walleye, lake sturgeon and lake whitefish. Commercial fishing based in Duluth and Superior rapidly depleted the stocks, with a scarcity of fish reported for the St. Louis River and the western part of the lake by 1869-1870 (Kaups, 1978).

2.2 Surrounding Environment

Approximately 800 people live within one mile of the Site. Residences are located on the 63rd Avenue Peninsula and south of the railroad tracks. Area recreational facilities include a walking trail and boat docks along the western bank of Stryker Bay. Some residents swim in the embayment despite posted warnings restricting swimming. A campground, a school, a community center, and a school playfield are located within one mile of Site boundaries (MPCA, 1999).

The Duluth community, both city-wide and in the immediate vicinity of the Site, has clearly demonstrated its concern about the legacy of contamination in the harbor and specifically at the SLRIDT Site. A community work group has been regularly meeting and reviewing the Superfund/MERLA actions and status since 1995, and continually voicing their desire for effective remedial action at the Site. Furthermore, in a recent public opinion survey commissioned by the city's Environmental Advisory Board, Duluthians expressed overwhelming support for the protection and preservation of green space. Among the results of the survey, conducted by Minnesota Sea Grant's tourism and recreation extension coordinator, were the following:

- 96 percent agreed or strongly agreed that views overlooking Lake Superior and the St. Louis River are an important part of the character of Duluth and must be protected and managed.

- 95 percent agreed or strongly agreed that natural open spaces are an essential element in the aesthetics of Duluth.

- 95 percent agreed or strongly agreed that natural open spaces – forests, meadows, ponds, wetlands, wooded hillsides and creeks – within the city limits are defining characteristics of Duluth and make it unique.

- < 89 percent agreed or strongly agreed that it is important to keep existing open space connections and/or make new connections to create public green belts (corridors) throughout Duluth.

- < 88 percent agreed or strongly agreed that forest wildlife (deer, bear, moose, birds, etc.) within the city is a defining characteristic of Duluth.

The poll format and questions were developed by the University of Minnesota's Center for Survey Research.

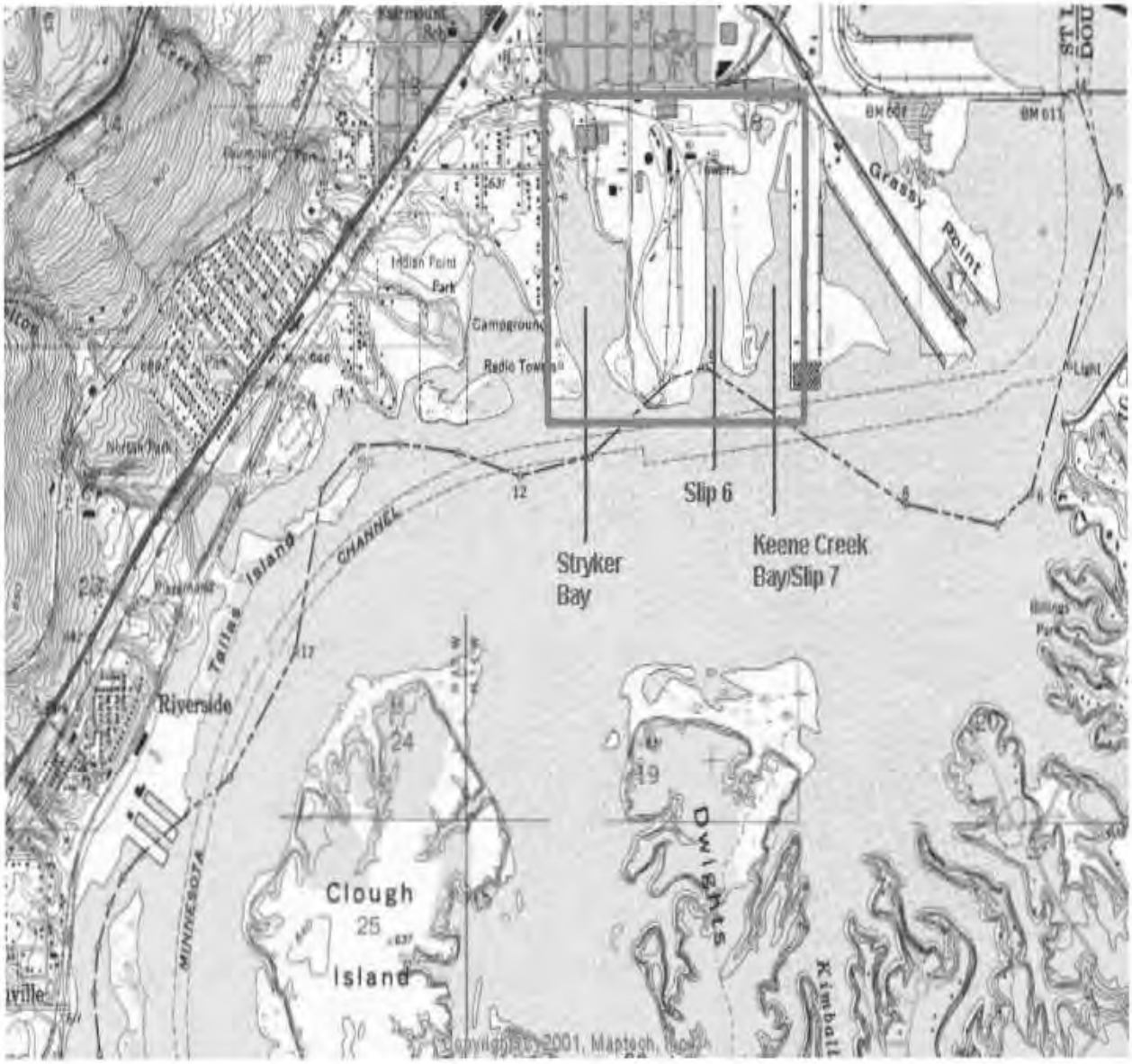
2.3 Location and Description of the Assessment Area

2.3.1 Site Location and Description

The St. Louis River/Interlake/Duluth Tar (SLRIDT) Superfund Site includes 255 acres on the north (Minnesota) bank of the St. Louis River, the largest tributary and estuary to Lake Superior. It includes two peninsulas and three embayments on the main river channel approximately four miles upstream of the outlet to Lake Superior (Figure 1). The upland area is comprised of two peninsulas constructed primarily of fill in the early part of the century. The 59th Avenue Peninsula, or Hallett Peninsula, is the western and larger of the two. Most of the industrial activity at the Site occurred in this area. To the west of the Hallett Peninsula is Stryker Bay, a shallow (#5 feet) embayment with a narrow outlet to the main river. The western shore of Stryker Bay is formed by the 63rd Avenue Peninsula; this is also the western Site boundary. To the east of Hallett Peninsula is a boat slip belonging to the Hallett Dock Company (Slip 6). The slip is connected to the main shipping channel of the river and has a depth of 26 feet. Slip 6 is defined to the east by the 54th Avenue Peninsula, a partially wooded and unoccupied parcel. The third embayment and eastern boundary of the Site is Slip 7, and the adjacent Keene Creek Bay. The Burlington Northern & Santa Fe Railway tracks form the northern border of the Site.

The Site is located within the section of the St. Louis River that is significantly affected by seiche events. Weather fronts and winds induce seiche oscillations in Lake Superior that force water through the Duluth Ship Canal and Superior Entry. During such events, harbor water levels can fluctuate from 3-25cm and the flow of the river may reverse until the seiche reverses. This reverse flow is strong enough that it has been measured as far upstream as the Oliver Bridge, 11 miles upstream of the inlets. In addition, the seiche also creates a "mini-seiche" event in the harbor as water rocks back and forth off the harbor shores (Jordan *et al.*, 1981). The seiche phenomenon may expand the area that is influenced by SLRIDT Site contaminants.

Figure 1. The St. Louis River/Interlake/Duluth Tar (SLRIDT) Superfund Site.



2.3.2 History of Regulatory and Enforcement Involvement

In 1983, the United States Environmental Protection Agency (EPA) included the Site together with the U.S. Steel site, which is also located on the St. Louis River Estuary, as the "St. Louis River/Interlake/US Steel Site" on the National Priorities List (NPL). In October, 1984, the MPCA placed the Site on the State Superfund Permanent List of Priorities. MPCA is the lead agency for cleanup activities and enforcement at the Site by agreement with the EPA. The initial remedial investigation in 1986 resulted in the identification of three stages of cleanup, which are referred to as "operable units" (OUs): Tar Seeps, Soil, and Sediments. MPCA and EPA jointly issued a ROD for the Tar Seeps OU in 1990. Requests for Response Action (RFRAs) were issued to the RPs in 1991 and 1993. Interlake Corporation (now XIK Corp.), Allied Signal Incorporated, and Domtar Incorporated responded and completed remedial action for the Tar Seeps OU in 1994. MPCA issued a ROD documenting the remedy for the Soils Operable Unit (SOU) in 1995, and the RPs completed the remedy in 1997. RFRAs for the Sediments OU were issued in 1994 to Interlake and 1996 to Allied, Domtar, and Beazer East Incorporated. Beazer has not responded and is not participating in the RI/FS process. The RI/FS for the Sediment OU (SedOU) is ongoing.

2.3.3 Historical Industrial Activities and Processes at the Site

Industrial activity at the Site began with the construction of the Duluth Iron and Steel Co. plant in 1890. This eventually became the Zenith Furnace Company, which later split into the Interlake Iron Company and Duluth Tar and Chemical. Zenith installed 65 coke ovens at the Site in 1904 (MPCA and WDNR, 1992). Operation of the tar and chemical facilities continued until the 1940s, while the iron plant operated until the 1960s (MPCA, 1990).

