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FIVE-YEAR REVIEW REPORT
ST. REGIS PAPER COMPANY SITE
CASS LAKE, MINNESOTA

Prepared By:
Minnesota Pollution Control Agency
St. Paul, Minnesota

March 27, 1995

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

APR 0 6 1995

REPLY TO THE ATTENTION OF:

H-7J

James Warner, Manager
Ground Water and Solid Waste Division
Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, Minnesota 55155

RE: St. Regis Paper Company, Cass Lake, Minnesota
Five Year Review Report

Dear Mr. Warner:

U.S. EPA has reviewed the Five-Year Review Report developed by the Minnesota Pollution Control Agency for the St. Regis Paper Company Site, dated March, 1995. The purpose of this letter is to transmit U.S. EPA's approval of the report. U.S. EPA appreciates the effort you and your staff put into conducting this review. Please feel free to contact me if you have any questions.

Sincerely

Wm. E. Muno

William E. Muno, Director
Waste Management Division

I. BACKGROUND

A. Introduction

The Minnesota Pollution Control Agency (MPCA) conducted this Five-Year Review of the remedial actions (RA) implemented at the St. Regis Paper Superfund Site (Site), Cass Lake, Minnesota, on behalf of the United States Environmental Protection Agency (EPA). This review evaluated whether the RA at the Site remains protective of public health and the environment.

Section 121 of the Comprehensive Environmental Response Compensation and Liability Act of 1980 as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and Section 300.430(f)(4)(ii) of the National Oil and Hazardous Substance Contingency Plan require review of any RA which results in substances, pollutants or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure. The review should occur no less often than every five years after the initiation of such RA to ensure that human health and the environment are being protected.

OSWER Directive 9355.7-02 (Structure and Components of Five-Year Reviews, May 23, 1991) states that the EPA will conduct five-year reviews as a matter of policy at: (1) sites where no hazardous substances will remain above levels that allow unrestricted use and unrestricted exposure after completion of the RA, but the cleanup levels specified in the Record of Decision will require five or more years to attain; and (2) sites addressed pre-SARA at which the remedy, upon attainment of the cleanup levels, will not allow unlimited use and unrestricted exposure. The five-year review of the RA at this Site was conducted in accordance with this policy.

The EPA established a three-tier approach to conducting five-year reviews, the most basic of which provides a minimum protectiveness evaluation (Level I review). EPA determines the level of the review based on site-specific considerations, including the nature of the response action, the status of ongoing site response activities, and proximity to populated areas and sensitive environmental areas. A Level I review was conducted for the Site, and consisted of: (1) a review of all documents associated with the RA, (2) a recent site visit on July 18-19, 1994, and (3) a limited ecological risk evaluation.

The Site was placed on the National Priorities List on September 21, 1984, with a Hazard Ranking Score of 53. Champion International Corporation (Champion) performed the RA at the Site in accordance with Response Orders by Consent (Consent Orders) dated February 26, 1985. The major components of the RA included ground water extraction/containment systems at the treating facility (Operable Unit (OU)1) and the former Cass Lake City Dump (OU2), a granulated activated carbon (GAC) ground water treatment system located at OU1 for OU1 and OU2, an extension of the Cass Lake municipal water system (OU3), and a vault (OU4) for the contaminated soil from OU1 and OU2. The Consent Orders were executed under authority given to the MPCA by the Minnesota Environmental Response and Liability Act (MERLA).

B. Site Background

The Site is located in the city of Cass Lake, on the Leech Lake Indian Reservation and in the Chippewa National Forest. It is bounded on the north by the Burlington Northern (BN) and Soo

Line Railroads, and to the west by Minnesota Highway 371 (Figure 1). This area is part of the Mississippi River headwaters, and surface water drains into Pike Bay, Cass Lake and the channel between the two. These waters then empty into the Mississippi River.

Beginning in 1957, St. Regis Corporation operated a wood preserving business at the site on land leased from the Great Northern Railroad, which through merger has become part of BN. The site was eventually expanded by purchasing land south of the leased facility. Creosote use began in 1957, and pentachlorophenol (PCP) in 1960; both chemicals were used until the facility closed. PCP was generally combined with a carrier solvent, usually No. 2 fuel oil, and when present as a contaminant in the ground water tends to float. In the latter years of facility operations, a water dispersible PCP concentrate, which was a proprietary mixture of PCP and ketone, was used. The PCP concentrate was denser than water, and would sink if present as a contaminant in the ground water. From approximately 1969 until 1973, in the non-freezing months, a water soluble Copper-Chromium-Arsenate (CCA) salt solution was also used for wood treating.

The following paragraphs detail a history of operations at the Site. See Figure 2 for an overview of the Site operations.

1. OU1 - Treating Facility. The generation of wastewater began at the facility in 1957 when a 72-inch diameter by 75-foot long pressure cylinder was installed in the wood treating plant in the northcentral portion of the Site. Creosote was used as the wood treating chemical during the early years of facility operation. Wastewater discharged from the cylinder passed through a baffled separator tank and a charcoal filter before being discharged to a disposal pond located adjacent to the treating plant, Pond A.

   In 1960, a 49-foot long extension was added to the original cylinder. The use of PCP as a treating chemical began at about this time. Two underground tanks were added to further separate the water from the oil in the discharge. Beginning in about 1960, wastewater was discharged to a series of three ponds, Pond B.

   In 1969, a second cylinder was added to treat wood with CCA. The small amount of water that was routinely generated when the water soluble preservatives were used was returned as makeup water for preparing the treating solution; however, some cylinder washwater was discharged to the disposal ponds.

   In mid-1971, the series of three disposal ponds was covered with sand and replaced with a new pond, Pond C. In 1972, the cylinder that had been used for treating wood with CCA was added as an expansion tank to the original cylinder and a new 72-inch diameter by 150-foot long cylinder was added for treating wood with PCP and CCA. In addition, a 20,000 gallon underground wastewater separation tank was added for each cylinder.

   Improvements were made to the wastewater treatment system in 1974. With these improvements, wastewater from each cylinder was carried to a primary separating tank which was approximately 8 feet in diameter and 40 feet long. The oil that accumulated on top of the wastewater was skimmed and returned to the process. Water from the primary tank was pumped to a mixing station where a flocculating agent was added. The mixture was then pumped to a second tank for settling. Water was pumped from this tank through a sand filter and carried through the pipe to a sawdust filter located adjacent to Pond C.

During the period 1974 through mid-1980, the average flow of wastewater to Pond C was estimated to be 12,000 gallons per day with a maximum flow rate of approximately 17,000 gallons per day. Water in Pond C was aerated and nutrients were added to improve the treatment of the wastewater. This system operated from 1974 until the pressure treating system was again revised in mid-1980. From mid-1980 to 1985, water was evaporated from the waste and the residue placed in barrels and transported to a hazardous waste disposal facility out-of-state. From mid-1981, the PCP used was a type that allowed the wastewater to be reused in the process. Mention was made in MPCA correspondence from 1976 of two tipi burners at the Site. These burners were used by St. Regis to make charcoal from wood scrap. One of the burners was situated just to the south of Pond C, and spray irrigation of wastewater from Pond C was used for fire prevention on the grassland where the burner was located (see Figure 2, Wastewater irrigation area 1977). The location of the second tipi burner is not known.

A 3,000 gallon spill of creosote in 1976 was recovered by absorption with sawdust, which was later burned in a brush-burning project. During two occasions in 1976, sludge from the cleaning of tanks was hauled to a disposal site in the southwestern corner of the property. Pond C was dredged on one occasion, and the dredged bottom material was placed on the south, east and north sides of the pond. Sawdust from the sawdust filters was periodically deposited in the landfill area northeast of Pond C. In 1980, wastewater from Pond C was sprayed on the ground in the southwest portion of the property. Timber, metal and other demolition wastes were deposited in the landfill area. Empty containers that once contained water soluble, wood preserving chemicals were also reported to have been placed in the landfill area.

2. OU2 - Cass Lake City Dump Pit. Between 1957 and 1960, wastewater from Pond A and sludge (the substance left at the bottom of storage tanks when they were cleaned) were hauled to a pit in the dump and burned (see Figure 3). The disposal from Pond A occurred almost daily at an estimated rate of 500 gallons per day, for a total of 547,500 gallons for those three years. From 1960 to 1975, unknown quantities of sludge were hauled to the pit. It is probable that the contents of the pit were burned during this time period as well. The pit containing the ash and unburned residuals was eventually covered. All three types of chemicals: creosote, PCP and CCA, were used at the facility during the time that waste was hauled to the pit.

Champion assumed responsibility for the Site when it acquired and merged with St. Regis Corporation in January 1985. The wood preserving operation ceased in September 1985, and the oil/water separator tanks were removed. In 1986, Champion dismantled the facilities on the Site in accordance with a MPCA approved plan. The demolished buildings were landfilled adjacent to the on-site landfill area in accordance with the requirements of a MPCA landfill permit. The steel tanks were cleaned by Hydra-Blasting, and then sold as scrap metal. The pressure treating cylinders were cleaned and sold to another wood treating operation for use at a different site.

In September 1988, Champion presented a large portion of the Site to the City of Cass Lake and the Leech Lake Reservation Business Committee. See Figure 4 for locations of the property retained by Champion, and Appendix A for additional information.

C. Remedial Objectives

The response goals and objectives, as stated in the Minnesota Enforcement Decision Document (MEDD) for OU1 dated March 5, 1986, were to:

1. Adequately protect the public against exposure to PCP, polynuclear aromatic hydrocarbons (PAHs), hexa, hepta and octachlorodibenzo-p-dioxin (PCDD) and polychlorinated dibenzo-p-furans (PCDF) isomers through direct contact or ingestion of ground water from private and public water supplies.

2. Adequately protect the public against exposure to PCP, PAH, PCDD and PCDF isomers potentially released to surface water from the ground water.

