Canada's Nuclear Regulator

# Comprehensive Study Report for the Proposed Midwest Mining and Milling Project in Northern Saskatchewan, AREVA Resources Canada Incorporated

Prepared by:

Canadian Nuclear Safety Commission (CNSC)
Fisheries and Oceans Canada (DFO)
Transport Canada (TC)
Natural Resources Canada (NRCan)
Saskatchewan Ministry of Environment (SMOE)

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Canada

# EXECUTIVE SUMMARY

## Background

This Comprehensive Study Report (CSR) has been collaboratively prepared as a common basis for a provincial environmental assessment (EA) under the *Saskatchewan Environmental Assessment Act* (SEAA) and the federal *Canadian Environmental Assessment Act* (CEA Act). Under the *Canada-Saskatchewan Agreement on Environmental Assessment Cooperation*, the federal and provincial EA process was coordinated for the proposal by AREVA Resources Canada Incorporated (AREVA) for the proposed Midwest Mining and Milling Project (the Midwest Project).

AREVA is the majority owner and operator of the Midwest Project and the McClean Lake Operation. The McClean Lake Operation is a CNSC licensed uranium mine and mill facility located approximately 15 kilometres (km) east of the Midwest Project. Both the Midwest Project and McClean Lake Operation lie in the eastern margin of the Athabasca Basin of northern Saskatchewan.

AREVA is proposing to extend the mining and milling activities at the McClean Lake Operation to include mining uranium ore at the Midwest site by open pit mining methods; hauling ore along a road linking the Midwest site with the existing McClean Lake Operation; and milling the uranium ore at the JEB Mill located at the McClean Lake Operation. The Midwest Project would be operated as part of the McClean Lake Operation with the mining activities integrated into the McClean Lake Operation.

The Midwest Project is proposed to extract and process approximately 985,000 tonnes of ore averaging 1.7% uranium (U) for a total resource of approximately 16,500 tonnes U metal (approximately 42 million pounds (lbs) uranium oxide ($U_3O_8$) equivalent). The development of the Midwest pit, including mining, is expected to take approximately five years, with ore initially accessed after two years. The Midwest ore is expected to be milled in the following five to seven years. Decommissioning of the Midwest site is expected to last two years, followed by five years of post-decommissioning monitoring. The proposed Midwest Project components include:

- development of the Midwest ore body as an open pit mine
- dewatering and depositing of material in the Mink Arm portion of South McMahon Lake to access the ore
- construction of site infrastructure and mine waste management facilities
- construction of a mine water treatment plant at the Midwest site, which will include a reverse osmosis (RO) treatment process
- construction of a 17 km transportation and utility corridor linking the Midwest site with the existing McClean Lake Operation
- development of a pipeline along the transportation corridor to transport waste water from the Midwest site to the McClean Lake Operation for release to the Sink Vulture Treated Effluent Management System (S/V TEMS)

- increasing production capacity at the JEB Mill from the currently approved 24 million lbs $U_3O_8$ equivalent per year to 27 million lbs $U_3O_8$ equivalent per year
- managing the corresponding tailings at the JEB Tailings Management Facility (TMF)
- development and implementation of a Fish Habitat Compensation Plan (FHCP)

## Federal Regulatory Responsibilities

This CSR has been prepared by the CNSC, Fisheries and Oceans Canada (DFO), Transport Canada (TC) and Natural Resources Canada (NRCan) as Responsible Authorities (RAs) and in consultation with Environment Canada (EC) and Health Canada (HC) as federal authorities (FAs) having specialist and expert information or knowledge needed to conduct the EA. Aboriginal Affairs and Northern Development Canada (AANDC) participated in this EA by assisting CNSC and the CEA Agency identify Aboriginal communities and organizations that might have an interest in the Midwest Project. CNSC, DFO, TC and NRCan, as RAs, have determined that each would have a regulatory decision to take with respect to the Midwest Project as described:

- CNSC has determined that the proposed Midwest Project may require an amendment to the existing Uranium Mine Operating Licence under subsection 24(2) of the *Nuclear Safety and Control Act* (NSCA)
- DFO has determined that the proposed Midwest Project may cause the harmful alteration, disruption, or destruction (HADD) of fish habitat, and will therefore require an Authorization under subsection 35(2) of the *Fisheries Act* and a section 32 Authorization under the *Fisheries Act* for the destruction of fish by any means other than fishing
- TC may issue a *Navigable Waters Protection Act* (NWPA) Approval under section 5(3) of the NWPA which allows for the interference to navigation
- NRCan may issue a factory licence pursuant to paragraph 7(1)(*a*) of the *Explosives Act* based on the need for an explosives factory and magazine facility during the construction and operation of the Midwest Project

These decisions, which would enable the Midwest Project to proceed, trigger the requirement for an EA in accordance with the CEA Act. An exemption from the Governor in Council under section 23 and approvals under sections 6(4) and 10(2) of the NWPA will also be required to enable the Midwest Project to proceed as proposed. As the Midwest Project is described under paragraph 19(a) of the Schedule to the *Comprehensive Study List Regulations* under the CEA Act, a comprehensive study is required.