Coke is a hard, hot-burning fuel produced in a batch process by heating pulverized coal to very high temperatures in the absence of oxygen. This drives off volatile compounds, leaving finished coke. The volatile byproducts are collected for further processing. Some are used to fuel the coke ovens, while others are sold for use as chemical feedstocks. At the SLRIDT Site, the byproduct was condensed into coal tar using ammonia water, which provided the input for the tar and chemical operations. Coal tar and ammonia water were stored in various tanks around the property (IT Corporation, 1991).

Molten pig iron is produced in a blast furnace by combining coke, iron ore, and limestone in the presence of air and heat. The iron is poured into molds and cooled into ingots, while impurities from the ore combine with the limestone to form slag, which usually requires land disposal (IT Corporation, 1991). As is typical, the iron companies at the SLRIDT Site used the coke produced on-site in their iron-making operations.

After the tar and chemical operations ceased in the 1940s, areas of the Site were used by several meat-packing companies. These operations ceased in the 1970s (IT Corporation, 1991). Hallett

Dock Company is the current major user of the Site, including the boat slips. Coal and bentonite are stored on the Site and loaded onto ships for transport.

2.4 Hazardous Substances Released in the Assessment Area

2.4.1 Contaminants of Concern

Information reviewed by the trustees indicate that hazardous substances have been emitted, emptied, discharged, allowed to escape, disposed, or otherwise released directly or indirectly into the St. Louis River estuary from the Site. Over the past 10 years, hundreds of samples were collected from surface water, ground water, soil, and sediments at the Site as part of response activities and analyzed for chemical contamination. Additionally, environmental studies not related to SLRIDT Site response activities have collected samples from various media at the SLRIDT Site location.

Contaminants of concern identified in a variety of samples from the SLRIDT Site include polycyclic aromatic hydrocarbons (CAS# 130498292), benzene (CAS# 000071432), toluene (CAS# 000108883), ethylbenzene (CAS# 000100414), xylenes (CAS# 1330207), cyanide (CAS# 57125), mercury (CAS# 7439976), arsenic (CAS# 7440382), cadmium (CAS# 7440439), chromium (CAS# 7440473), copper (CAS# 7440508), lead (CAS# 7439921), nickel (CAS# 7440020), and zinc (CAS# 7440666). These compounds or mixtures have been identified under CERCLA §102 as hazardous substances (40 CFR §302, Table 302.4).

The above contaminants are consistent with manufacturing processes operated at this location. Coking, coal tar, and iron-making operations all involved the use of coal. Because mercury is found in appreciable quantities in coal, it is reasonable to expect mercury to be found in concentrated form in coke, coal tar liquors, coal ash, and coal tar wastes from coal burning (MDH, 2002; USEPA, 1997). EPA confirmed the presence of mercury in similar wastes at the Tacoma Tar Pits Superfund Site in Tacoma, WA where discarded coal tar liquors, coal ash and coal tar wastes contained a variety of heavy metals including arsenic, mercury, and lead as well as volatile organic compounds such as benzene, toluene, and PAHs (USEPA, 1996).

Other compounds may be produced through various transformation processes, including microbial metabolism or biotransformation, photodegradation, or photoactiviation and general chemical reactions. The trustees intend to focus on exposure and injuries to natural resources due to the release of polycyclic aromatic hydrocarbons and mercury in this Assessment Plan (Chapters 3 & 5). However, as more information becomes available through the remediation investigation and injury assessment, any information pertaining to other contaminants of concern listed above will also be taken into consideration.

2.4.2 Quantity of Released Hazardous Substances

Contaminants found at the SLRIDT Site are consistent with the manufacturing processes that took place at that location starting as early as 1890. Evidence that the releases occurred during the Site's manufacturing period is available. MPCA's fact sheet from October 1999 (MPCA, 1999) states that wastes from iron operations were discharged from the so-called "48-inch outfall" at the end of the 54th Street Peninsula, which discharged to the St. Louis River. This is corroborated by the Draft Supplemental Remedial Investigation and Feasibility Workplan for Soil OU (IT Corporation, 1991), which shows several waste streams from the coke oven and pig iron manufacturing processes going to the outfall. The presence of elevated concentrations of PAHs, VOCs and cyanide in sediments around the end of the outfall (Malcolm Pirnie, 1990) is consistent with past operations. Other outfalls may have discharged directly into Stryker Bay and Keene Creek Bay (MDH, 1989).

Both of the peninsulas are known to have been constructed from fill during the early part of the century. Slag, solid byproducts, and wastes were used as fill material (MPCA, 1999). The Soil OU RI confirmed the presence of slag in several areas (ENSR, 1992). In addition, a layer of slag is found in Slip 7 sediments (IT Corporation, 1997). Slag has the potential of being a source of hazardous substances, including PAHs and metals, at the Site (SERVICE, 1998).

Test trenches and soil borings indicate the presence of soil and ground water contamination at known former locations of storage tanks and pipelines. The source of this contamination is unknown, although leaks and spills from operations are suspected (ENSR, 1992).

The primary contaminants of concern (COC) at the SLRIDT Site are polycyclic aromatic hydrocarbons (PAHs). PAHs are a major class of environmental contaminants that are byproducts of the burning of fuel, generation of synthetic fuels from fossil fuels, and wood treatment. They exhibit a wide range of toxicity, insolubility in water, and persistence in aquatic systems. Concentrations of PAHs in the environment are often expressed as the sum of several individual compounds. This is often termed "total PAHs" or tPAH. Sources may also report on the sum of those PAH compounds that are considered to be possible or probable human carcinogens, which may be reported as cPAH.

Although MPCA staff detected PAHs in Stryker Bay sediments as early as 1979, the 1990 Remedial Investigation (Malcolm Pirnie, 1990) is the earliest comprehensive survey of contamination at the Site. Since then, both the RPs and public entities have collected additional data. Contaminated sediment layers exist throughout all three embayments, at the end of the 54th Street Peninsula, and in soils in some areas of the Hallett Peninsula. Layers of sediment in Stryker Bay are contaminated with PAHs at concentrations in the thousands of parts per million (ppm). Background PAH levels are on the order of 1 ppm (R-EMAP 1995 unpublished data).

Site investigations also found elevated levels of mercury at the Site. Stryker Bay sediments contain mercury in excess of the recommended Level II Sediment Quality Target (predicted to be toxic) of 1.1 ppm for the protection of sediment-dwelling organisms in the St. Louis River (Crane;MacDonald *et al.*, 2000) and the Ontario Severe Effects Level (SEL) concentration of 2 ppm (IT Corporation, 1997). Ground water at the Site contains concentrations of mercury in excess of surface water standards and the more upgradient monitoring wells show considerably less mercury in ground water than downgradient monitoring wells.

2.5 Natural Resources and the Services They Provide in the Assessment Area

Natural resources that have been, or potentially have been affected by the discharge or release of the hazardous substances, include but are not limited to: geologic resources, ground water, surface water (including sediments) and biological resources including aquatic and terrestrial plants and microorganisms; aquatic and terrestrial mammals; amphibians; fish; and migratory birds, including waterfowl, shorebirds, raptors and others. Services provided by these natural resources include fishing, boating, and swimming; provision of fish and wildlife habitat, quality food resources, and other services which will be fully described in later sections of this Assessment Plan.

The lower St. Louis River provides important habitat for fish and wildlife species. Priority resource needs that have been identified for this area include conserving and enhancing near-shore shallow water fishery habitat, nesting and rearing habitat for shorebirds, and wetland habitat. Within these habitats, benthic invertebrates, aquatic plants, benthic and predatory fish, migratory birds, surface water, ground water, sediment, and soil resources have been exposed to the contaminants of concern (see Chapter 3 - Confirmation of Exposure).

Bird species in the St. Louis River estuary include, but are not limited to the common tern (*Sterna hirundo*) - a threatened species in Minnesota and an endangered species in Wisconsin, piping plover (*Charadrius melodus*) - a federally endangered species and an endangered species in Minnesota, ring-billed gull (*Larus delawarensis*), herring gull (*Larus argentatus*), black tern (*Chlidonias niger*), great blue heron (*Ardea herodias*), bald eagle (*Haliaeetus leucocephalus*) - a Minnesota Species of Special Concern, gyrfalcon (*Falco rusticolus)*, snowy owl (*Nyctea scandiaca*), peregrine falcon (*Falco peregrinus)* - a threatened species in Minnesota, double crested cormorant *(Phalacrocorox auritus)* and a variety of waterfowl.

Fish species in the St. Louis River estuary include, but are not limited to the lake sturgeon (*Acipenser fulvescens*) - a Minnesota Species of Special Concern and a species of management interest to the trustees, walleye (*Stizostedion vitreum*), black crappie (*Pomoxis nigromaculatus*), carp (*Cyprinus carpio*), muskellunge (*Esox masquinongy*), northern pike (*Esox lucius*), smallmouth bass (*Micropterus dolomieu*), channel catfish (*Ictalurus punctatus*), and white sucker (*Catostomus commersoni*). Many species are seasonally abundant, using the river and

estuary to spawn and return to Lake Superior, making the estuary critical to the fishery of western Lake Superior.

CHAPTER 3
CONFIRMATION OF EXPOSURE

The DOI NRDA regulations state that before including Type B assessment methodologies in the Assessment Plan, the Plan must confirm that:

> "at least one of the natural resources identified as potentially injured in the preassessment screen has in fact been exposed to the released substance" (43 CFR § 11.37(a)).

A natural resource has been exposed to a hazardous substance if "all or part of [it] is, or has been, in physical contact with a hazardous substance, or with media containing the hazardous substance" (43 CFR § 11.14(q)). The DOI regulations also state that "whenever possible, exposure shall be confirmed by using existing data" from previous studies of the assessment area (43 CFR § 11.37(b)(1)).