3. Adequately protect and minimize damage to the environment from the migration of PAH, PCDD and PCDF isomers in the ground water.

D. Summary of Response Actions

The MEDD for the St. Regis Paper Company, which incorporates the RA for OU1, and creates OU3 (Extension of Cass Lake Municipal Water System) and OU4 (Contaminated Soil Vault), was signed on March 5, 1986. The MEDD for the Cass Lake City Dump Pit (OU2) was signed on July 29, 1986. The response actions required at the Site were state-of-the-art for 1986.

The response actions for each operable unit were as follows:

1. OU1 - Treating Facility. A temporary stockpile with a synthetic membrane liner and cap was constructed in 1985, and sludge and contaminated soil from OU1 and OU2 were excavated and placed in this stockpile. Ten ground water extraction wells were constructed to act as a gradient control system. The contaminated ground water from OU1 and OU2 was pumped to a newly constructed water treatment plant which used GAC as a filtration medium. The outfall pipeline for the treated ground water was constructed to the discharge point in the channel between Pike Bay and Cass Lake. Special scavenger wells for the possible future recovery of light nonaqueous phase liquid (LNAPL) were installed adjacent to each extraction well, and monitored to determine if LNAPL accumulated in the drawdown cones around the extraction wells. If recoverable amounts of LNAPL were found to accumulate in the scavenger wells, LNAPL recovery equipment would be installed. Other actions included the construction of a demolition debris landfill in accordance with a MPCA permit, and a spent carbon storage cell, which was never used since the GAC is regenerated off-site and recycled. Six additional monitoring wells were installed, and 17 monitoring wells were abandoned. Long-term monitoring of the ground water, treated ground water discharge, selected fish species, and LNAPL levels were planned, as well as maintenance of the RA.

2. OU2 - Cass Lake City Dump Pit. The RA at OU2 involved construction of three ground water extraction wells, each capable of pumping 40 gallons per minute; three scavenger wells for possible future LNAPL recovery (see discussion in above paragraph); underground pipelines from the extraction wells to the control shed and from the control shed to the junction building at OU1; and the control shed and junction building. Four monitoring wells were installed in the vicinity of the pit. Long-term monitoring of the

ground water and LNAPL levels were planned, as well as maintenance of the extraction system.

3. OU3 - Extension of Cass Lake Municipal Water System. The community water system was extended to include 15 residences potentially impacted by the Site. Private wells were located to the north, south and west; those to the south were closest to the Site, one being only 200 feet from the area of contaminated shallow ground water. Sampling of the residential wells showed no evidence of contamination. Cass Lake municipal wells 1 and 3 were also potentially affected by the Site; well 1 has since been abandoned, and well 3 is being used as a monitoring well. New municipal wells were installed into the deeper aquifer on the opposite side of town.

4. OU4 - Contaminated Soil Vault. The vault was designed consistent with the requirements of a Resource Conservation and Recovery Act (RCRA) Subtitle C containment vault. 37,500 cubic yards of contaminated soil and sludge from the wastewater lagoons in OU1 was removed from the temporary stockpile and placed in the vault, as were 4,500 cubic yards of contaminated soil and sludge from OU2. Long-term monitoring of the ground water below the vault, and operation and maintenance (O&M) of the vault were planned. Ground water monitoring and vault O&M have been carried out since June 1987. Monitoring has shown that the integrity of the vault has not been compromised.

E. Applicable or Relevant And Appropriate Requirements (ARARs)

In the MEDD for OU1, the original ARARs were listed as follows:

- Applicability of RCRA was deferred until the completion of the response actions.
- Clean Water Act
- Safe Drinking Water Act
- MERLA
- Rules and Regulations of the MPCA, Minnesota Department of Health (MDH) and Minnesota Department of Natural Resources (DNR)
- Statutes of the State of Minnesota

New ARARs have been promulgated for both surface water and ground water. These are discussed in the following sections.

1. Surface Water.

   a. **National Pollutant Discharge Elimination System (NPDES) discharge permit limit.** The NPDES permit effluent limit for discharge of treated ground water to the channel was 8 micrograms per liter (ug/l) PCP in 1986. In the 1992 NPDES permit, the discharge limit for PCP was still 8 ug/l. This ARAR is still applicable, and can remain at 8 ug/l.

   b. **Ground Water to Surface Water Discharge.** Ground water to surface water discharge is a concern because of the remnant ground water plume and the effects it may have on aquatic life in Pike Bay and Cass Lake. There are no surface water limits in the MEDDs. The MPCA Aquatic Life Standards for Class 2B waters were

revised in April 1994 (Minn. Rule Chapter 7050). They are listed in Table 1. According to Minnesota Rule 7050, these standards must be met when contaminated ground water meets surface water; dilution resulting from the mixing of the two is not allowed. If the untreated ground water is discharging to the channel system, it is clearly in excess of established state water quality standards.

2. Ground Water. In the OU1 MEDD, Response Action Levels (RALs) for the ground water plume were given as:

PCP - 1010 ug/l
carcinogenic PAHs - 0.028 ug/l
non-carcinogenic PAHs - 0.300 ug/l
PCDD and PCDF - no levels listed.

In the OU2 MEDD, RALs for the ground water plume were given as:

PCP - 220 ug/l
carcinogenic PAHs - 0.28 ug/l
non-carcinogenic PAHs - 0.300 ug/l
PCDD - no level listed.

Since 1986, new ARARs have been promulgated for ground water. The Health Risk Limits (HRLs) are found in Minn. Rule 4717.7100-4717.7650. Both the new Maximum Contaminant Levels (MCLs) and HRLs for PCP are more stringent than the RALs listed in the MEDDs. The MDH recommended guideline for total carcinogenic PAHs is 0.03 ug/l, which is consistent with the former RAL. Table 2 compares the current MCLs and HRLs for Site-related compounds.

II. SITE CONDITIONS

Underlying OU1 and OU2 is an estimated 400-foot thick sequence of glacial material. Investigation at the Cass Lake sites have penetrated the upper 130 feet of glacial material and have identified four major glacial units.

An upper glacial outwash (surficial aquifer);
An upper glacial till (upper till);
Lower glaciofluvial sediments (lower aquifer);
Lower glacial till.

Figure 5 lays out transects for geologic cross-sections for both OU1 and OU2. Cross-sections for OU1 are located on Figures 6-8, and those for OU2 are on Figures 9-11. Figure 12 is a cross-section across both operable units parallel with the channel.

The following discussion describes the site at each operable unit. The present situation and associated issues are then discussed in more detail.

A. OU1 - Treating Facility

The boundaries of OU1 and OU4 (Figure 4) define the limits of operation of the former wood treating facility. The area around OU1 consists of a flat, sandy outwash plain which is sparsely vegetated. The lack of vegetation may be due in part to the presence of ponded surface water in some areas, despite the generally sandy nature of the soils. Much of the area was planted with red pine during the summer of 1993. East of OU1 lies a low wetland area composed primarily of tag alder and willow, and beyond that the channel which connects Cass Lake to Pike Bay. The channel itself consists of a relatively narrow (50 feet), shallow (5 to 7 feet) waterway, bordered on the east by a large wetland area consisting of cattails, wild rice, and other aquatic species. The western shore of the channel is well defined, but the eastern edge is not.

The following issues are the most relevant in assessing the effectiveness of the RA implemented at OU1.

1. Ground Water Extraction/Containment System Assessment. The ground water RA involves the removal of contaminated ground water with a series of extraction wells, subsequent GAC treatment and discharge to the Pike Bay/Cass Lake channel. The extraction/containment system consists of 10 extraction wells, as indicated on Figure 4, which have been pumped at rates up to 20 gallons per minute (gpm). The contaminants are removed from the extracted ground water via three 20,000 pound GAC units operated in series. GAC change-out consists of one of the units being replaced every four months. During each change-out, the spent GAC is removed from the primary absorber, first in the series, and replaced with regenerated GAC. After change-out, this absorber is placed in the tertiary position, last in the series. The extraction/containment system (OU1 and OU2 combined) has removed approximately 410 million gallons of ground water with an approximate contaminant mass removal of 12,500 pounds of PCP and 3,700 pounds of PAHs since being placed in operation in 1987. Champion has plans to replace all the carbon steel piping in the water treatment building with polyethylene pipe during the winter of 1995 because of corrosion problems.

   Currently, extraction wells 401, 402, 406 and 410 are operating at 5 gpm; extraction wells 403, 408, and 409 are operating at 15 gpm; and extraction wells 405 and 407 are operating at 20 and 10 gpm, respectively. Extraction well 404 is not operating at this time. Champion has evaluated the current pumping rates using SLAEM, an analytical ground water computer model, and has determined that the current configuration is effectively containing the contaminant plume.

2. Remnant Plume. The remnant plume is an area of contaminated ground water lying east of the capture zone created by the extraction wells (Figure 4). Concentrations of PCP (2200 ug/l) in this area greatly exceed the MCL of 1 ug/l. The bulk of the contamination is located at the base of the surficial aquifer in the form of a density plume, as indicated by sampling results from monitoring wells 212, 213, 215 and 220. Monitoring well 220 was installed in 1993 to define the southern extent of the contaminant plume; sampling results indicate that the plume extends south, beyond this location. The MPCA and Champion currently believe the remnant ground water plume is discharging to the channel and the surrounding wetlands of Pike Bay and Cass Lake. In 1993, concentrations of PCP in the northern portion of the remnant plume ranged from 1000 to 3000 ug/l and total PAH concentrations, consisting primarily of noncarcinogenic compounds, ranged

from 30 to 250 ug/l. The chronic aquatic life water quality standard established by the MPCA for PCP is 5.5 ug/l for Class 2B waters at pH> 6.96. The standard decreases with pH below 6.96. The pH of the water in the channel ranges from 6.6 to 7.8. The average pH of the treated ground water discharged to the channel was 7.9 in 1993. Recent data from well 220 suggests that chronic aquatic life standards for individual PAHs such as naphthalene are also being exceeded. According to Minnesota Rule 7050, these standards must be met when contaminated ground water meets surface water; dilution resulting from the mixing of the two is not allowed. If the untreated ground water is discharging to the channel system it is clearly in excess of established state water quality standards.