This CSR was prepared by the CNSC in consultation with DFO, TC, NRCan, EC, HC and the Saskatchewan Ministry of Environment (SMOE) following a technical review of AREVA's Environmental Impact Statement (EIS) report and additional information provided to the regulators by AREVA as requested.

## Scope of the Proposed Project

The federal scope of the proposed Midwest Project (also referred to as the Project) considered within this CSR includes the construction, operation, and decommissioning of all proposed Project components previously described. The scope of the Midwest Project was approved by the federal Minister of the Environment, in consultation with the President of the CNSC.

## Scope of the Assessment

The assessment under CEA Act considered the potential environmental effects of the Midwest Project, including the atmospheric, geological/hydrogeological, aquatic, terrestrial, human and socio-economic environments, taking into account measures that are technically and economically feasible to prevent or reduce any potential adverse effects of the Project.

The scope of assessment also includes a consideration of: alternatives to the Project; alternative means of carrying out the Project; the effects of the environment on the Project; environmental effects related to malfunctions and accidents; potential cumulative environmental effects; measures that would mitigate adverse environmental effects; the significance of the environmental effects; the capacity of renewable resources likely to be affected by the Project; and a monitoring and follow-up program.

## Potential Effects of the Project on the Environment

The RAs assessed the potential impacts that the Midwest Project is likely to have on the environment, based on information provided by AREVA in their EIS and supplemental filings, expert advice provided by the FAs, and discussions with the provincial government through the cooperative review. Aboriginal communities and organizations and public comments were also considered in the EA.

The environmental effects which were determined to result in residual effects, which are effects that remain after mitigation has been put into place, were:

- changes to air quality from air emissions and dust deposition
- changes to groundwater levels
- changes to groundwater and surface water quality from the long-term release of contaminants of concern (COCs) related to tailings and waste rock disposal
- permanent loss of fish habitat from the Mink Arm portion of South McMahon Lake
- potential aquatic and terrestrial habitat disturbance
- altered movement and behaviour of wildlife from sensory disturbance
- changes to surface water quality and sediment quality with aquatic and terrestrial valued ecosystem components (VECs) and human receptors
- interaction of COCs in air, water, and sediment with aquatic and terrestrial VECs and human receptors

Although the Midwest Project will interact with the environment and human components in various ways, through the implementation of mitigation measures, none of the residual effects are considered to be significant.

The proposed Midwest Project will result in the HADD of fish habitat due to the alteration of fish habitat through the dewatering of Mink Arm of South McMahon Lake and through the installation of culverts at stream crossings along the proposed transportation corridor. Pending the outcome of the federal Minister of Environment's determination of this CSR, the HADD of fish habitat will necessitate a regulatory decision under subsection 35(2) of the *Fisheries Act* prior to the Midwest Project proceeding. The RAs have determined that based on successful implementation of AREVA's proposed fish habitat compensation plan at the Montreal River weir, it is likely that the productive capacity of fish habitat will be maintained. Consequently, the adverse residual effects on fish habitat are not considered significant.

## Consultation

Following the whole-of-government approach, Aboriginal consultation was integrated into the environmental assessment and regulatory review processes. Aboriginal engagement was undertaken during the EA process by AREVA, the SMOE, the RAs, and the CEA Agency.

A community and stakeholder consultation program was undertaken during the EA process by AREVA, the SMOE, the RAs, and the CEA Agency. AREVA organized a number of community information meetings, open houses and published project-specific information. Through the cooperative EA process, the RAs, CEA Agency and the SMOE provided public comment periods and Aboriginal engagement on key EA documents. Opportunities to comment were advertised in newspapers, radio announcements, web postings and local viewing locations. The RAs considered the comments from the public and Aboriginal communities and organizations in the EA process for establishing the scope and level of federal EA and in the identification of issues during the review of AREVA's EIS.

## Monitoring and Follow-up Programs

A Monitoring and Follow-up Program has been proposed which will address compliance and effective monitoring for each stage of the project development, as well as long-term monitoring requirements.