This part of the Plan provides confirmation of exposure, based on a review of the available data, for a number of the potentially injured resources within the SLRIDT Assessment Area, including:

- surface water resources, including surface water and sediments
- biological resources, including benthic macroinvertebrates, fish, wildlife and plants.
- ground water resources
- geologic resources

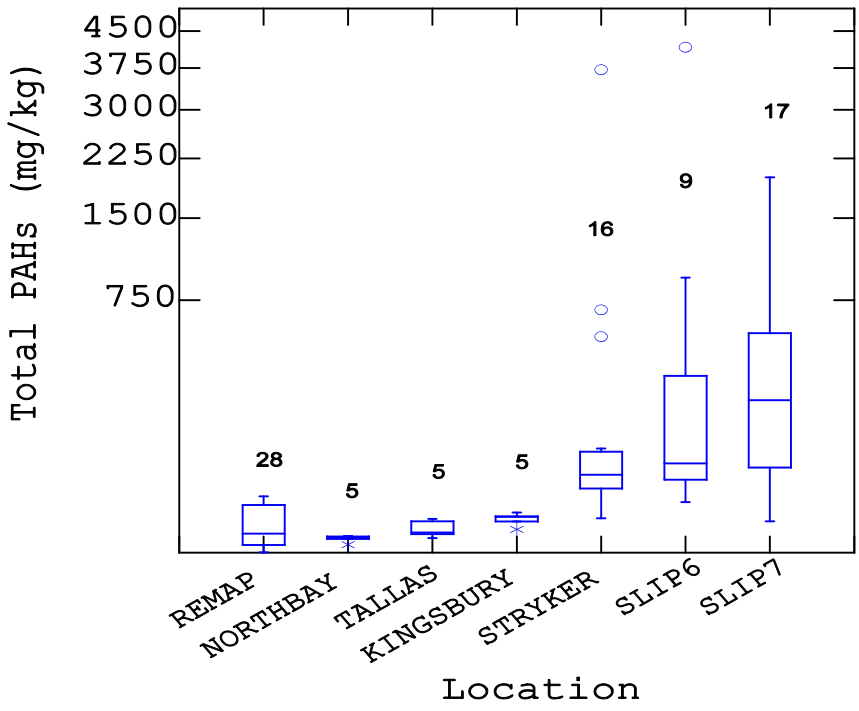
Although many contaminants have been detected at the Site (see Section 2.4.1), the trustees are focusing primarily on PAHs and mercury since the majority of the available exposure data relate to these contaminants. However, as more information becomes available through the RI/FS process and the injury assessment proposed by this Plan, any information pertaining to the remaining contaminants of concern will also be considered.

3.1 Surface Water/Sediment Resources

Surface water resources are defined as including both surface water and sediments suspended in water or lying on the bank, bed, or shoreline (43 CFR § 11.14(pp)). Available data on chemical concentrations in sediment document that these resources are exposed to contaminants of concern from the SLRIDT Site.

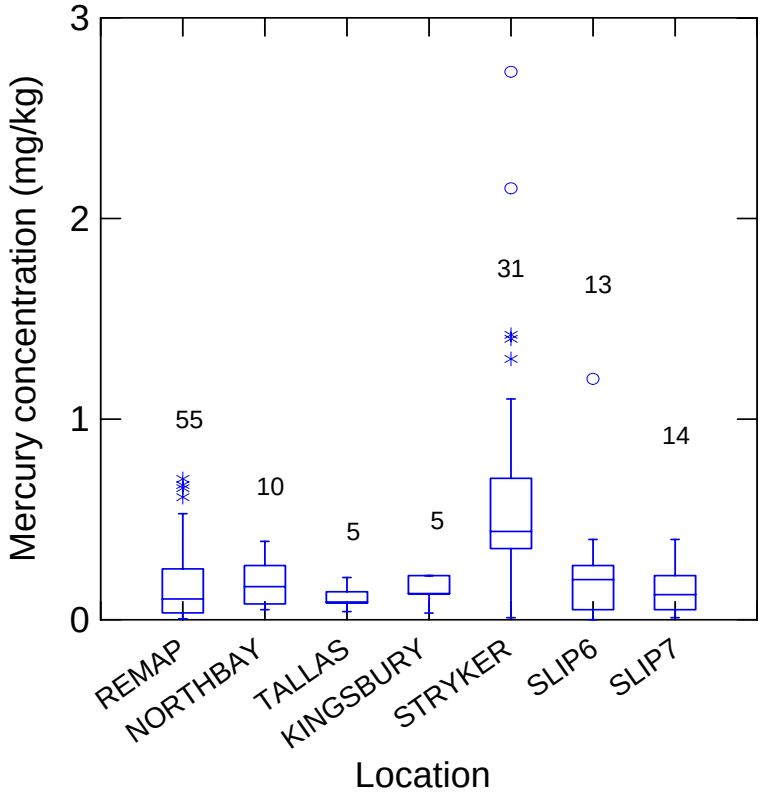
Various investigations have found that PAH concentrations in sediments in all three Site embayments are clearly elevated in comparison to other areas in the St. Louis River. Total PAH concentrations in surface sediments (0-6 inches) at the SLRIDT Site range from 5.5 to 3717 ppm; subsurface sediment concentrations are much higher, up to several tens of thousands of ppm in some places (IT Corporation, 1997). Preliminary data collected by the MPCA Site Team indicate that surface sediment concentrations measured in Kingsbury Bay (immediately upstream of the Site) range from 3.1 to 9.6 ppm, 1.3 to 6.6 ppm in Tallas Island Bay (just upstream of Kingsbury Bay), and 0.4 to 1.5 ppm in North Bay (a reference area located about 9 miles upstream of the Site) (MPCA, 2001). In addition, surface sediment concentrations in random locations in the St. Louis River, both upstream and downstream of the Site, only range from 0.04 to 20.6 ppm total PAHs (The Regional Environmental Monitoring and Assessment Program [R-EMAP] 1995 unpublished data) (Figure 2).

Figure 2. PAH concentrations in surface sediments at the SLRIDT Site (Stryker Bay, Slip 6, Slip 7) and other areas in the St. Louis River.



Mercury concentrations in Stryker Bay surface sediments are also elevated, with concentrations up to 2.7 ppm (IT Corporation, 1997). Preliminary data collected by the MPCA Site Team indicate maximum surface sediment concentrations in Kingsbury Bay are 0.34 ppm, 0.37 ppm in Tallas Island Bay, and 0.39 ppm in North Bay (MPCA, 2001). In addition, the maximum mercury concentration measured in 55 random locations in the St. Louis River was 0.7 ppm (R-EMAP 1995 unpublished data) (Figure 3).

Figure 3. Mercury concentrations in surface sediments at the SLRIDT Site (Stryker Bay, Slip 6, Slip 7) and other areas in the St. Louis River.



3.2 Biological Resources

Biological resources are defined in the DOI regulations as "those natural resources referred to in section 101(16) of CERCLA as fish and wildlife and other biota. Fish and wildlife include marine and freshwater aquatic and terrestrial species; game, nongame, and commercial species; and threatened, endangered, and State sensitive species. Other biota encompass shellfish, terrestrial and aquatic plants, and other living organisms" (43 CFR § 11.14(s)). Available data (summarized below) on chemical concentrations in several organisms document that these resources are exposed to contaminants of concern from the SLRIDT Site.

3.2.1 Benthic Invertebrates

Benthic invertebrates were collected in 1996 from 10 sites in the St. Louis River, including Keene Creek Bay at the SLRIDT Site, and analyzed for body burdens of PAHs (Thijssen, 1997). Oligochaete worms and chironomids from Keene Creek Bay contained 21.5 ppm and 5.0 ppm tPAHs, respectively. In comparison, chironomids collected from the Clough Island area (approximately 1 mile upstream of the Site) and from the Boy Scout Landing area (approximately 8 miles upstream) contained 0.36 ppm and 0.30 ppm tPAHs, respectively (Thijssen, 1997). In the same study, *Lumbriculus variegatus* (an oligochaete worm) were exposed to field-collected sediments in the laboratory. *Lumbriculus* exposed to sediments from Keene Creek Bay accumulated an average of 39.6 ppm tPAHs, compared to 0.88 ppm and 1.2 ppm tPAHs in *Lumbriculus* exposed to Clough Island and Boy Scout Landing area sediments, respectively (Thijssen, 1997).

MPCA Site Team investigations collected 3 benthic invertebrate taxa (chironomids, amphipods, and tricopterans) from the SLRIDT Site and the North Bay reference area in 2001, and analyzed these samples for tissue residues of PAHs and metals (MPCA, 2001). Preliminary results indicate that invertebrates from the SLRIDT Site have body burdens of tPAHs ranging from 0.28 to 29.4 ppm, compared to a range of 0.12 to 0.43 ppm for invertebrates from North Bay. The MPCA Site Team investigation also included exposure of *Lumbriculus variegatus* to field-collected sediments in the laboratory (MPCA, 2001). Preliminary data for a portion of the samples indicate that *Lumbriculus* from the SLRIDT Site accumulated up to 63 ppm tPAHs, compared to a maximum of 0.08 ppm in *Lumbriculus* exposed to sediments from North Bay.

3.2.2 Plankton

Zooplankton collected at the SLRIDT Site in 1990 had a mercury concentration of nearly 700 ppb (Sorensen;Glass *et al.*, 1992). The maximum concentration in plankton collected from 27 other locations in the St. Louis River in the same study was approximately 450 ppb, with concentrations less than 150 ppb in plankton from 26 of the 27 locations.

3.2.3 Aquatic Plants

The RPs collected samples of 2 species of wetland plants (cattail and alder) from the SLRIDT Site in 1996 and analyzed them for root and stem tissue residues of COCs (IT Corporation, 1997). Contaminants detected in plant tissue included tPAHs, lead and mercury, with maximum concentrations of 24 ppm, 10 ppm, and 0.04 ppm respectively.

MPCA Site Team investigations collected aquatic plants (*Vallisneria, Myriophyllum, and Potamogeton sp.*) from the SLRIDT Site and the North Bay reference area in 2001, and analyzed whole plants for tissue residues of PAHs and metals (MPCA, 2001). Preliminary data indicate that plants from the SLRIDT Site accumulated tPAH concentrations up to 25 ppm compared to a maximum of 1.2 ppm in plants from North Bay. The heavy metals copper, lead, nickel and zinc were also detected at higher concentrations in plants from the SLRIDT Site than in plants from North Bay.