Champion has indicated that contaminant concentrations have been declining in recent years in the wells monitoring the remnant plume, and projects future contaminant concentrations using a log-normal relationship with time. The plots generally show a decreasing trend in contaminant concentrations and indicate that water quality standards should be met in wells at the channel sometime within the next thirty years. However, the plots must be interpreted with care, as some of the monitoring wells evaluated (212 and 213) are within or very near the zone of influence of an active extraction well. If the monitoring wells are being influenced by the extraction/containment system, they may not be representative of actual (non-pumping) contaminant concentrations at that location. Champion has increased the pumping rate in extraction well 408, which is located within the remnant plume, and this has helped to contain some of the remnant plume.

Champion's steady state SLAEM-projected capture zone is presented in Figure 4. MPCA has requested that Champion evaluate the extent and magnitude of the remnant plume, estimate discharge and loading to the surface water system, and conduct surface/ground water and sediment sampling in identified ground water discharge areas, but to date Champion has not done this.

An additional concern regarding the remnant plume involves the potential for migration beyond the channel and the lake, northeast towards an area of residential wells known as Stoney Point. Monitoring well 219 is located on the east side of the channel, along the north side of the BN railroad tracks (Figure 3). Sampling results from this monitoring well have consistently shown measurable concentrations of PAHs, some in excess of ground water cleanup levels established in the MEDDs. If the assumption is made that this contamination is Site-related, it indicates that ground water is passing under the channel in an eastward and potentially northward direction. Monitoring well 217, located further east along the BN tracks, has also shown PAH contamination, typically below health-based standards. Champion installed monitoring well 221 on the east side of the channel in 1993. This new well is located along US Highway 2 between the remnant plume and Stoney Point. It has been sampled once and no contamination was detected.

3. LNAPL Extent and Magnitude. LNAPL has been identified at the upper surface of the surficial aquifer in several areas. On June 25, 1992, Champion conducted a survey of LNAPL levels in OU1 wells. LNAPL was present in four OU1 wells, as can be seen in Table 3. The extent of the LNAPL contamination is not well-defined, and its detection has been incidental. The Remedial Investigation (RI) estimated a large area of LNAPL extending from monitoring well 118 to just west of the current line of extraction wells. LNAPL has since been found further east, at piezometers 505 and 506. In 1993,

Champion began recovering the LNAPL from scavenger and monitoring wells at OU2. To date, no LNAPL has been recovered from wells at OU1, reportedly because the volume is not sufficient for efficient recovery with existing equipment.

Although dense nonaqueous phase liquid (DNAPL) has not been identified in the aquifers underlying the Site, it is possible that DNAPL exists somewhere in the vicinity. This theory is supported by the presence of a density plume at the base of the surficial aquifer. In later years of facility operation, a proprietary ketone/PCP mixture was used, which was water dispersible. The mixture was reported to be heavier than water. If DNAPL is present, it would tend to pool in low spots in the upper till or migrate in an easterly direction parallel to the sloping surface of the upper till unit.

4. Monitoring Network. The current ground water monitoring system consists of thirteen shallow monitoring wells screened near the watertable, eight monitoring wells screened near the base of the surficial aquifer, and two lower aquifer monitoring wells. There are also ten ground water extraction wells, four LNAPL scavenger wells and eight observation wells located around the extraction wells. These numbers are estimates as many wells at the Site have been abandoned since the investigation began, and no accurate, comprehensive list and/or map of all Site wells is available. The approximate locations of the wells discussed above can be found on Figure 3. The ground water analyte list and a summary of proposed monitoring events from Champion's 1993 Annual Monitoring Report are presented in Tables 4 and 5, respectively.

   There is a need for additional monitoring points at OU1 as the southern boundary of the remnant plume is not well defined. There is also a need for a lower aquifer monitoring well in an appropriate location, directly under the upper aquifer plume, to monitor downgradient lower aquifer conditions.

5. Residual Soil Contaminant Levels. As part of the RA, on-site source areas identified during the RI were excavated. These source areas consisted primarily of lagoons or pits containing sludge and associated contaminated soils. The MEDD stated that sludge, visibly contaminated soil and uncontaminated soil were differentiated on the basis of visual appearance. Sludge was principally black or brown organic material, with some sand and sawdust. Visibly contaminated soil was oily brown or black sand, with a distinct creosote or fuel oil odor. Uncontaminated soil was sand with no oily appearance and little or no black or brown color or creosote/fuel oil odor. Obvious visual staining was the criterion used to identify contaminated material for excavation. After excavation of the visually stained material, site restoration, consisting of surface grading and seeding, was completed. No additional surface soils were brought in and placed above the original surface. The file does not identify that any confirmatory sampling was conducted to determine the amount of residual contamination in the soils.

   It is possible that some level of contamination exists throughout the former operations area, as it was common for treated timbers and lumber to be placed on racks or in stacks and allowed to drip dry prior to shipping. Additionally, as indicated earlier, wastewater was spray-irrigated on at least two areas of the Site.

   As was discussed above, Champion retained ownership of the area of the ground water treatment plant and the contaminated soil vault. A location within the area given to the

city of Cass Lake was recently considered for residential development, but development activities were revised due to the unknown conditions of surface and subsurface soils in the area. The developer has since purchased land from the city which is immediately adjacent to the Site. No institutional controls or deed restrictions for the Site are known to exist. Access to most of the treating facility area is not restricted.

B. OU2 - Cass Lake City Dump Pit

The boundaries of this operable unit are presented in Figure 3. The general area displays more relief than OU1, possibly because the area was previously filled. Surficial soils are very similar to those found at OU1, consisting of sandy soils at the higher elevations and organic soils at the lower elevations. The areas of higher elevation tend to be wooded with mixed deciduous and conifer species. The areas of lower elevation, south and east of the pumpout wells towards the channel and Fox Creek, are predominantly wetland areas consisting of cattails, sedges, rushes and other wetland species. Between the wetland and the wooded areas lie transitional areas consisting of thick willow and alder brush. Vegetation growth on the actual location of the former disposal pit and surrounding disturbed areas is sparse. Adjacent to and just south of the pit lies the former Cass Lake City Dump. The former Cass Lake sewage treatment plant is directly northwest of the dump.

The following issues are the most relevant in assessing the effectiveness of the RA implemented at OU2.

1. Ground Water Extraction/Containment System Assessment. The ground water RA involves the extraction of contaminated ground water from three extraction wells with subsequent GAC treatment and discharge to the Pike Bay/Cass Lake channel. The 3 extraction wells (2401, 2402, and 2403) are pumping at rates ranging from 10 to 20 gpm.

   The 1989 Annual Monitoring Report discusses the shutdown of extraction well 2401 on August 17, 1989, due to problems associated with the LNAPL accumulation, and goes on to mention that "an oil [LNAPL] recovery system will be designed to recover the oil [LNAPL] and well 2401 will be placed back on-line." At the time of shutdown, more than two feet of LNAPL was present in the scavenger well (S2401) adjacent to extraction well 2401. It is probable that the buildup of LNAPL in the scavenger well resulted in LNAPL entering the extraction well and fouling it. Champion evaluated the effectiveness of the two remaining extraction wells (2402 and 2403) and determined that capture was maintained with just the two extraction wells pumping at approximately 20 gpm each. On July 8, 1992, Champion submitted an evaluation of the LNAPL levels in all Site wells and began developing a plan for product recovery. The LNAPL levels measured on June 25, 1992, are presented in Table 3. Extraction well 2401 was serviced and put back into operation on April 13, 1993. Currently, extraction wells 2401, 2402, and 2403 are pumping at approximately 10, 15 and 20 gpm respectively. Champion has evaluated the current pumping rates using SLAEM and has determined that the current configuration is effectively containing the contaminant plume.

2. LNAPL Extent and Magnitude. LNAPL has been identified at the upper surface of the surficial aquifer in several areas. The extent of the LNAPL contamination is not well defined and detections of its occurrence have been incidental. As discussed above, Champion conducted a survey of LNAPL levels in OU2 wells on June 25, 1992, which

indicated the presence of LNAPL in at least six wells (see Table 3). No estimates of the amount or extent of LNAPL contamination have been made for OU2. In 1993, Champion removed 42 gallons of LNAPL from a single scavenger well (S2402). During the summer of 1994, approximately 35 gallons of LNAPL were recovered from the scavenger wells, 30 gallons from S2402 and 4.5 gallons from S2401. LNAPL was also present in monitoring wells 2102, 2103, 2104, and 2105. The product that is recovered is transported to a wood treating facility in South Dakota for use.

3. Monitoring Network. The current ground water monitoring system consists of nine shallow monitoring wells screened near the watertable, one monitoring well screened near the base of the surficial aquifer, and two lower aquifer monitoring wells. There are also three piezometers, three LNAPL scavenger wells and two observation wells located around the extraction wells. These numbers are estimates as many wells at the Site have been abandoned since the investigation first began, and an accurate, comprehensive list and/or map of all Site wells is not available. See Figure 3 for the approximate locations of these wells. The ground water analyte list and a summary of proposed monitoring events from Champion's 1993 Annual Monitoring Report are presented in Tables 4 and 5, respectively.