In accordance with the CEA Act, the follow-up program will be designed to verify the accuracy of the EA predictions for the Project, determine the effectiveness of measures taken to mitigate the potential adverse environmental effects of the Project, and support the implementation of adaptive management measures to address unanticipated adverse environmental effects. Environmental monitoring will likely be required under permits, licences and authorizations that may be issued upon completion of the EA.

## Conclusion

Taking into account the implementation of the proposed mitigation measures and commitments made by AREVA in its EIS, along with the proposed follow-up and monitoring program, the RAs conclude that the Midwest Project is not likely to cause significant adverse environmental effects.

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# ACRONYMS AND SHORT FORMS

| | |
|---|---|
| µg/g | microgram per gram |
| µg/L | microgram per litre |
| AANDC | Aboriginal Affairs and Northern Development Canada |
| AEDTC | Athabasca Economic Development and Training Corporation |
| AREVA | AREVA Resources Canada Incorporated |
| AWG | Athabasca Working Group |
| BAP | Best Available Practice |
| BAT | Best Available Technology |
| bcm | bank cubic metre |
| BMPs | Best Management Practices |
| Bq/g | Bequerels per gram |
| Bq/L | Becquerel's per litre |
| $Bq/m^3$ | Becquerel's per cubic metre |
| CCC | Crown Consultation Coordinator |
| CCME | Canadian Council of Ministers of the Environment |
| CEA Agency | Canadian Environmental Assessment Agency |
| CEA Act | *Canadian Environmental Assessment Act* |
| CEAR | Canadian Environmental Assessment Registry |
| CNSC | Canadian Nuclear Safety Commission |
| COCs | contaminants of concern |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| CPUE | catch per unit effort |
| CSA | Canadian Standards Association |
| CSR | comprehensive study report |
| CWQG | Canadian Water Quality Guidelines |
| DFO | Fisheries and Oceans Canada |
| EA | environmental assessment |
| EC | Environment Canada |
| ECOP | environmental code of practice |
| EEM | environmental effects monitoring |
| EIS | environmental impact statement |
| EPP | environmental protection program |
| EQC | (Athabasca) Environmental Quality Committee |
| FA | federal authority |
| FEAC | federal environmental assessment coordinator |
| FHCP | fish habitat compensation plan |
| ha | hectares |
| HADD | harmful alteration disruption or destruction |
| HC | Health Canada |
| HHRA | human health risk assessment |
| HRDA | Human Resources Development Agreement |
| HRIA | Heritage Resource Impact Assessment |
| IMA | Impact Management Agreement |

| | |
|---|---|
| IQMS | Integrated Quality Management System |
| $km^2$ | square kilometres |
| lbs | pounds |
| $m^2$ | square metres |
| $m^3$ | cubic metres |
| $m^3/d$ | cubic metres per day |
| $m^3/hr$ | cubic metre per hour |
| $m^3/s$ | cubic metres per second |
| masl | metres above sea level |
| MMER | *Metal Mining and Effluent Regulation* |
| MN-S | Métis Nation Saskatchewan |
| MPMO | Major Projects Management Office |
| mSv | millisieverts |
| NEWS | nuclear energy workers |
| NNL | no net loss |
| NRCan | Natural Resources Canada |
| NSCA | *Nuclear Safety and Control Act* |
| NSEQC | Northern Saskatchewan Environmental Quality Committee |
| NWPA | *Navigable Waters Protection Act* |
| PAGC | Prince Albert Grand Council |
| PBCN | Peter Ballantyne Cree Nation |
| PFP | participant funding program |
| PMP | probable maximum precipitation |
| PSG&SD | Project Specific Guidelines and Scoping Document |
| RA | responsible authority |
| RO | reverse osmosis |
| SARA | *Species at Risk Act* |
| S/V TEMS | Sink Vulture Treated Effluent Management System |
| SEAA | *Saskatchewan Environmental Assessment Act* |
| SI | screening index |
| SKCDC | Saskatchewan Conservation Data Centre |
| SMOE | Saskatchewan Ministry of Environment |
| SSWQO | Saskatchewan Surface Water Quality Objectives |
| TC | Transport Canada |
| TLE | Treaty Land Entitlement |
| TMF | tailings management facility |
| TOVP | Tailings Optimization and Validation Program |
| TSS | total suspended solids |
| U | uranium |
| $U_3O_8$ | uranium oxide |
| VECs | valued ecosystem components |
| WTP | water treatment plant |

# 1 INTRODUCTION

## 1.1 Project Overview

AREVA Resources Canada Incorporated (AREVA – formerly Cogema Resources Inc) indicated its intent to develop the Midwest ore body at its CNSC licensed site located approximately 700 km north of Saskatoon, near the eastern margin of the Athabasca basin (figure 1-1). In December 2005, AREVA submitted their proposal for the Midwest Uranium Mine Project (Midwest Project) to the CNSC, the SMOE and the CEA Agency [1]. The Midwest Project involves extending the mining and milling activities at AREVA's McClean Lake Operation to include the mining of the Midwest ore body and processing of the ore at the existing McClean Lake Operation JEB Mill. The Midwest Project will be operated as part of the McClean Lake Operation with the mining activities integrated into the McClean Lake Operation. The McClean Lake Operation lies approximately 15 km east of the Midwest deposit (figure 1-2).