3.2.4 Fish

Minnesota and Wisconsin have each taken steps to manage health risks associated with consuming St. Louis River AOC fish. Minnesota issues a sport fish consumption advisory for western Lake Superior and the entire length of the St. Louis River. Wisconsin's advisory includes Lake Superior and the lower 23 miles of the St. Louis River it shares with Minnesota. All fish species sampled and analyzed by the two states since 1978 have contained detectable levels of mercury, with concentrations ranging from 0.02 to 1.4 ppm in fillets. Sixteen walleyes between 14 and 24 inches in length collected by the Minnesota DNR in 2000 contained mercury concentrations ranging from 0.12 to 1.08 ppm (MDNR, 2001).

Sorensen et al.(1992) analyzed mercury residues in yellow perch (*Perca flavescens*), logperch (*Percina caprodes*) and spottail shiner (*Notropis hudsonius*) collected from the vicinity of the Site in 1990 and 1991. Average mercury concentrations in the three species were 28, 36, 45 ppb wet weight, respectively, in 1990. The average mercury concentration in spottail shiners from the Site was higher in 1991 (134 ppb); this value was the highest measured for this species among 23 locations in the St. Louis River.

MPCA Site Team investigations collected black crappie (*Pomoxis nigromaculatus*) and golden shiner (*Notemigonus crysoleucas*) from the SLRIDT Site and North Bay reference area in 2001, and analyzed 9 composite samples of whole fish for each species for contaminants of concern (MPCA, 2001). Preliminary data indicate that young of the year crappies from the SLRIDT Site average 109 ppb (range 81-134 ppb) tPAHs (wet weight), compared to 37 ppb (range 38-53 ppb) in North Bay crappies. Golden shiners from the Site averaged 178 ppb (range 139-229 ppb) tPAHs, compared to 22 ppb (range 19-24 ppb) in North Bay. Analytical results for mercury and other metals are not available at this time.

The trustees also collected white sucker (*Catostomus commersoni*) and northern pike (*Esox lucius*) from the SLRIDT Site in 2001 (Trustees, 2002b). Whole fish were analyzed for contaminants of concern. PAHs were detected in 90% of fish collected from the Site (N=20). Based on preliminary data analysis, tPAH concentrations (wet weight) in white sucker and northern pike averaged 111 ppb (range 0-346 ppb) and 22 ppb (range 14-34 ppb), respectively. Analytical results for mercury and other metals are not available at this time.

3.2.5 Birds

Tree swallows (*Tachycineta bicolor*) are being used by the trustees as a representative bird species with semi-aquatic food habits to document the extent of contaminant bioavailability at the Site. Nestlings, eggs, and diet samples (from both GI tract and prey fed to nestlings [boli]) were collected from swallows nesting in and around the Site in 2001 and analyzed for contaminants of concern (Trustees, 2002a). Preliminary results for tPAH and mercury residues are presented in Table 1.

Table 1. Residues of tPAHs and mercury in tissues and diet from tree swallows nesting in and around the SLRDIT Site, Duluth, Minnesota, 2001.

Sample Type	Keene Creek/Slip 7	Stryker Bay	Kingsbury Bay
Carcasses mean (range) tPAH ppm wet weight	0.08 (0.02-0.33) N=10	0.09 (0.02-0.27) N=11	0.06 (0.04-0.09) N=2
Diet (GI) tPAH ppm wet weight	6.1	5.6	0.05
Diet (Boli) tPAH ppm wet weight	0.04	0.80	--
Carcasses mean (range) Mercury ppm wet weight	0.028 (0.022-0.037) N=10	0.028 (0.020-0.038) N=11	0.030 (0.023 - 0.037) N=2
Egg mean (range) Mercury ppm wet weight	0.108 (0.066-0.167) N=7	0.086 (0.080-0.102) N=5	0.048

3.3 Ground Water Resources

Ground water resources are defined as "water in a saturated zone or stratum beneath the surface of land or water and the rocks and sediment through which ground water moves. It includes ground water resources that meet the definition of drinking water supplies" [43 CFR § 11.14(t)].

According to the RPs' Draft Hydrogeology Report (SERVICE, 2002):

"In the St. Louis River estuary, the bedrock is overlain by 300 to 500 feet of silt and clay lake deposits, with localized saturated glacial lake sands usually less than 10 feet thick. Groundwater development is limited, and primarily restricted to the glacial lake sands and gravels."

Ground water also permeates layers of industrial fill on the peninsulas at the Site.

As part of the Soils OU ROD and the SedOU Investigation, ground water has been monitored in monitoring wells to determine ground water quality associated with residual soil contamination. The following table lists the highest average detection in these monitoring wells (SERVICE, 2002):

Table 2. Highest average contaminant concentrations detected in monitoring wells at the SLRIDT Superfund Site.

Compound	Concentration (mg/L)	Well
Total PAH	4755	MW-32A
*BTEX	3724	MW-28
Hg	2.00	MW-26S
acenaphthene	265	MW-16
anthracene	19	MW-44S
napthalene	4250	MW-32A
phenanthrene	106	MW-44S
benzo(a)pyrene	0.19	MW-45
zinc	3350	MW-29D

*BTEX = Benzene, Toluene, Ethylbenzene, and Xylene compounds

The trustees further note the following evidence of mercury in ground water at the Site: mercury has been detected in monitoring wells 48, 44S, and 26S at 1.9, 0.12, and 2.0 μg/L mercury respectively. These wells are located in slag fill and/or in the tarry fill material. Additionally, MW 47, 26S, and 35, located in areas containing buried tar material have mercury concentrations of 0.057, 2.0, and 0.17 μg/L respectively. MW-47 is in an area where original industrial waste streams were discharged to ponds. In comparison, monitoring wells MW 19M and 43 are approaching an up-gradient baseline reference location and have low concentrations of mercury, 0.0014 and 0.0016 μg/L respectively (SERVICE, 2002). It is noted here that further ground water monitoring may be needed to confirm upgradient baseline locations and conditions.

3.4 Geologic Resources

Geologic resources are defined as "those elements of the Earth's crust such as soils, sediments, rocks, and minerals . . . that are not included in the definitions of ground and surface water resources" (43 CFR § 11.14(s)). Confirmation of exposure of sediments is described in Section 3.1 above.

The RPs describe the generalized stratigraphy of the Site to include:

"near-surface industrial fill and recent bay sediment underlain by 0 to 25 feet of sandy silt (Upper Silt Layer) and silty fine to medium sand (Sandy Sediment Layer), then a laterally extensive Thick Confining Layer, which is more than 50 feet thick and is separated into three members: Silt Member, Clay Member and Lower Silt Member" (SERVICE, 2002).

Soil contamination was addressed in the RI and remedial action conducted for the Soils OU. The RI/FS for the Soils OU was completed by the RPs from 1991 to 1995. During that process, soils on Site were documented to contain semi-volatile organic compounds, including PAHs. Elevated levels of mercury in soil were also documented - mercury was detected in 11 of 14 soil samples from Area E at concentrations ranging from 0.15 to 10.7 ppm, with 9 of the 11 detected concentrations exceeding 0.5 ppm (Malcolm Pirnie, 1990). The SOU ROD listed contaminants of concern and clean up levels for soil (MPCA 1990).

3.5 Conclusions

Results from the above studies provide evidence that a variety of natural resources have been exposed to contaminants of concern in and around the SLRIDT Site. This evidence indicates that natural resources may have been injured as a result of exposure to hazardous substances released at the Site and provides the basis for further assessment as described in Chapter 5 of this Assessment Plan. As noted in Chapter 2, seiche events may expand the area that is influenced by SLRIDT Site contaminants. Therefore, the trustees intend to carefully examine data from other locations near the Site (e.g., Kingsbury Bay) to determine the full extent of the area influenced by contaminants released at the Site.

CHAPTER 4
PRELIMINARY DETERMINATION OF THE RECOVERY PERIOD

This part of the Plan describes a preliminary determination of the recovery period of natural resources exposed to hazardous substances released at the assessment area. The recovery period is defined as "either the longest length of time required to return the services of the injured resource to their baseline condition, or a lesser period of time selected by the authorized official and documented in the Assessment Plan" (43 CFR §11.14(gg)). As presented in Section 6.2 of the Plan, the trustees' priority at the SLRIDT Site is to return natural resources to their baseline condition of services, ie.services that would have been provided by natural resources but for the releases of hazardous substances at and from the Site.

The preliminary evaluation of the recovery period can assist in focusing on the types of resource services which may be impacted at the Site, and in developing injury determination and quantification methods necessary to identify the applicable type and extent of restoration. The following factors should be considered in this determination (43 CFR §11.73(c)(2)):

- Ecological succession patterns in the area;

- Growth or reproductive patterns, life cycles, and ecological requirements of biological species involved, including their reaction or tolerance to the hazardous substance involved;

- Bioaccumulation and extent of hazardous substances in the food chain;

- Chemical, physical, and biological removal rates of the hazardous substance from the media involved, especially as related to the local conditions, as well as the nature of any potential degradation or decomposition products from the process including:

  Dispersion, dilution, and volatilization rates in air, sediments, water, or geologic materials; transport rates in air, soil, water, and sediments; biological degradation, depuration, or decomposition rates and residence times in living materials; soil or sediment properties and adsorption-desorption rates between soil or sediment components and water or air; soil surface runoff, leaching, and weathering processes; and local weather or climatological conditions that may affect recovery rates.

Based on information documented in Chapter 3 of this Plan, the trustees believe that the recovery period for natural resources at the SLRIDT Site is largely dependent on the extent to which exposure to released hazardous substances, especially PAHs and mercury, may be reduced such

that: (1) growth or reproductive patterns, life cycles, and ecological requirements of biological species are returned to their baseline level, and (2) resource services lost due to bioaccumulation and presence of hazardous substances in the food chain are returned to their baseline level.