   The monitoring network at OU2 is lacking in wells screened at the base of the upper aquifer. Much of the contamination at OU1 is migrating in the form of a density plume located at the base of the upper aquifer. Currently only one monitoring well (2234) at OU2 is screened at the base of the upper aquifer. In 1993, concentrations of carcinogenic and non-carcinogenic PAHs detected in monitoring well 2234 exceeded cleanup levels established in the MEDD; however, data from this monitoring well does not indicate the presence of a significant density plume at that location.

   Champion has interpreted that the surface of the upper confining layer may slope in a westerly direction under the former disposal pit. If this is the case, the potential for gravity-driven movement of contaminants exists along the surface of the upper confining layer. An additional well screened at the base of the surficial aquifer west of the disposal pit may also be advisable. The water table and lower aquifer monitoring network at OU2 appear adequate.

4. Residual Soil Contaminant Levels. Contaminated soil and sludge was excavated from the disposal pit on a visual basis. The file does not identify that any confirmatory sampling was conducted to assess the effectiveness of the removal action.

C. OU3 - Municipal Water System

Municipal water has been provided to 15 residences in the adjoining residential area, but one resident has consistently refused to hookup to the water system. This resident began using bottled water in 1991 for reasons unrelated to the Site. On September 23, 1993, this resident began receiving weekly deliveries of bottled water from Champion.

D. OU4 - Contaminated Soil Containment Vault

The vault (see Figure 4 for its location) is covered with approximately 5 feet of soil, and is vegetated. Evidence of burrowing mammals can be seen on the cover. The perimeter of the vault is protected by a chain-link barbed wire fence. Bluebird houses have been attached to this fence.

The containment vault was constructed during 1986 and 1987. The placement of the contaminated soil in the containment vault was completed in late 1986, but due to winter weather conditions, the cover liner could not be installed during 1986. All precipitation which occurred between the time that contaminated soil was first placed in the vault and the time that the clay cover liner was installed accumulated in the vault. During the spring of 1987, a 12-foot square hole was accidentally torn in the primary high density polypropylene (HDPE) membrane cover liner near the west top edge of the vault while final shaping of the contaminated soil was taking place in preparation for the clay cover liner. A portion of the HDPE drainage net was also torn, but the secondary HDPE liner was not damaged. The hole remained open for several weeks during significant rainfall events and it was estimated that thousands of gallons of water entered the vault before it was repaired. As a result the leachate level in the leak detection system increased several feet. In order for the leachate to get from the leachate collection system to the leak detection system, a hole must exist in the primary liner. Barr has estimated the hole to be relatively small based upon the rate of leachate collection.

On October 20, 1987, prior to the removal of any leachate from the leachate collection sump, the depth of liquid in the leachate collection sump was 14.19 feet. Over the next several months 1,216,300 gallons of leachate were removed from the vault and pumped to the treating facility for treatment and subsequent discharge. Leachate removal was initiated again on July 8, 1992 with a total removal of 160,000 gallons over a four month period. This leachate was also pumped to the treating facility for treatment and discharge.

Ground water monitoring around the vault is conducted in accordance with the 1992 Revised Post-Closure Submittal. The monitoring program consists of semi-annual sampling of monitoring wells 124, 125, 126, 128, 129, and 130 for PAHs and phenolics. Ground water elevations are measured quarterly in all vault monitoring wells. To date none of the vault monitoring wells have indicated significant contamination, demonstrating that the integrity of the vault is intact.

In 1992, Champion submitted a work plan and sampling plan for biotreatment of the contaminated soil in the vault. Because of various regulatory issues, this innovative remedial option has not been implemented.

E. Other Site-Related Issues

Sampling of the wells at the Leech Lake Division of Resource Management (DRM) Fish Hatchery during 1992 indicated low level PAH contamination in the south production well (#4 on Figure 4). Further investigation into this matter indicated very low level contamination had also been detected in 1985. The well was resampled in 1993 and 1994, and PAH concentrations seem to be climbing slightly. The cumulative concentrations of non-carcinogenic PAHs detected in 1994 (3.18 ug/l) were the highest detected to date, and were above the state recommended allowable limit of 0.30 ug/l.

The ground water pumped from the south production well is used for rearing fish and is not known to be directly consumed by hatchery personnel. Well logs indicate that the two production wells are approximately 120 feet deep, and suggest that the upper till unit is present at the north

production well but is conspicuously absent at the south production well. Water level measurements in monitoring wells around the soil containment vault have indicated ground water flow reversals towards the hatchery as a result of hatchery pumping. This is significant in that it shows a strong hydraulic connection between the upper and lower aquifers in the area of the hatchery and vault.

One possible source of the south production well contamination is a former disposal pit utilized by St. Regis for a short period in 1976. The pit was located very near the current southwest fence corner pole for the soil containment vault. It is believed that the pit was excavated to the same visual standards as the rest of the Site, and the contaminated soil placed in the vault. Champion's technical responses to the above issues are included in Appendix B.

III. ECOLOGICAL EVALUATION

A. Ecological Resources

A search of the Minnesota Natural Heritage Information System was conducted by the DNR to determine if any rare plant or animal species or other significant natural features occur in the vicinity of Pike Bay or Cass Lake within a two-mile radius of the site. No records of endangered species were found for the area. However, bald eagles, a Federal and State threatened species, are known to feed in Cass Lake and Pike Bay, and an active bald eagle nest was located at the south end of Pike Bay in 1994. An inactive nest remnant was found in 1984 just south of the Site in the Swede Hill area, indicating possible former nesting activity very near the Site. An osprey (State species of special concern) nest area is located along the west shore of Pike Bay within 1.5 miles of the Site. In addition, two significant natural plant communities, an old growth red pine forest and a black spruce swamp, occur along the west shore of Pike Bay approximately two miles south of the Site.

A variety of terrestrial and aquatic habitat types occur on and near the Site. Descriptions of the vegetation and locations of these areas can be found in sections II.A and II.B. An important habitat feature of the channel connecting Cass Lake and Pike Bay is an extensive wild rice bed and area of emergent vegetation comprising the eastern edge. Common fish species include northern pike, walleye, perch, brown bullhead, white sucker, tullibee and whitefish. Northern pike reportedly spawn in the channel and in Cass Lake near the north end of the channel. A public fishing pier is located in Cass Lake near the channel mouth. During Site visits by MPCA personnel, river otters, common and Caspian terns, waterfowl, great blue and green-backed herons, osprey, various songbirds, painted turtles, beaver and raccoon sign, and a feeding adult bald eagle were observed in or near the channel. Woodchuck, ground squirrels, crows and various songbirds, and deer and rabbit sign were observed on the Site property.

Environmental media relevant to the ecological evaluation of this Site are soil, surface water, ground water discharging to surface water, sediments and biota.

B. OU1 - Treating Facility

1. Residual Soil Contamination. The potential exists for significant residual contamination of Site surface soils by PCP, PAHs, PCDD/PCDFs, and possibly the metals copper, chromium and arsenic. All of these chemicals could present potential hazards to terrestrial ecological receptors due to direct toxicity or food chain

bioaccumulation/biomagnification. Potential migration pathways from soil are runoff to surface water and infiltration to ground water with subsequent discharge to surface water and sediments of Pike Bay and/or Cass Lake. Soil sampling to determine the extent and magnitude of residual contamination should be carried out. Analyses should include congener specific determination of 2,3,7,8-substituted PCDD/PCDFs so that 2,3,7,8-TCDD toxic equivalents can be calculated for risk screening. TCDD equivalent concentrations in the low parts per trillion (ppt) range may be hazardous to certain wildlife species, e.g. those which consume a high percentage of earthworms in the diet. Surficial soil samples taken in 1985 had TCDD equivalent concentrations up to 30 ppb, due entirely to hexa, hepta and octa congeners (assuming all 2,3,7,8-substituted forms). However, only limited sampling was done, apparently in areas that were obviously visibly contaminated.

2. Remnant Plume. Concentrations of PCP in the remnant plume in 1993 exceed the MPCA chronic aquatic life water quality standard for Class 2B surface waters by 200 to 500 times (1000-3000 ug/l vs. 5.5 ug/l). Naphthalene concentrations also exceed the 2B chronic standard of 81 ug/l. No recent analyses have been done for PCDD/PCDFs, but given the high PCP concentrations and the fact that PCDD/PCDFs are contaminants of technical grade PCP, these compounds also likely occur in the density plume. Arsenic, copper and chromium could be additional contaminants. The remnant plume ground water may be discharging to the channel/wetland area and adjoining areas of Cass Lake and Pike Bay. Therefore the potential exists for adverse impacts to aquatic biota through direct toxicity and bioaccumulation in these systems. Because this ground water discharge cannot exceed state surface water quality standards at the point of entry to surface water, it is important to determine if it is in fact occurring, and if so, to locate the ground water discharge area so surface water and sediment sampling can be carried out in that vicinity. It is also important to obtain an estimate of the volume of ground water discharge so the magnitude of potential future adverse impacts can be estimated. If a discharge area can not be specifically located or is diffuse, and the volume of ground water discharge indicates the potential for detrimental effects, then it may be necessary to carry out sediment sampling over a larger area to determine whether there are significant contaminant levels.

   The contaminants of concern would tend to accumulate in sediments in the area of ground water discharge. Previous sampling of channel surface water has detected PAHs below surface water chronic standards, but no PCP (PCDD/PCDFs and metals were not analyzed). Very limited sampling of channel sediments has detected polyychlorinated biphenyl compounds (PCBs) at levels of potential concern (350 parts per billion (ppb)), but no PCP, PAHs or 2,3,7,8-TCDD (the TCDD detection limit was too high, however; other PCDD/PCDF congeners and metals were apparently not included in the analyses). The source of the PCBs is unknown. These results could indicate the remnant plume ground water discharge is elsewhere, such as to wetland areas east of the channel rather than to the channel itself. PCP and PAH concentrations in the mid to high ppb range, and TCDD toxic equivalents in the ppt range, depending on various factors such as total organic carbon, could indicate potential ecological effects from sediment contamination.