Key aspects of the Midwest Project are as follows:

- develop the Midwest ore body as an open pit mine
- dewater and deposit material in the Mink Arm portion of South McMahon Lake
- construct site infrastructure and mine waste management facilities at the Midwest site
- construct a mine WTP at the Midwest site, which will include a reverse-osmosis (RO) treatment process
- construct a 17 km transportation and utility corridor (transportation corridor) linking the Midwest site with the existing McClean Lake Operation
- develop a pipeline along the transportation corridor to transport waste water from the Midwest site to the McClean Lake Operation for release to the S/V TEMS
- increase the production capacity at the JEB Mill from currently approved 24 million lbs $U_3O_8$ equivalent per year to 27 million lbs $U_3O_8$ equivalent per year, with minor modifications to the mill circuits to process the Midwest ore
- manage the corresponding tailings at the approved JEB TMF
- develop and implement a fish habitat compensation plan

The development of the Midwest pit is expected to be mined in five years, with ore initially accessed after two years. The Midwest ore is expected to be milled in the following five to seven years. The annual production capacity of the JEB Mill will be expanded to 27 million lbs $U_3O_8$ equivalent to accommodate the increased milling rate for the incoming Midwest ore.

Various components of the project require a number of federal regulatory approvals before the project can proceed. Before issuing the federal approvals,

federal departments are required to ensure that an EA is conducted pursuant to the CEA Act. In addition, there are a number of provincial permits and provincial EA requirements that must be met under the SEAA.

The Midwest uranium mine development was previously evaluated by a Joint Federal-Provincial Panel (Joint Panel) in 1993 [2] and 1997 [3]. The 1993 proposal was rejected by the Joint Panel. The proposal was revised in 1995 [4] and was recommended by the Joint Panel to proceed in 1997. The federal and Provincial governments granted EA approvals for the Midwest Project in 1998. The Midwest project, as approved in 1998, proposed mining the Midwest ore body by freezing the ore body and extracting the ore using a non-entry underground jet-boring mining method, with off-site ore processing and tailings management at the McClean Lake Operation.

The current Midwest Project still involves mining the Midwest ore and transporting the ore to the McClean Lake Operation for milling, as approved in 1998. However, several changes are proposed to the Project relative to what was previously reviewed and approved. These changes include a change to the mining method from underground to open pit, development of a transportation corridor from the Midwest site to the McClean Lake Operation JEB Mill, and a faster rate of milling of Midwest ore at the JEB Mill. With the proposed changes, improvements are expected in terms of protection of workers and the environment. Table 1-1 outlines some key differences between the 1992, 1995 and 2005 proposals for the mining of the Midwest ore body.

In May 2002, AREVA was issued a CNSC Uranium Mine Site Preparation Licence (UMSL-Excavate-Midwest.05.indf) for the Midwest Project. In June 2009, CNSC approved AREVA's licence renewal with amendment for the McClean Lake Operation Uranium Mine and Mill Operating Licence (UMOL-MINEMILL-McClean.00/2017) to include the activities currently authorized by the Midwest Uranium Mine Site Preparation Licence and revoked the Midwest Licence. The Midwest site maintains Approval to Temporarily Close (IT-39) under Saskatchewan Environment Approval. The Midwest uranium mine development is currently in a care and maintenance mode because market conditions did not warrant implementation of the development.

Due to economic factors, including low uranium prices and increased development costs, a decision to develop the Midwest Project has not been made at this time. The EA and engineering activities are still ongoing to allow the Midwest Project to proceed when market conditions improve. Once EA approval is obtained and market conditions are favourable, AREVA will initiate the approval process for all permits and approvals under the federal and provincial regulatory responsibilities.