There are four remedial alternatives currently under consideration for the SedOU at the SLRIDT Site, as referenced in the "Agreement Between the Minnesota Pollution Control Agency, the Interlake Corporation, Honeywell International Inc. and Domtar Inc. Concerning Selection of the Remedy for the SedOU of the St. Louis River/Interlake/Duluth Tar Superfund Site", February 2000. These alternatives are: (1) a "No Action" alternative, (2) dredging and containment in Boat Slip 6, (3) a "Wetland Cap", and (4) dredging, upland dewatering and off-site disposal.

The draft ROD for the SedOU transmitted by the MPCA to the Responsible Parties on October 15, 1999, describes the "No Action" alternative to include "long-term ground-water monitoring at the Site". No other actions would be implemented.

The draft SedOU ROD describes the dredging and in-water containment as "dredging contaminated sediment in Stryker Embayment, Keene Creek/Boat Slip 7, the 48-Inch Outfall area and isolating them in a CAD/CDF in Boat Slip 6"; this remedial alternative would be conducted in a phased approach. Phase I would dredge sediment layers from Stryker Bay down to native sediment, and place them in Boat Slip 6 as either a Contained Aquatic Disposal Facility (CAD) or a Confined Disposal Facility (CDF). A CAD is located in-water and remains an aqueous site; a CDF is capped and becomes an upland site. Phase II of this alternative considers several different options for managing contaminated sediments from Keene Creek Bay/Boat Slip 7. These sediments may be completely or partially dredged and placed in the Boat Slip 6 facility (if sufficient capacity remains following Phase I), dredged and placed in an additional CAD/CDF to be developed in Keene Creek Bay/Boat Slip 7, or consolidated and capped in place. Soft sediment would be dredged down to the hard slag layer in the 48-Inch Outfall Area. Residual PAH levels would be evaluated for human health and environmental risks; additional remedial actions may be required. Further details of this alternative are presented in the draft ROD.

The "Wetland Cap" is described in the "Supplemental Detailed Analysis Report, Wetland Cap Alternative" (SDAR) prepared by SERVICE Environmental & Engineering for the Interlake Corporation, September 16, 1999. This alternative consists of placing a 2-3 foot cap of clean material over contaminated sediment areas, and developing wetlands in Stryker Bay, and in the shallow areas of Boat Slip 6, Keene Creek Bay/Boat Slip 7, and the 48-Inch Outfall Area. Further details of this alternative are presented in the SDAR.

The draft 1999 SedOU ROD describes the dredging, upland dewatering and off-site disposal alternative as "dredging all contaminated sediments, dewatering the sediments, treating the water and hauling the dewatered sediments to a landfill for disposal. After dredging the shallows of Keene Creek Bay the hard slag areas would be covered with clean sediment."

The trustees recognize that each of these alternatives include elements which will affect the extent to which natural resources are exposed to, and affected by, hazardous substances released at the Site. The effectiveness of each of these elements, in turn, may be affected by chemical, physical, and biological conditions specific to the Lower St. Louis River. In addition, the trustees note that consequences of remedial actions themselves may affect the timing and extent of the return of natural resource services to baseline. For example, the type and amount of wetland habitat functions which may be restored at the Site are dependent on the bathymetry, substrate, and type of vegetative communities which may result following the implementation of a given remedy. Similarly, it could take decades (at a minimum) for resources to even partially recover with the "No Action" alternative which relies only on natural recovery. Therefore, the trustees believe it is important to further evaluate each of these alternatives in greater detail to determine their effects to the recovery period of natural resources at the Site. This proposed evaluation is presented in Chapter 5, and includes injury determination and quantification methods specific to the types of resource injuries and service losses likely to have resulted from the types of hazardous substances released into the St. Louis River environment at the SLRIDT Site.

CHAPTER 5
NATURAL RESOURCE INJURY DETERMINATION

5.1 Introduction

This part of the Plan describes the trustees' methods to document and evaluate potentially injured natural resources at the Site and the impairment of ecological and human use services resulting from those injuries. This chapter also describes the approach to complete an evaluation to identify potential restoration of those losses under each of the currently proposed remedial actions. Injury determination is guided by procedures outlined in 43 CFR §11.61-64 which direct the trustees to ascertain "...whether an injury to one or more of the natural resources has occurred; and that the injury resulted from the discharge of oil or release of a hazardous substance based upon the exposure pathway and the nature of the injury" (43 CFR §11.61(a)(1)). Services which may be affected by injuries to natural resources at an assessment area are defined as "the physical and biological functions performed by the resource including the human uses of those functions. These services are the result of the physical, chemical, or biological quality of the resource" (43 CFR §11.14(nn)).

The trustees intend to focus on the loss of ecological and human use services at the Site that result from injuries to a variety of natural resources. These losses may include, but are not necessarily limited to: loss of, and degradation to, benthic, fish, and wildlife habitat; loss of recreational activities; loss of Native American cultural uses; decreased viability of fish and wildlife; and decreased public use (e.g., consumption) of fish and wildlife and other natural resources. The trustees recognize that the design and implementation of remedial actions pending for the SedOU at the Site may affect the extent to which resource losses are restored; therefore, a preliminary comparative evaluation of currently proposed remedial alternatives for potential restoration is described in this chapter. Methods to quantify final resource service losses, after remedy implementation, and to determine corresponding damages to restore or replace the losses, are presented in the "Natural Resource Injury Quantification and Damage Determination" (Chapter 6) of the Assessment Plan.

5.2 General Approach

Natural resource injuries form the basis for the losses of resource services which the trustees will seek to restore at the SLRIDT Site. Using data currently available (including historical data), pending data, and data collected by this assessment, the trustees will identify injuries to surface water, biological, ground water, and geologic resources resulting from exposure to hazardous substances released at the Site; assumptions and uncertainties for which there is insufficient data will be specified. The trustees will evaluate these injuries to determine which ecological and human use services have been impaired at the Site. The trustees will also determine ecological

and human use services that would have been provided by natural resources at the Site in their baseline condition. Baseline services are those that would have been provided by natural resources but for the releases of hazardous substances at and from the Site. Metrics by which these services may be measured are described in Section 5.4.

5.3 Pathway Determination

The trustees will demonstrate in this assessment that natural resources at the Site have been exposed to hazardous substances released at the Site primarily by documenting the presence of these hazardous substances in sufficient concentrations in media, foodchain, and other resources serving as pathways to resources of concern in the assessment area. Results from this part of the assessment will determine the type of injuries the trustees will further evaluate for service losses to be restored.

Data and other information currently available, pending, or to be collected in this assessment will be utilized in the pathways analysis. Data and studies described in the "Confirmation of Exposure" section of this Plan, as well as those to be developed for the service loss analyses for each of the resource categories described below, will be used to document injury pathways from the sources of hazardous substances released at the Site through various environmental media (e.g., surface water, ground water, sediments and soils) and food chain items of invertebrates, fish, and wildlife to reach biological and other resources. Testing and sampling methods will follow the guidance presented in 43 CFR §11.64. Any assumptions and uncertainties utilized in this determination for which there is insufficient data will be specified.

5.4 Injury Identification

Based on the information presented in the "Confirmation of Exposure" section of this Plan, the trustees intend to focus on natural resource injuries as provided by the regulations noted below. Other injuries may be identified for further study as additional Site information becomes available, and will be documented for public review and comment as a proposed modification to this Plan.

5.4.1 Surface Water Resources

An injury to a surface water resource has resulted from the release of a hazardous substance if concentrations and duration of substances measured in suspended, bed, bank, or shoreline sediments are sufficient to have caused injury to biological resources (43 CFR 11.62(b)(1)(v)).

The trustees intend to utilize existing Site data and data resulting from 2001 MPCA Site investigations (MPCA, 2001), as well as additional data to be collected as part of this assessment, to document that concentrations of hazardous substances in sediments in and around the SLRIDT Site are sufficient to injure biological resources, as described in the following

section. Other tests to further determine injury to surface water resources may be developed as necessary, and will be documented for public review and comment as a proposed modification to this Plan.

5.4.2 Biological Resources

An injury to a biological resource has resulted from the release of a hazardous substance if the concentration of the substance is sufficient to: 1) cause the biological resource or its offspring to have undergone at least one of the following adverse changes in viability: death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction), or physical deformations; or 2) exceed levels for which an appropriate State health agency has issued directives to limit or ban consumption of such organism (43 CFR 11.62(f)(1)(i) and (iii)).

The trustees intend to evaluate injuries to biological resources by determining adverse viability changes in select species of benthic organisms, aquatic vegetation, fish, and birds; and by determining the bioaccumulation of mercury in tissues of select fish species at the Site which may contribute to the exceedance of fish consumption advisories in the St. Louis River.

The trustees intend to use toxicity tests conducted with Site sediments as measurements of adverse viability changes in benthic organisms and aquatic vegetation. MPCA Site investigations in 2001 collected sediments from the assessment area for use in performing the following toxicity tests: *Hyalella azteca* 28-day survival and growth; *Chironomus tentans* life-cycle survival, growth and emergence; common cattail *(Typha latifolia)* seed germination and early seed growth; and wild rice *(Zizania aquatica)* seed germination and early seed growth (MPCA, 2001).

To determine adverse viability changes in fish and wildlife, the trustees intend to measure tumor incidences and other health indicators in select fish species, and chromosome damage and oxidative stress in tree swallows as indicators of foodchain effects in semi-aquatic birds at the Site (Trustees, 2002a; b). Mercury accumulation in fish tissues will be determined by measuring concentrations in different size/age classes of representative fish species at the Site (Trustees, 2002b), and comparing results to standards established by the State of Minnesota to determine consumption limits of fish taken from the St. Louis River. Other tests to further determine injury to biological resources may be developed as necessary, and will be documented for public review and comment as a proposed modification to this Plan.