3. Groundwater extraction/containment system effluent and fish monitoring. The extraction well effluent discharged to the channel is regulated by a NPDES permit which limits PCP, and PAH concentrations to levels which should not impact aquatic ecological receptors.

Northern pike and tullibee from Pike Bay have been analyzed for hexachlorodibenzo-p-dioxin (HxCDD) since 1985, as part of the NPDES permit. No HxCDD has been detected at various detection limits ranging from 0.32 to 40 picagram per gram. While this sampling may be adequate to address concerns for human health effects from consumption of typical food fish species from Pike Bay, it is not sufficient to demonstrate a lack of contaminant-related effects on biota in the area of the Site. PCP and PAH impacts would likely be more localized to ground water discharge areas, while assessment of PCDD/PCDF effects would require information such as congener specific analysis of prey species of piscivorous wildlife or bioaccumulation by caged fish in areas of sediment contamination.

C. OU2 - Cass Lake City Dump Pit

1. Residual Soil Contaminant Levels. Soil/sludge sampling in 1985 indicated similar high contaminant levels as found in the treating facility area before excavation. Possible residual soil contamination, although presumably more limited in spatial extent than at the treating facility, would be of potential concern due to the proximity to wetlands and Fox Creek.

2. Groundwater. Further monitoring appears necessary to determine if a density plume containing PCP and PAHs exists at the base of the surficial aquifer, and if so, if there is ground water discharge to Fox Creek, the adjacent wetlands or Pike Bay. Limited sediment sampling in Fox Creek in 1983 detected PAHs and PCBs at concentrations exceeding sediment screening criteria [NOAA Effects Range Low values (Long and Morgan 1990) and Ontario Lower Effect Levels (Persaud et al. 1993)], indicating the potential for impacts to aquatic biota. High levels of chlorobenzenes, phthalates and phenol were also detected. Additional sediment sampling, including analyses for PCDD/PCDF congeners, is warranted in Fox Creek and Pike Bay at the creek mouth to determine the extent of the possible contamination and the relationship to potential sources.

D. Fish Hatchery Well

Non-carcinogenic PAH concentrations detected in the fish hatchery south production well have been well below available aquatic life chronic surface water standards, indicating low potential for adverse effects to hatchery fish from these compounds. However, continued monitoring seems warranted to determine if concentrations are in fact increasing with time.

IV. RECOMMENDATIONS

A. Recommendations/Technology

Issues concerning the RA implemented at the Site during the years 1985 through 1988 are documented in this review, and also in reviews conducted by Crague Biglow (MPCA RCRA) and Daniel Symonik (MDH) (in Appendix B). Resolution of the following issues is recommended.

1. OU1 and OU2 - Treating Facility and City Dump Pit

   a. **Capture Zone**. A technical review assessing the effectiveness of the extraction system capture zones should be done by regulatory staff.

   b. **OU1 Remnant Plume**. Evaluation of the remnant plume of contaminated ground water and an ecological evaluation will show the potential for impact to the Cass Lake/Pike Bay ecosystem. The following is recommended:

      1) Comprehensive sediment and near bottom surface water sampling from suspected remnant plume ground water discharge areas for PCP/phenolics, PAHs, metals, congener-specific PCDD/PCDFs, and total organic carbon (the latter two for sediments only).
      2) Determine if the source of the remnant plume is other than residual contaminant migration from the shallow aquifer (e.g. NAPL), or contamination eluding the capture zone of the extraction system.

   c. **OU1 Monitoring Network**. An additional downgradient monitoring well may be necessary at OU1 to define the southern extent of the remnant plume. Installation of an additional lower aquifer monitoring well is also advisable, because the other lower aquifer monitoring well (306) is located near the outer edge of the contaminated zone. Monitoring well 221 should remain as part of the long-term monitoring well network.

   d. **NAPL Extent and Magnitude**. LNAPL extent and depth should be defined across the Site to determine the adequacy of the current recovery effort.

      It is not known if DNAPL is present in the ground water at the Site. An assessment should be made of the potential for DNAPL contamination and its long-term impact on the remedial objectives established in the MEDD.

   e. **OU2 Monitoring Network**. At least one additional monitoring well screened at the base of the upper aquifer is necessary downgradient of the extraction system capture zone to evaluate the potential for a remnant density plume as is present at OU1.

   f. **Residual Soil Contamination Levels**. The RA removed the visibly contaminated soils and sludge, but the file does not identify that any confirmatory sampling was done to document the effectiveness of the removal for PAHs, PCP, dioxin and metals. This information is essential to determine the relative risk associated with the soils and also to determine what type of land use restrictions should be associated with the property. Confirmatory surface and subsurface sampling should be conducted, and a report submitted reviewing the data and making recommendations. Field screening methods such as immunoassay techniques may be adequate, provided good correlation with analytical results can be established. Particular attention should be paid to the areas of the Site no longer owned by Champion.

   g. **ARARs**. Federal and state water quality standards have changed since issuance of the MEDDs. Both the MCL and the HRL are more stringent for PCP than the 1986

RAL. MPCA Aquatic Life Standards for Class 2B waters were updated in 1994, and include six chemicals of Site concern. These standards did not exist in 1986. It is recommended that ground water standards for the Site compounds be changed to reflect the more stringent of new ARARs listed in Table 2, and also that the cumulative carcinogenic PAH MDH guideline of 0.03 ug/l be used as a cleanup level. It is also recommended that the MPCA Aquatic Life Standards listed in Table 1 be used for evaluating the potential impact of the remnant plume on the Cass Lake/Pike Bay system.

h. Ecological Evaluation. If significant soil, sediment, or surface water contamination related to OU1 or OU2 is found , then an ecological risk assessment should be performed to assess the existing and potential impacts of Site contaminants to terrestrial receptors and the Pike Bay/Cass Lake system.

i. Hatchery Well. Semi-annual monitoring of the south production well should continue and the other hatchery wells should be sampled annually. Efforts should be made to ensure that ground water from the south production well is not used for human consumption.

j. DRM Potable Water Supply Well. Considering the proximity of the DRM potable water supply well to the soil containment vault, the documented ground water flow reversals under the soil containment vault as a result of hatchery pumping, and the documented detections of Site-related compounds above drinking water guidelines at the hatchery south production well, it is believed that the DRM water supply well is at risk. It is recommended that the DRM water supply well be sampled quarterly for Site-related compounds.

2. OU3 - Extension of Cass Lake Municipal Water System.

a. Identify any residential wells still in use in the vicinity of the Site.

B. Statement on Protectiveness

1. Long-Term Water Supply. The connection to the Cass Lake municipal water system has provided the residents near the Site with a safe, long-term drinking water source, which has eliminated their exposure to contaminated ground water from the Site via private wells. The resident who has consistently refused to hookup to the municipal water supply now receives weekly supplies of bottled water.

2. Ground Water RA. It is recommended that the new ARARs be implemented. The ground water extraction/containment systems present at the Site will remain protective of public health and the environment with the implementation of the new ARARs.

3. Soil. While the RA for OU4 placed visibly contaminated soils and sludges in a contaminated soil vault, concentrations of contaminants on the surficial soils left on the Site are unknown. Until these levels are ascertained and evaluated, the RA for the soils can not be determined protective of human health and the environment.

4. Vault. The contaminated soil vault is still protective of human health and the environment.

V. NEXT REVIEW

Hazardous substances, pollutants or contaminants will remain at the St. Regis Paper Superfund Site which require access controls as well as operation and maintenance and therefore will not allow unlimited or unrestricted use. EPA will conduct another Five-Year Review by October 1999.

VI. IMPLEMENTATION REQUIREMENTS

Prior to the next Five-Year Review, the aforementioned recommendations should be addressed.

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3. MPCA Board Item: Request for Response Action to the St. Regis Corporation, Burlington Northern Railroad, Inc. and the City of Cass Lake Regarding Contamination at and Around the St. Regis Hazardous Waste Site Located in Cass Lake and the Former Cass Lake City Dump. nApril 24, 1984.
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5. MPCA Board Item: Response Order by Consent with the Champion International Corporation for the Purpose of Completing a Remedial Investigation and Feasibility Study and Developing and Implementing a Response Action Plan at the St. Regis Paper Co. Hazardous Waste Site in Cass Lake. February 26, 1985.
6. MPCA Board Item: Response Order by Consent with the Champion International Corporation for the Purpose of Completing a Remedial Investigation and Feasibility Study and Developing and Implementing a Response Action Plan for the Former Cass Lake City Dump Site in Cass Lake With Regard to St. Regis' Use of the Dump. February 26, 1985.
7. City Dump Pit Site Evaluation Report. Champion International. March 26, 1985.
8. Site Security and Safety Plan. Barr Engineering Company, 1984-1985.
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12. Report on Feasibility Evaluation Thermal Desorption Treatment of Contaminated Soil for Barr Engineering Company. IT Corporation, September 1985.
13. NPDES Permit #MN 0056537, December 13, 1985.
14. Work Plan, Pilot Scale Treatment Plant. January 1986.
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16. Minnesota Enforcement Decision Document: St. Regis Paper Company. March 5, 1986.
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23. Response Action Plan, Contaminated Groundwater Treating Facility Site. Barr Engineering Company, June 1986.