5.4.3 Ground Water Resources

An injury to ground water resources has resulted from the release of a hazardous substance if concentrations are in excess of drinking water standards, or sufficient to have caused injury to surface water, air, geologic, or biological resources, when exposed to ground water (43 CFR § 11.62(c)(i) and (iv)).

The trustees intend to utilize existing Site data and data resulting from 2001 MPCA Site investigations (MPCA, 2001) and the RPs' Draft Geology-Hydrogeology Report (SERVICE, 2002), as well as additional data to be collected as part of this assessment, to document that concentrations of hazardous substances in ground water in and around the SLRIDT Site are sufficient to cause injury to ground water, surface water, geologic and/or biological resources, as described in previous and following sections. Other tests to further determine injury to ground water resources may be developed as necessary, and will be documented for public review and comment as a proposed modification to this Plan.

5.4.4 Geologic Resources

An injury to a geologic resource has resulted from the release of a hazardous substance if concentrations are sufficient to injure other resources, including terrestrial organisms and vegetation (e.g., toxicity), ground water, and wildlife (43 CFR 11.62(e)).

The trustees intend to utilize existing Site data and data resulting from the Soils OU Investigations and ROD, as well as additional data to be collected as part of this assessment, to document that concentrations of hazardous substances in soils in and around the SLRIDT Site are sufficient to injure other resources, as described in the previous sections. Other tests to further determine injury to geologic resources may be developed as necessary, and will be documented for public review and comment as a proposed modification to this Plan.

5.5 Service Loss Evaluation

The following sections present the trustees' intended approach to analyze natural resource injuries at the Site to evaluate the loss of ecological and human use services provided by those resources. This analysis is presented for each of the resource categories previously identified, and will provide the basis for the comparative evaluation of service losses described in Section 5.6. This evaluation includes a comparison of resource services estimated to be achieved by each of the four remedial alternatives currently under consideration with baseline resource services described below. The extent to which these estimated resource services may differ from baseline will be further evaluated for potential restoration, as described later in the Assessment Plan.

5.5.1 Surface Water Resources

Surface water resources include the sediments suspended in water or lying on the bank, bed, or shoreline. Because surface water contamination is directly affected by the dissolved or particulate concentration of contaminants in sediments, surface water and sediment quality are linked. Therefore, in evaluating injuries associated with this resource category, the trustees will address ecological and human use services provided by both sediments and surface water.

Sediments and surface water provide habitat and nutrients for aquatic organisms such as plankton, invertebrates, fish and vegetation. Exposure of surface water resources to hazardous substances released at the Site may alter the physical and chemical characteristics of these resources to the extent that growth, survival and reproduction of organisms inhabiting the Site are impaired. Sediments and surface water also provide human use and enjoyment such as recreational opportunities (e.g., wading, swimming, boating); commercial uses (e.g., water transportation, industrial process and cooling water); intrinsic (enjoyment through the knowledge that the water resource exists in a functional state) and aesthetic values (e.g., viewing clean water). Stryker Bay residents have specifically identified the importance of the Bay's recreational services and intrinsic and aesthetic values.

Surface Water Resources Ecological Services Analysis - To determine the baseline ecological services provided by surface water resources at the Site, the trustees intend to focus on benthic organisms and aquatic macrophytes as representatives for all ecosystem components supported by this resource. Benthic organisms are important to shallow bays as a primary food source for juvenile game fish, waterfowl, and other aquatic and semi-aquatic foraging species. Aquatic macrophyte diversity, abundance and distribution is important to the function of shallow bays along the Lower St. Louis River for fish and other foraging species by providing food, spawning areas, nursery habitat, and hiding cover for escape from predation. The trustees therefore plan to evaluate the capability of surface water and sediments to provide habitat for benthic organisms and aquatic vegetation to grow, survive, and reproduce to determine baseline ecological services.

The trustees believe there are insufficient historical data which may indicate the baseline ecological services provided by sediments and surface water. The trustees note that MPCA Site investigations (for remedial design) in 2001 collected sediments from North Bay (a sheltered embayment on the St. Louis River located approximately 9 river miles upstream from the Site) which serve as a reference for the following toxicity tests: *Hyalella azteca* 28-day survival and growth; *Chironomus tentans* life-cycle survival, growth and emergence, *Typha latifolia* seed germination and early seed growth; and *Zizania aquatica* seed germination and early seed growth (MPCA, 2001). The trustees believe that North Bay is comparable to the shallow water embayments at the Site for this resource category, and has not (to the trustees' current knowledge) been affected by hazardous substances under investigation at the Site. The trustees therefore conclude that North Bay sediments may serve as an appropriate control resource for baseline surface water resources, and intend to utilize the identified toxicity tests as metrics to measure the baseline level of ecological services. Other metrics may be developed as necessary, and will be documented for public review and comment as a proposed modification to this Plan.

Surface Water Resources Human Use Services Analysis - To determine baseline human use services provided by surface water resources at the Site, the trustees intend to focus on recreational activities (e.g., swimming, wading, recreational boating) and intrinsic and aesthetic values. Water-based recreational activities are particularly important to people living and

visiting in the Duluth-Superior area. Having aesthetically pleasing natural spaces such as clean embayments on the St. Louis River is highly valued. Therefore, the trustees plan to evaluate the ability of the public to use surface water and sediment resources at the Site for recreational activity opportunities and to enjoy the intrinsic and aesthetic values provided by the area in determining baseline human use services for this resource.

The trustees define baseline recreational activities at the Site to be the ability to engage in the activity without restrictions due to the release of hazardous substances or due to effects from the remediation of these substances. For example, baseline human use services of swimming and wading are the ability to swim and/or wade at the Site without restrictions as identified by public health and environmental agencies. Also, baseline recreational boating is the ability to navigate a typical (up to 18 ft.) recreational water craft into the slips and embayments (to a similar extent as currently available) without restrictions.

The trustees define baseline intrinsic and aesthetic appreciation of natural resources as not adversely affected by the presence of Site contaminants or due to effects from the remediation of the contaminants. For example, baseline aesthetic and intrinsic values provided by surface water resources in embayments and slips at the Site (as currently defined) are considered to be pleasing to view, and without odor and sheen resulting from the effects due to hazardous substances released at the Site. The trustees intend to use public surveys to develop data/information to determine baseline measurements of intrinsic and aesthetic values. Other metrics may be developed as necessary, and will be documented for public review and comment as a proposed modification to this Plan.

5.5.2 Biological Resources

Biological resources provide a wide variety of ecological services, including: nutrient cycling and supply; primary productivity and other forage bases; propagation and maintenance of fish and other aquatic life; waterfowl and wildlife reproduction; nursery and escape cover for fish, wildlife, amphibians and invertebrates; and other fish and wildlife habitat needs. With the combination of a shallow water embayment (Stryker Bay) connected to the main river channel, deepwater shipping slips, and a shallow water embayment (Keene Creek Bay) immediately adjacent to deepwater habitat (Slip 7), the Site represents significant fishery habitat potential. The upland peninsulas of the Site support birds and other wildlife species that are dependent on the nearby surface water of the embayments for emerging insects and other food items, drinking water, and vegetative cover. Human use services related to biological resources include recreational fishing (including fishing for human consumption), wildlife viewing, and hiking. Human use services of particular significance to the trustees at the Site are the Ojibwe bands' hunting, gathering, and fishing of a wide variety of biological resources, especially wild rice (reference Section 2.1).

Biological Resources Ecological Services Analysis - To determine baseline ecological services provided by biological resources at the Site, the trustees intend to focus on wetland and terrestrial plant communities, quality and quantity of food resources for representative foodchain receptors (including humans), and viability of fish and wildlife. The trustees therefore plan to evaluate the capability of biological resources at the Site to provide habitat for plants, fish, and wildlife to grow and reproduce; and to serve as sources of food sufficient to sustain viable fish and wildlife populations.

The trustees believe there is insufficient historical data which may indicate baseline ecological services provided by biological resources; aerial photos and surveys may reflect some level of habitat historically provided at the Site. MPCA Site investigations in 2001 were implemented to measure accumulation of Site contaminants in tissues of benthic invertebrates, wetland plants, and fish collected from North Bay (MPCA, 2001). MPCA Site investigations in 2001 also used North Bay sediments to measure the bioaccumulation of Site contaminants in a benthic invertebrate species under standard laboratory conditions (MPCA, 2001). The trustees believe that North Bay is comparable to the embayments at the Site for this resource category (as described under Surface Water Resources). The trustees therefore conclude that North Bay sediments may serve as an appropriate control resource to help evaluate some baseline ecological services provided by biological resources at the Site, and intend to utilize the identified bioaccumulation tests as metrics to contribute to the measurement of baseline ecological services pertaining to quality of food resources.

The trustees believe that additional ecological services data pertaining to quality and quantity of food resources for representative foodchain receptors (including humans), as well as viability of fish and wildlife, may be collected at an efficient cost at the same time as the exposure studies described in the "Confirmation of Exposure" section of this Plan. Data will include tissue concentrations of bioaccumulating contaminants of concern in select fish and bird species, tumor incidences and other health indicators in fish, and chromosome damage and oxidative stress in birds (using tree swallows as an indicator species). Reference the avian and fish study workplans (Trustees, 2002a; b) for a more detailed description of these metrics and the data collection methods. The trustees believe tissue concentrations from ecological receptors in North Bay provide a measure of the baseline quality of food resources for representative foodchain receptors, while tumor incidences, fish health indicators, and indicators of chromosome damage and oxidative stress provide information on the baseline viability of fish and wildlife. This information will be used with the toxicity and bioaccumulation tests previously referenced as metrics to determine baseline services reflecting the capacity of biological resources at the Site to provide a quality food base which sustains viable fish and wildlife populations.

The trustees believe that ecological services data pertaining to habitat services may be provided in part by historical information/data (e.g., aerial photos), supplemented with vegetative

community surveys and wetland mapping projects currently under development by the MPCA Site Team. The trustees have determined that historical information/data (e.g., aerial photos) of vegetation and habitat type present on Site peninsulas, or alternatively, the same type of information/data from an appropriate reference area, documented in the same vegetative community classification system utilized in the Lower St. Louis River Habitat Plan (following the Association for Biodiversity Information classification as modified by C. Reschke & E. Epstein) will provide appropriate measures for the density, diversity and distribution of terrestrial vegetative communities on the upland peninsulas under baseline. The trustees have determined that mapping of wetland types (using NWI classification system) and bathymetric measurements in Kingsbury Bay will provide appropriate measures to determine the density, diversity and distribution of emergent and submersed aquatic vegetative communities and open water suitable to meet the spawning, nursery, forage and cover requirements of fishery and wildlife resources inhabitating shallow (<6ft) water habitats at the Site under baseline conditions. The trustees have determined that mapping of wetland types (using NWI classification system and aerial photos) on the peninsulas (prior to remedial and post-remedial activities) will provide measures for those wetland habitats under baseline conditions.

Biological Resources Human Use Services Analysis - To determine the baseline level of human use services provided by biological resources at the Site, the trustees intend to focus on public uses of fish, wildlife and plant resources (e.g., consumption, recreational fishing). These public uses include recreational and subsistence fishing, hunting, gathering (especially wild rice), wildlife viewing, and hiking. These activities contribute to the publics' enjoyment of the area.

The trustees define baseline level of human use services provided by biological resources at the Site to be the ability to use these resources without restrictions due to the release of hazardous substances, or due to effects from the remediation of these substances. For example, baseline recreational and subsistence fishing is the opportunity to catch and consume fish from the Site without restrictions as identified by public health and environmental agencies. The trustees propose to utilize data from fisheries creel surveys to determine the sport fishery resource value within the St. Louis River estuary. The Minnesota DNR has proposed creel surveys during the winter of 2002/2003 and during the summer of 2003, interviewing anglers at eight access points around the estuary. If implemented, these surveys will provide current data on angling pressure, catch rates, total harvest, structure of catch, and angler attitudes toward current management strategies within the St. Louis River estuary, and will also include a specific goal of calculating the lost “sport fishery resource value” due to injuries to fishery resources and habitat. Baseline hunting or gathering is defined by the trustees as the opportunity to hunt wildlife or gather plants (or their parts) and consume these resources without restrictions.

The trustees also define baseline services such as wildlife viewing and hiking around the area as unrestricted due to effects from the hazardous substances. The trustees intend to use surveys to develop data/information to determine baseline measurements of the publics' ability to view

wildlife and hike. Other metrics may be developed as necessary, and will be documented for public review and comment as a proposed modification to this Plan.

5.5.3 Ground Water Resources

Ground water provides ecological services to surface water and biological resources at the site. These ecological services include reserve stock for drought, water supply for vegetation and wildlife, surface water supply, and maintenance of hydrologic flows. Ground water also provides potential human use services, including industrial activity support, agricultural uses, and future drinking water supply.

Ground Water Resources Ecological Services Analysis – To determine the baseline ecological services provided by ground water at the Site, the trustees intend to focus on water supply for surface water and biota. The trustees believe that upgradient monitoring wells may be used as a source of ground water that has not been affected by discharges at the Site, and may therefore represent baseline ground water conditions. These conditions, if uncontaminated from other sources, will meet all Minnesota water quality standards, thereby fully supporting all ecological services. Therefore, the trustees will use Minnesota water quality standards for surface water as a metric for measuring the capability of ground water to support baseline levels of ecological services.

Ground Water Resources Human Services Analysis – To determine baseline human use services provided by ground water the trustees intend to focus on future use of ground water resources for drinking water. The trustees believe that upgradient monitoring wells may be used as a source of ground water that has not been affected by discharges at the Site, and may therefore represent baseline ground water conditions. These conditions, if uncontaminated from other sources, will meet all Minnesota drinking water standards thereby supporting all human use services. Therefore, the trustees will use Minnesota drinking water standards as a metric for measuring the capability of ground water to support human use services.

5.5.4 Geologic Resources

Geologic resources provide ecological services including habitat for growth of vegetation and other biota, and as a filtering mechanism for ground water. Geologic resources may also provide human use services such as residential use, industrial use, agricultural use, and support for recreational activities such as hiking, biking and camping. The trustees believe that the primary geologic resource service at the SLRIDT Site is the filtering of ground water provided by the soils. This mechanism is important to ensure that the quality of ground water discharged to surface water resources (including sediments) is sufficient to provide habitat and nutrients for aquatic organisms such as plankton, invertebrates, fish and vegetation, as well as to provide human use and enjoyment such as recreational opportunities and intrinsic and aesthetic values (e.g., viewing clean water). Because the trustees intend to evaluate these same services as part of the sediment/water resource category, no additional geologic resource service analysis is

anticipated for this assessment.

5.6 Comparative Evaluation of Service Losses and Preliminary Estimates of Damages
The trustees recognize that restoring natural resource services to baseline levels at the SLRIDT Site is dependent on the type of remedy selected at the SedOU (reference the "Preliminary Determination of the Recovery Period" section, above). The trustees will evaluate each of the four remedial alternatives to estimate their potential for restoring natural resource service losses at the Site. This evaluation will compare baseline ecological and human use services provided by natural resources at the Site to the services anticipated (ie., predicted) to be restored by implementation of each of the remedial alternatives. If the restoration achieved by a remedial alternative is not estimated to attain baseline (within each potential remediation scenario) the trustees will identify a "service loss" which will require further action to reach the baseline level of resource services. The trustees note that The Interlake Corporation (now XIK Corp.) provided the trustees with a preliminary analysis of the restoration potential which the RPs anticipate would result from the implementation of each of the four remedial alternatives (SLRIDT Superfund Site Restoration Potential: Post-Remediation Natural Resource Conditions, WindWard Environmental, May 2001). The trustees will consider information presented in this report in their preliminary evaluation.

The analysis of baseline restoration will include a ***Comparative Preliminary Estimate of Damages (PED)*** to identify possible alternatives, including a "No Action - Natural Recovery" alternative, for baseline restoration projects associated with each of the four remedial alternatives under consideration. The PED will also provide an estimate of the anticipated costs to implement the various habitat-based projects and other actions designed to return natural resource services at the Site to their baseline level of services; cost estimating and valuation methodologies will follow the guidance provided in 43 CFR §11.83. The comparative PED will clearly identify the information, data, assumptions, and uncertainties by which the preliminary sets of restoration alternatives have been developed. The comparative PED is intended to be completed within a timeframe sufficient to be utilized by the RPs and the MPCA in their development of the Feasibility Study for the Site. The trustees and/or the RPs may subsequently determine to obtain additional information and data at the Site to address any of the assumptions and/or uncertainties identified in the comparative PED. The primary purpose of the comparative PED is to provide the RPs, MPCA, and public with a preliminary indication and estimated costs of the baseline restoration actions under each of the remedial alternatives considered by the trustees to be sufficient to restore, rehabilitate, replace and/or acquire the equivalent of the injured natural resources.

The trustees will also complete a preliminary comparative analysis of compensatory restoration at the Site; that is, the damages necessary to compensate for resource services which may be lost or affected up until the point in time that baseline restoration is achieved. The same

Comparative Preliminary Estimate of Damages described above will also include an initial evaluation of actions to address interim losses of resource services anticipated under each of the four remedial alternative scenarios and presumed baseline restoration projects associated with each remedy. Interim losses and compensatory restoration will be determined in terms of select services the resources provide. The comparative PED will identify possible alternatives for compensatory restoration projects and other actions associated with each of the four remedial alternatives under consideration; estimated costs of such actions will be determined following the guidance provided in 43 CFR §11.83. Again, this comparative PED is intended to be completed within a timeframe to be utilized by the RPs and the MPCA Site Team in the development of the Feasibility Study. The trustees and/or the RPs may subsequently determine to obtain additional information and data at the Site to address any of the assumptions and/or uncertainties identified in the comparative PED associated with this analysis of interim resource losses.

The trustees intend to complete the preliminary comparative evaluation of the four remedial alternatives, including the PED, in sufficient time for the RPs and the MPCA Site Team to utilize the information in the development of the Feasibility Study for the SedOU. In addition to the PED, a "Baseline Services Determination" report may be developed and released by the trustees as an interim product to facilitate coordination of this part of the assessment with the evaluation of data from the re-opened Remedial Investigation. Following the selection of the remedy for the SedOU (as documented in the ROD), the trustees will develop a final evaluation of lost services that may be restored in coordination with response actions, as described in Chapter 6.

5.7 Injury Determination Review

Following injury identification and the preliminary evaluation of resource service losses and potential restoration anticipated under each of the four remedial alternatives, the trustees will determine which natural resource services to more fully analyze in the final injury quantification and damage determination phases of this assessment as part of a "Plan review" (43 CFR §11.32(f)). A "Preliminary Injury Determination Report" may be developed and released by the trustees as an interim product which documents the initial results of the trustees' injury determination, and provides the basis to select assessment methodologies referenced in the "Natural Resource Injury Quantification and Damage Determination" section of the Plan (Chapter 6). Such a report may also continue to facilitate coordination of the assessment with the evaluation of data collected as part of the re-opened RI/FS process.

CHAPTER 6
NATURAL RESOURCE INJURY QUANTIFICATION AND DAMAGE DETERMINATION

6.1 Introduction

This section of the Plan describes how the trustees' will use results from the injury determination part of the assessment to further quantify losses of select natural resource services at the Site in order to determine what restoration is appropriate to compensate for those losses. The trustees intend to further develop the preliminary injury quantification and damage determination described in Section 5.6 of the Plan by developing a final determination of restoration and compensation following the selection of the remedy (as documented in the ROD) for the SedOU. The trustees will provide a more detailed description of the methodologies to be used in this part of the assessment following the completion of the comparative PED previously described. Again, the trustees intend to complete this work in sufficient time for the MPCA Site Team and the RPs to utilize the information concurrent with other aspects of site response actions.