24. Pre-Construction Hydrogeologic Study, Contaminated Soil Containment Vault Area. Barr Engineering Company, June 1986.
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26. Minnesota Enforcement Decision Document: Former Cass Lake City Dump Site. July 29, 1986.
27. MPCA Demolition debris landfill permit. September 1986.
28. Clay Liner Installation in Containment Vault. Barr Engineering Company, December 1986.
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30. Clay Cap Installation for Containment Vault. Barr Engineering Company, August 1987.
31. MPCA Board Item: Update on the Completed Response Actions At The St. Regis Paper Company and The Cass Lake City Dump Sites in Cass Lake, Cass County. September 22, 1987.
32. Annual Monitoring Report January 1987-December 1987. Barr Engineering Company, October 1988.
33. Response Action Final Report, Cass Lake Treating Facility Site. Barr Engineering Company, September 1988.
34. Response Action Final Report, City Dump Pit Site. Barr Engineering Company, November 1988.
35. Quarterly Progress Reports, 1988. Barr Engineering Company.
36. Annual Monitoring Report January 1988-December 1988. Barr Engineering Company, July 1990.
37. ATSDR Health Assessment for St. Regis Paper Company National Priorities List Site. April 10, 1989.
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39. Annual Monitoring Report January 1989-December 1989. Barr Engineering Company, January 1991.
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53. Final Work Plan Free Product Recovery/Reuse. Champion International Corporation, July 1993.
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55. Barr Engineering letter dated April 28, 1994, from Thomas Mattison to Miriam Horneff, MPCA concerning installation of additional monitoring wells.
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TABLE 1

MPCA Aquatic Life Standards for Class 2B Waters

Acenapthene	12 ug/l
Anthracene	0.029 ug/l
Fluoranthene	20 ug/l
Napthalene	81 ug/l
Phenanthrene	2.1 ug/l
PCP	5.5 ug/l

TABLE 2

Comparison of HRLs and MCLs for Site Compounds

	MCL	HRL
CARCINOGENIC PAHs		
Benzo(a)anthracene	0.1 ug/l	none
Benzo(a)pyrene	0.2 ug/l	none
Benzo(a)fluoranthene	0.2 ug/l	none
Indeno(1,2,3-c,d)pyrene	0.4 ug/l	none
Dibenz(a,h)anthracene	0.3 ug/l	none
Benzo(b)fluoranthene	0.2 ug/l	none
Benzo(k)fluoranthene	0.2 ug/l	none
Chrysene	0.2 ug/l	none
NON-CARCINOGENIC PAHs		
Napthalene	none	300 ug/l
Fluoranthene	none	300 ug/l
Pyrene	none	200 ug/l
Anthracene	none	2000 ug/l
Acenapthene	none	400 ug/l
Fluorene	none	300 ug/l
Pentachlorophenol	1 ug/l	3 ug/l
2,3,7,8-TCDD (dioxin)	3.00E-05 ug/l	none

TABLE 3

LNAPL Levels in Monitoring Wells
June 25, 1992

Well Number	Oil Level	Water Level	Measuring Point Elevation (Ft. MSL)	Oil Depth	Oil Elevation (Ft. MSL)	Water Elevation (Ft. MSL)	Equilavent Elevation (Ft. MSL)
Treating Facility Site							
Staff		5.12	1295.94			1301.06	
104		15.3	1317.43			1302.13	
112		2.85	1304.11			1301.26	
113		3.55	1304.72			1301.17	
114							
115		4.6	1305.71			1301.11	
118	17.55	17.8	1318.32	0.25	1300.77	1300.52	1300.76
212		3.05	1304.18			1301.13	
213		4.75	1305.57			1300.82	
215		6.05	1307.22			1301.17	
S401	Trace	16.55	1309.03			1292.48	
S402		5.45	1306.91			1301.46	
S403		5.45	1307.58			1302.13	
411		8.45	1309.73			1301.28	
501		5.65	1306.85			1301.20	
502		4.6	1305.87			1301.27	
503		5.58	1306.93			1301.35	
504		6.15	1307.94			1301.79	
505	5.6	5.8	1306.89	0.2	1301.29	1301.09	1301.28
506	4.55	5.55	1306.17	1	1301.62	1300.62	1301.56
507		4.05	1305.12			1301.07	
508		4.25	1305.53			1301.28	
City Dump Pit Site							
2102	14.65	15.65	1316.79	1	1302.14	1301.14	1302.08
2103	16.4	16.9	1318.36	0.5	1301.96	1301.46	1301.93
2104	15.3	16	1317.55	0.7	1302.25	1301.55	1302.21
2105	18.9	22.6	1320.93	3.7	1302.03	1298.33	1301.81
2106		6.5	1307.82			1301.32	
2127		1.68	1304.20			1302.52	
2128		1.45	1302.93			1301.48	
2129		2.35	1304.54			1302.19	
2134		9.95	1311.35			1301.40	
2135		13.98	1315.33			1301.35	
S2401	9.45	11.3	1311.99	1.85	1302.54	1300.69	1302.43
S2402		4.55	1307.08			1302.53	
S2403	7.6	9.4	1310.57	1.8	1302.97	1301.17	1302.86
2501		10.52	1312.52			1302.00	
2502		7.2	1308.64			1301.44	
2503		2.07	1303.75			1301.68	
2504		8.15	1309.46			1301.31	

TABLE 4

Ground Water Analytes List

List 1 PAH Compounds

Benzo(a)anthracene
Chrysene
Benzo(b)fluoranthene
Indeno(1,2,3,cd)pyrene
Dibenzo(ah)anthracene
Benzo(ghi)perylene
Quinoline

List 2 PAH Compounds

2,3-Benzofuran
2,3-Dihydroindene
Benzo(e)pyrene
Indene
Naphthalene
Triphenylene
Benzo(k)fluoranthene
Benzo(b)thiophene
Isoquinoline
Indole
2-Methylnaphthalene
1-Methylnaphthalene
Biphenyl
Acenaphthylene
Acenaphthene
Dibenzofuran
Fluorene
Dibenzothiophene
Phenanthrene
Anthracene
Acridine
Phenanthridine
Carbazole
Fluoranthene
Pyrene
7,12-Dimethylbenzo(a)anthracene
Perylene
3-Methylcholanthrene

TABLE 4 (continued)

GROUND WATER ANALYTES LIST

Phenolic Compounds

Phenol
2-Chlorophenol
2-Nitrophenol
2,4-Dimethylphenol
2,4-Dichlorophenol
Benzoic Acid
4-Chloro-3-methylphenol
2,4,6-Trichlorophenol
2,4,5-Trichlorophenol
2,4-Dinitrophenol
4-Nitrophenol
2-Methyl-4,6-Dinitrophenol
Pentachlorophenol
o-Cresol
p-Cresol

TABLE 5

RECOMMENDED MONITORING EVENTS
CASS LAKE SITES
1994

Location	First Quarter				Second Quarter				Third Quarter				Fourth Quarter			
	Elevation	PAHs	Phenolics	Field Data	Elevation	PAHs	Phenolics	Field Data	Elevation	PAHs	Phenolics	Field Data	Elevation	PAHs	Phenolics	Field Data
W104					X	X	X	X								
W112	X				X	X	X	X	X				X			
W113					X	X	X	X								
W114	X				X	X	X	X	X				X			
W115					X	X	X	X								
W118[1]																
W212	X				X	X	X	X	X				X			
W213					X	X	X	X								
W215					X	X	X	X								
W217					X	X	X	X								
W218					X	X	X	X								
W219					X	X	X	X								
W220					X	X	X	X								
W221					X	X	X	X								
W302	X				X	X	X	X	X				X			
W306	X				X	X	X	X	X				X			
MW3					X	X	X	X								
Staff Gage	X				X				X				X			
CL-N															X	X
CL-S															X	X
W401						X	X[2]	X								
W402[1]						X	X[2]	X								
W403						X	X[2]	X								
W404[1]																
W405						X	X[2]	X								
W406						X	X[2]	X								

1 No sample collected.
2 Only analyzed for pentachlorophenol.

TABLE 5 (continued)

RECOMMENDED MONITORING EVENTS
CASS LAKE SITES
1994

Location	First Quarter				Second Quarter				Third Quarter				Fourth Quarter			
	Elevation	PAHs	Phenolics	Field Data	Elevation	PAHs	Phenolics	Field Data	Elevation	PAHs	Phenolics	Field Data	Elevation	PAHs	Phenolics	Field Data
W407						X	X[2]	X								
W408						X	X[2]	X								
W409						X	X[2]	X								
W410						X	X[2]	X								
W411					X											
W501					X											
W502					X											
W503					X											
W504					X											
W505					X											
W506					X											
W507					X											
W508					X											
W124	X				X	X	X	X	X				X	X	X	X
W125	X				X	X	X	X	X				X	X	X	X
W126	X				X	X	X	X	X				X	X	X	X
W127	X				X				X				X			
W128	X				X	X	X	X	X				X	X	X	X
W129	X				X	X	X	X	X				X	X	X	X
W130	X				X	X	X	X	X				X	X	X	X
W2102					X											
W2103	X				X				X				X			
W2104	X				X				X				X			
W2105					X											
W2106	X				X				X				X			
W2127					X	X	X	X								

1 No sample collected.
2 Only analyzed for pentachlorophenol.

LE (cont...ed)

RECOMMENDED MONITORING EVENTS
CASS LAKE SITES
1994

Location	First Quarter				Second Quarter				Third Quarter				Fourth Quarter			
	Elevation	PAHs	Phenolics	Field Data	Elevation	PAHs	Phenolics	Field Data	Elevation	PAHs	Phenolics	Field Data	Elevation	PAHs	Phenolics	Field Data
W2128					X	X	X	X								
W2129					X	X	X	X								
W2134	X				X	X	X	X	X				X			
W2135	X				X	X	X	X	X				X			
W2234					X	X	X	X					X	X	X	X
W2301					X	X	X	X								
W2325	X				X	X	X	X	X				X			
W2326					X	X	X	X								
W2329					X	X	X	X								
W2333	X				X	X	X	X	X				X			
W2335					X	X	X	X								
W2401						X	X[2]									
W2402						X	X[2]									
W2403						X	X[2]									
Fish4						X	X	X						X	X	X

No sample collected.
Only analyzed for pentachlorophenol.