The evaluation described in the "Injury Determination Review" section of this Plan is intended to provide the trustees with sufficient information to design and implement the tasks necessary to "quantify for each resource determined to be injured and for which damages will be sought, the effect of the discharge or release in terms of the reduction from the baseline condition in the quantity and quality of services" (43 CFR §11.70(a)(1)). The process described below is the trustees' method to determine the compensation to provide the "restoration, rehabilitation, replacement, and/or acquisition of the equivalent of the injured natural resources and the services those resources provide" (43 CFR §11.80(b)).

6.2 Baseline Restoration

The trustees' priority at the SLRIDT Site is to return natural resources to their baseline condition of services (see Section 5.2) by focusing on *habitat-based projects or other actions* which restore, replace, and/or provide (acquire) the equivalent of those services; ideally, in full coordination with remedial actions. Replacement and acquisition of the equivalent may involve projects or actions which provide a substitute for services lost or impaired by natural resource injuries. The replacement services must be considered sufficiently similar to the lost services. The trustees will identify potential restoration projects and other actions based on trustee resource management expertise, the St. Louis River Citizens Action Committee "Lower St. Louis River Habitat Plan" and other local sources, as well as results from other restoration sites. Cost estimating and valuation methodologies will follow the guidance provided in 43 CFR §11.83.

This analysis will identify a "reasonable number of possible alternatives" (including a "No Action - Natural Recovery" alternative) for baseline restoration at the SLRIDT Site within a ***Restoration and Compensation Determination Plan (RCDP)***; the selected alternative including "the actions required to implement that alternative" will also be presented (43 CFR §11.81(a)(1)). The range of possible restoration alternatives will consider each of the 10 factors identified in 43 CFR §11.82(d), including "the results of any actual or planned response actions" (43 CFR §11.82(d)(4)) in order to achieve baseline restoration in the most cost effective manner possible. Therefore, the RCDP will be developed following the final documentation of the selected remedy as identified in the ROD for the SedOU, and may serve as a preliminary restoration plan to facilitate concurrent and coordinated implementation of remedial and restoration actions at the Site. The RCDP will incorporate final results and evaluations of exposure and injury studies referenced in this Plan, as well as other related natural resource information being documented at the Site.

6.3 Compensable Value and Compensatory Restoration

In the DOI regulations, "compensable value" (43 CFR §11.80(b) and §11.83(c)(1)), is defined as "the amount of money required to compensate the public for the loss in services provided by the injured resources between the time of the discharge or release and the time the resources and the services those resources provided are fully returned to their baseline conditions" (43 CFR §11.83(c)(1)). At the discretion of the trustees a claim for natural resource damages may include the compensable value of "all or a portion of the services lost to the public" (43 CFR §11.80(b)).

The trustees intend to evaluate these interim losses at the SLRIDT Site according to *a range of lost services* associated with injured natural resources which are expected to occur up to the completion of baseline restoration. Similar to the baseline restoration evaluation, this analysis will utilize information developed in the assessment as described in the "Natural Resource Injury Determination" section of this Plan (Chapter 5). Cost estimating and valuation methodologies will follow the guidance provided in 43 CFR §11.83. However, rather than emphasizing monetary compensation, the analysis will emphasize lost services in resource terms (eg., lost angler-days or other "service-to-service" terms) and may identify a range of potential restoration *projects* (and associated costs) that could resolve the trustees' compensable value claim in lieu of the monetary value of public losses. Other methodologies, such as habitat equivalency, may also be considered where appropriate (e.g., replacement of fish and wildlife habitat which provide important services to the public).

The trustees will complete a final determination of compensable value or compensatory restoration at the SLRIDT Site within the same ***Restoration and Compensation Determination Plan (RCDP)*** as described above, following MPCA issuance of the ROD for the SedOU.

CHAPTER 7
QUALITY ASSURANCE DOCUMENTATION

NRDA regulations require an Assessment Plan to include a Quality Assurance Project Plan (QAPP) that "satisfies the requirements listed in the NCP and applicable EPA guidance for quality control and quality assurance plans" (43 CFR 11.31 (c)(2)). In performing this assessment, the trustees will use readily available SLRIDT Site data in addition to a limited collection of supplemental data. Each applicable study will have its own individual QAPP tailored to that specific study. Therefore, this section of the Assessment Plan will not provide a specific QAPP, but will instead outline the type of information that should be included. Studies used in the assessment will be screened to verify that supporting documentation is available and sufficient to allow for an evaluation of the reliability and usability of the information. This chapter will also provide an overview of the types of data sources that may be used in completing this assessment.

7.1 Elements of a QAPP

A QAPP is a formal document describing the necessary Quality Assurance/Quality Control (QA/QC) and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. In general, a QAPP must provide sufficient detail to demonstrate that:

- The project objectives are identified and agreed upon (USEPA, 1999);
- The intended measurements or data acquisition methods are appropriate for achieving project objectives (USEPA, 1999);
- Assessment procedures are sufficient for confirming that the type and quality of data required (and expected) are obtained (USEPA, 1999); and
- Any limitations on the use of the data can be identified and documented (USEPA, 1999).

The QAPP shall be composed of standardized, recognizable elements covering the entire project from planning, through implementation, to assessment. These elements have been arranged into four general groups and their intent are summarized as described by USEPA Requirements for Quality Assurance Project Plans (1999):

Project Management - Project management elements include the project history and objectives, roles and responsibilities of the participants, etc. These elements ensure that the project has a defined goal, that the participants understand the goal and the approach to be used, and that the planning outputs have been documented.

Data Generation and Acquisition - Data elements in this group address all aspects of project design and implementation. Implementation of these elements ensure that appropriate methods for sampling, measurement and analysis, data collection or generation, data handling, and QC activities are implemented and properly documented.

Assessment and Oversight - These elements address the activities for assessing the effectiveness of the implementation of the project and associated QA and QC activities. The purpose of assessment is to ensure that the QAPP is implemented as prescribed.

Data Validation and Usability - These data elements address the QA activities that occur after the data collection or generation phase of the project is completed. Implementation of these elements ensures that the data conform to the specified criteria, thus achieving the project objectives.

The trustees currently intend to conduct studies to confirm contaminant exposure and injury to avian and fish species (Trustees, 2002a; b). Chemical and biomarker analyses will be conducted according to the standard operating procedures, protocols, and quality assurance and controls specified by either the U. S. Fish and Wildlife Service Patuxent Analytical Control Facility (PACF) contract laboratory or the NOAA National Marine Fisheries Services, Northwest Fisheries Science Center (NOAA). Both PACF and NOAA maintain rigorous protocols and QA/QC programs for sample analysis. Documentation of these laboratory QA/QC requirements and protocols for analyses performed in the Avian and Fish Exposure and Injury Study Workplans are available upon written request from the trustees' Data Manager (see Section 7.2 and 7.3.3).

7.2 Trustee Organization and Responsibility

The trustees have organized themselves for the collection and management of data by appointing a Data Manager to provide oversight for supplemental studies and to ensure the use of laboratories that follow QA/QC procedures that satisfies the requirements listed in the NCP and applicable EPA guidance for quality control and quality assurance plans. The trustees' Data Manager for this assessment is Annette Trowbridge, U.S. Fish and Wildlife Service.

7.3 Data Sources

This section describes the data and information sources that will be considered for use in conducting this assessment. Readily available data and information will be used to the extent possible. However, supplemental studies will be conducted to obtain data that are considered critical for providing a sound scientific basis for this assessment, but are not currently available.

7.3.1 Available Data

The trustees will gather and evaluate available information relevant to this assessment for the purpose of determining exposure, evaluating pathways, and confirming injuries resulting from releases of hazardous substances at the SLRIDT Site. Data sources that will be considered in the assessment include, but may not be limited to:

state, tribal and federal government reports and data
industry reports and data
RI/FS reports, including technical memoranda
ecological risk assessment, including information used to support the risk assessment
ongoing ecological or toxicological studies being conducted by various investigators
MPCA Site Team Toxicity Studies
Lower St. Louis River Habitat Plan

Only information that has sufficient supporting documentation will be used in the assessment. Data sources will be screened to verify that supporting documentation is available and sufficient to allow for an evaluation of the reliability and usability of the information. Data sources should have the following types of supporting documentation available to be considered usable:

< sampling methodology, including information on sample location, environmental media samples, and measurement units;

< chemical analysis, including information on detection limits and methodology;

< raw data or data tabulations; and

< accompanying quality assurance/quality control (QA/QC) data or separate QA/QC reports

Data that are considered acceptable will be compiled into an electronic format for analysis (e.g. database or spreadsheets). Steps to ensure data quality for this procedure include: validation of all data entered and review of calculations performed on the data. Changes and modifications to the data will be tracked.

7.3.2 Supplemental Data Collection

The trustees anticipate collecting limited additional data for the purpose of determining exposure, evaluating pathways, and confirming injuries resulting from releases of hazardous substances at the SLRIDT Site, as described in Chapter 5 and avian and fish study workplans(Trustees, 2002a; b). Study plans detailing sampling sites, methodology, sample analysis, and sample processing and handling procedures will be developed for each study conducted.

7.3.3 Procedures for Sharing Data

The NRDA regulations state that an Assessment Plan includes "procedures and schedules for sharing data, split samples, and results of analyses, when requested, with any identified potentially responsible parties and other natural resource trustees" (43 CFR 11.31 (a)(4)).

To facilitate the data-sharing process, the trustees will provide RPs and other state or federal agencies with an opportunity to obtain a copy of the data used in the assessment once the data have been validated. If RPs or state or federal agencies wish to receive such data, a written request should be submitted to:

Annette Trowbridge
U. S. Fish and Wildlife Service
Twin Cities Field Office
4101 East 80th Street
Bloomington, MN 55425-1665

e-mail: annette_trowbridge@fws.gov

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