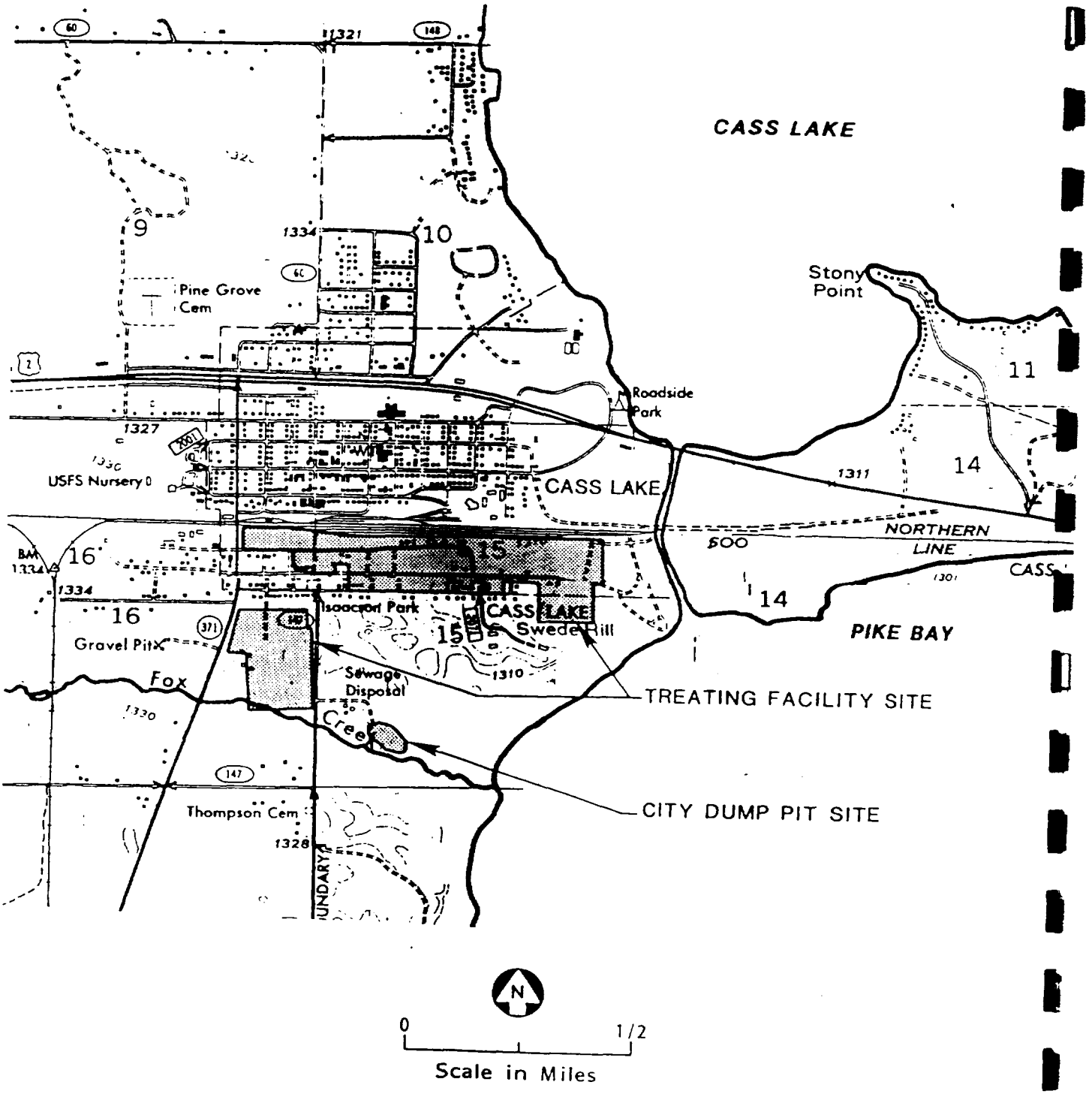

Figure 1

CASS LAKE SITES

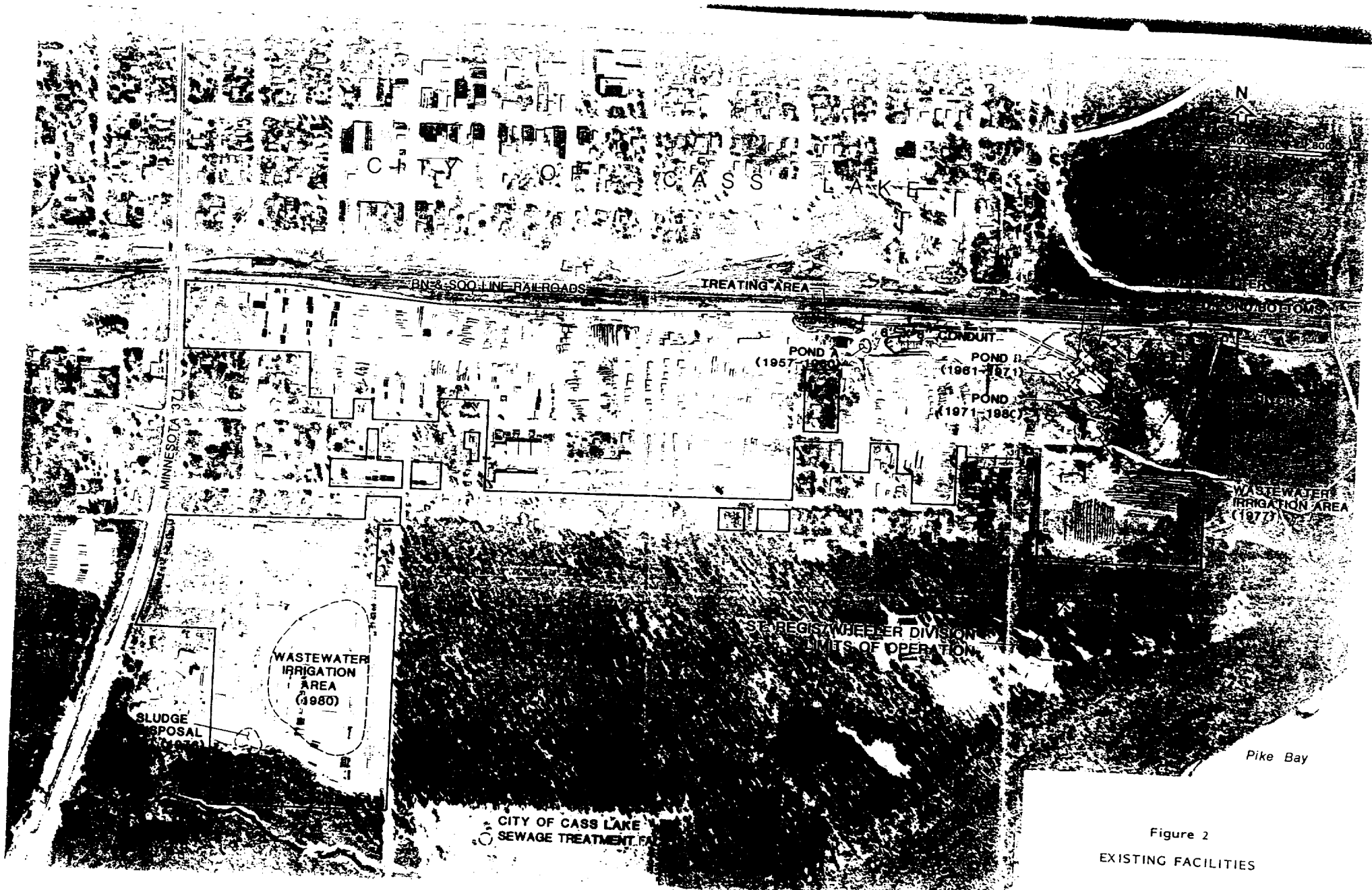

Figure 2

EXISTING FACILITIES

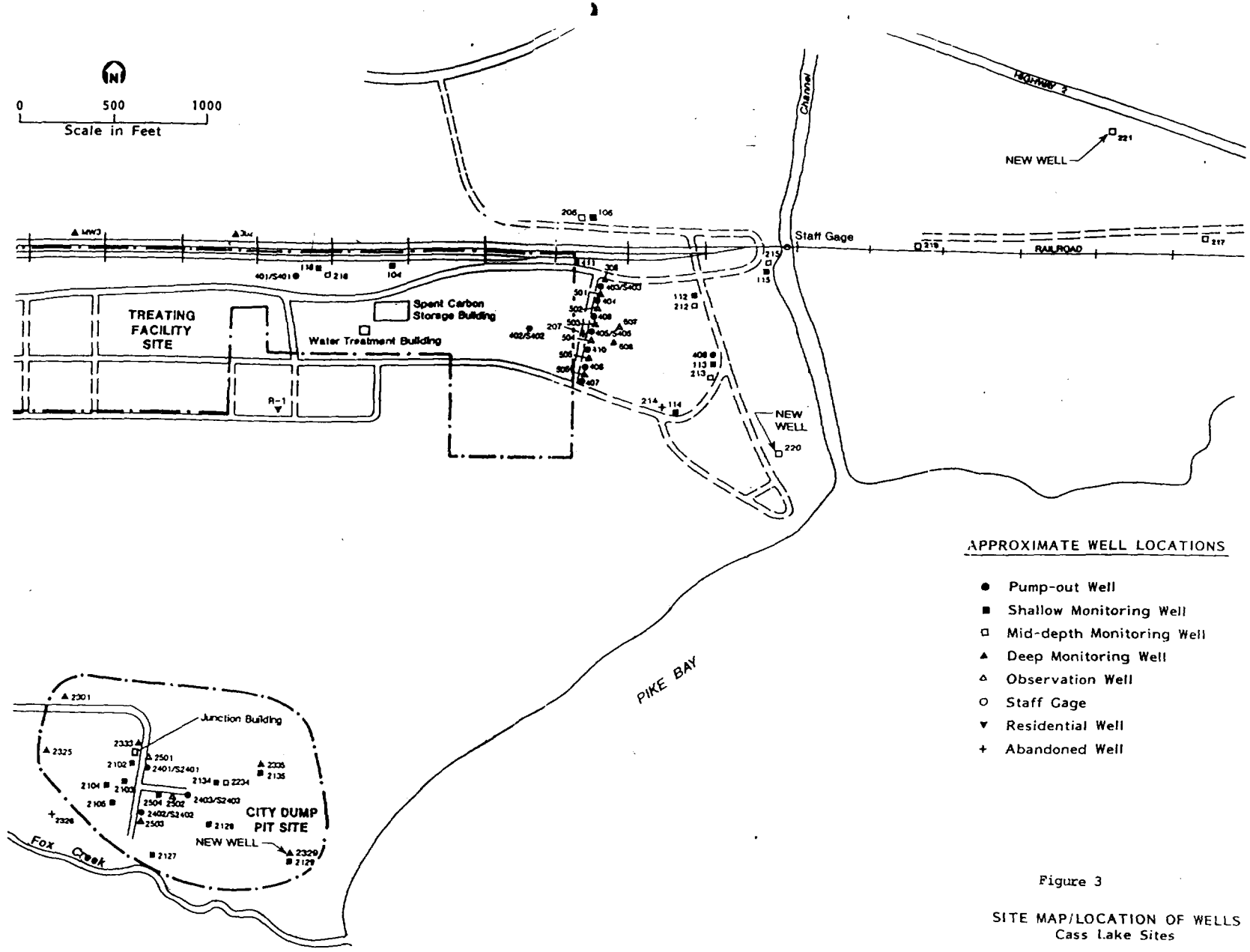

Figure 3

SITE MAP/LOCATION OF WELLS
Cass Lake Sites

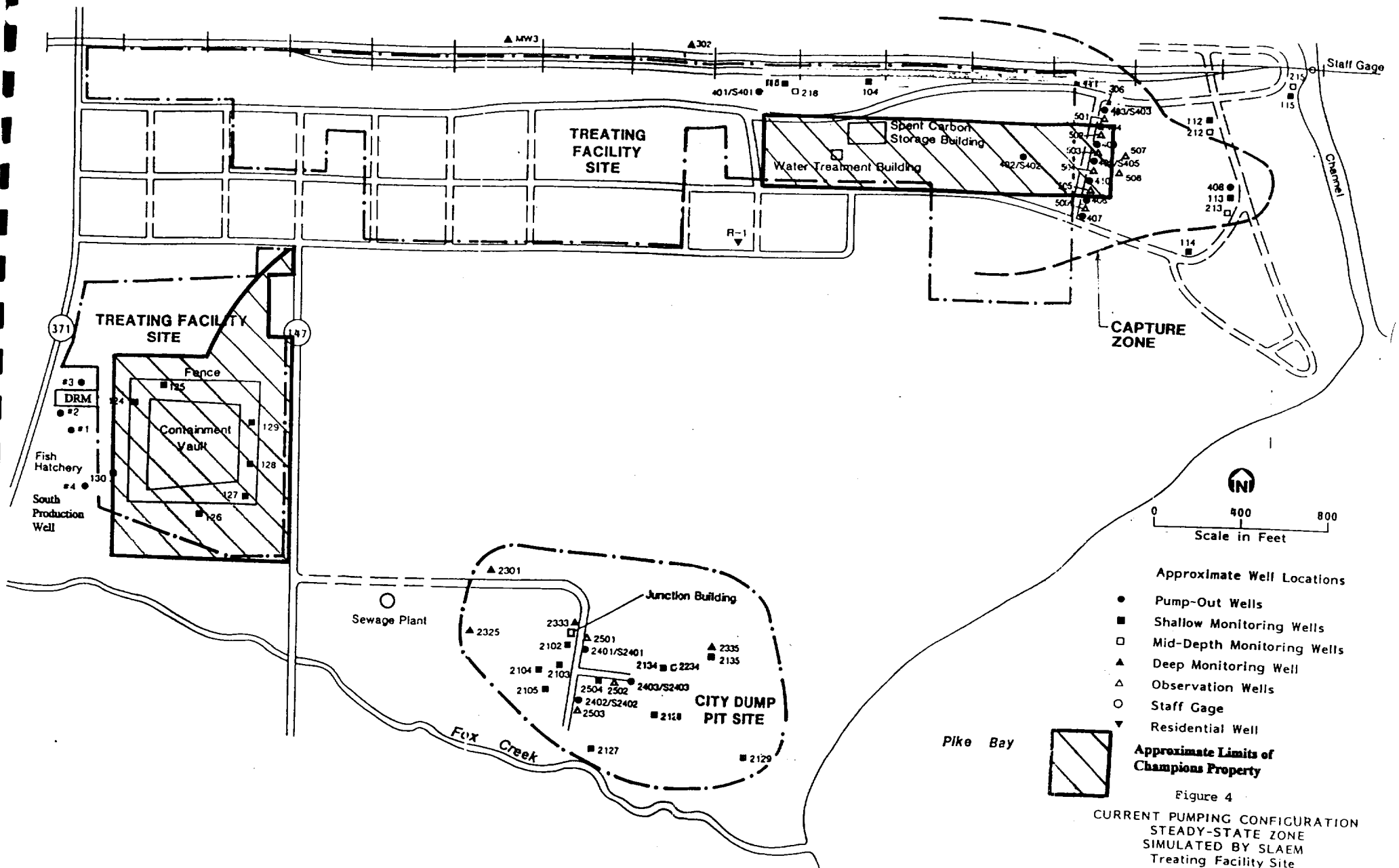

Figure 4

CURRENT PUMPING CONFIGURATION
STEADY-STATE ZONE
SIMULATED BY SLAEM
Treating Facility Site

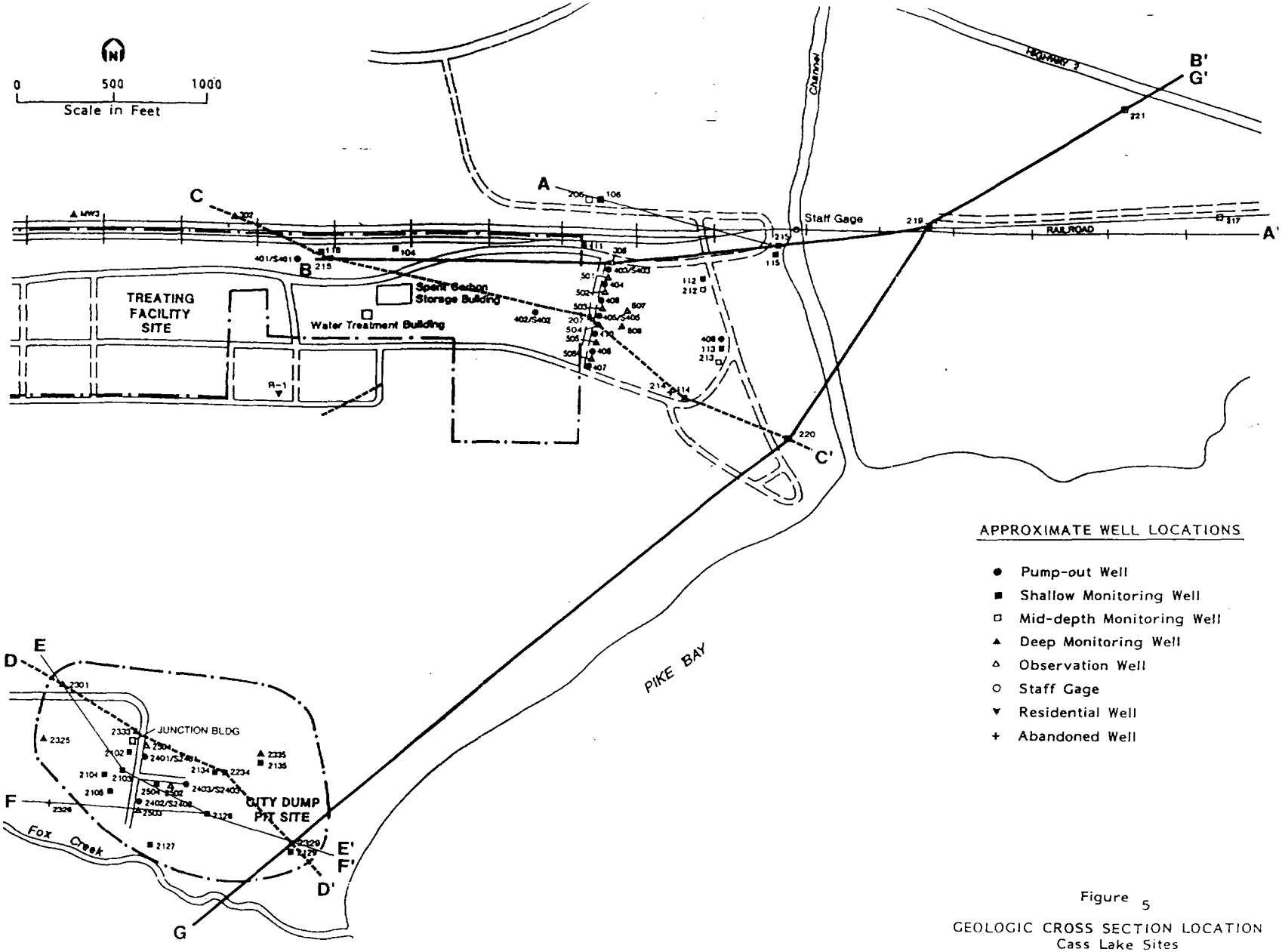

Figure 5

GEOLOGIC CROSS SECTION LOCATION
Cass Lake Sites