**Table 1-1** Comparison of the 1992, 1995 and Current Proposals for Mining the Midwest Uranium Deposit

| Panel Concerns with 1992 Proposal | Different Approaches in the 1995 Proposal | Current Proposal |
|---|---|---|
| **Mining Methods** | | |
| Use of unacceptable mining methods. The methodology proposed was the conventional underground shaft and raise method. | Use of a jet-boring technique, tested at the Cigar Lake test mine, should be a safer mining method. | Open pit mining method maximizes ore recovery. Worker safety would be enhanced over underground mining methods but worker doses would be higher than with the jet-boring technique. Existing experienced workforce can be utilized. The volume of groundwater inflow would require careful management. |
| Mining, in confined underground spaces, of an ore that contains high concentrations of uranium, arsenic, and nickel. | Automated mining from locations in the basement rock, underneath the ore body, should reduce exposure of miners to radioactivity and toxic heavy metals. | Open pit mining operational experience indicates higher occupational exposures than with jet-boring but lower occupational exposures relative to conventional underground mining methods. |
| The existence of over 600 explorations bore holes, most of them uncapped, in the vicinity of the ore body. | Freezing of the ore body would seal the bore holes during the operational phase. Jet-bore mining would result in 85% recovery of the Midwest ore. | Open pit mining is expected to result in close to 100% recovery of the Midwest ore. |
| **Transportation Methods** | | |
| The need to transport high grade ore on a public highway. | Ore, in slurry form, would be transported in specially designed and constructed vessels. | Private Road access between Midwest and JEB Mill would eliminate need for ore transport on highway 905. |
| **Water Treatment Methods** | | |
| The potential for environmental damage through the release of contaminated effluent into the Smith Creek watershed and the need to dewater an area of several square kilometres around the mine site. | Dewatering of Mink Arm and the surrounding area would not be required and the volume of effluent released would be greatly reduced. | Pumping effluent via pipeline to the Sink/Vulture Treated Effluent Management System (S/V TEMS) at the McClean Lake Operation. This will eliminate impacts on Smith Creek from release of treated effluent. No modifications to the S/V TEMS will be required to maintain current operational constraints. Dewatering impacts will be assessed, and mitigated as per DFO policy (see above). |
| Uncertainties in the disposal of mill tailings containing high concentrations of toxic heavy metals. | Protection from dust would be enhanced by the subaqueous disposal of tailings; however, there are concerns remaining regarding contamination of ground water. | Uncertainties associated with mill tailings disposal in the JEB TMF have been addressed by the Tailings Optimization and Validation Program. The program has validated predicted performance. |
| The contribution of this proposed mine to the combined effects of all of the mines (existing and proposed) in a relatively small area on the west side of Wollaston Lake. | The new mining methods and technologies proposed are intended to decrease loadings of contaminants to the environment. | Minimizing the number of treated effluent discharge locations reduces the spatial footprint of potential effects associated with treated effluent release. The incremental effects associated with the discharge of treated Midwest mine water in Collins Creek are expected to be not significant. The Cumulative Effects Monitoring Program has been established by the Province to assess cumulative effects at the regional level. None have been found to date. |
| **Recommended not to Proceed** | **Recommended to Proceed** | |

## 1.2 Proponent Information

AREVA is a Canadian company, headquartered in Saskatoon, Saskatchewan. The company is a 100% subsidiary of the AREVA group of companies, whose headquarters are located in Paris, France.

AREVA is the operator and licensee of the Midwest Project and the McClean Lake Operation. Table 1-1 shows the breakdown in ownership:

**Table 1-2** Ownership of the Midwest Project and McClean Lake Operation

| Ownership | Midwest Project | McClean Lake Operation |
|---|---|---|
| AREVA Resources Canada Inc. | 69.16% | 70% |
| Denison Mines Inc. | 25.17% | 22.5% |
| OURD (Canada) Co. Ltd. | 5.67% | 7.5% |

## 1.3 Project Need and Purpose

Mining comprises an integral part of the northern Saskatchewan economy. There is a need to locate and develop new ore bodies to help maintain the existing economy. The Midwest Project is needed to add to the ore reserves available for processing at the McClean Lake Operation, thereby adding to the positive economic, employment and business opportunities related to uranium developments in northern Saskatchewan.

The purpose of the Midwest Project is to mine the Midwest ore body to produce uranium concentrate, commonly referred to as yellowcake. Project activities will occur at both the Midwest site, at the existing McClean Lake Operation, and along a proposed transportation and utilities corridor which will connect the two sites. The McClean Lake Operation is a constructed mining and milling facility operating under Uranium Mine Operating Licence (UMOL-MINEMILL-McClean.00/2017) issued by the CNSC. The Midwest Project will be operated by the McClean Lake Operation and the quality management and regulatory compliance programs that are currently in place at the McClean Lake Operation will be applied to the Midwest Project.

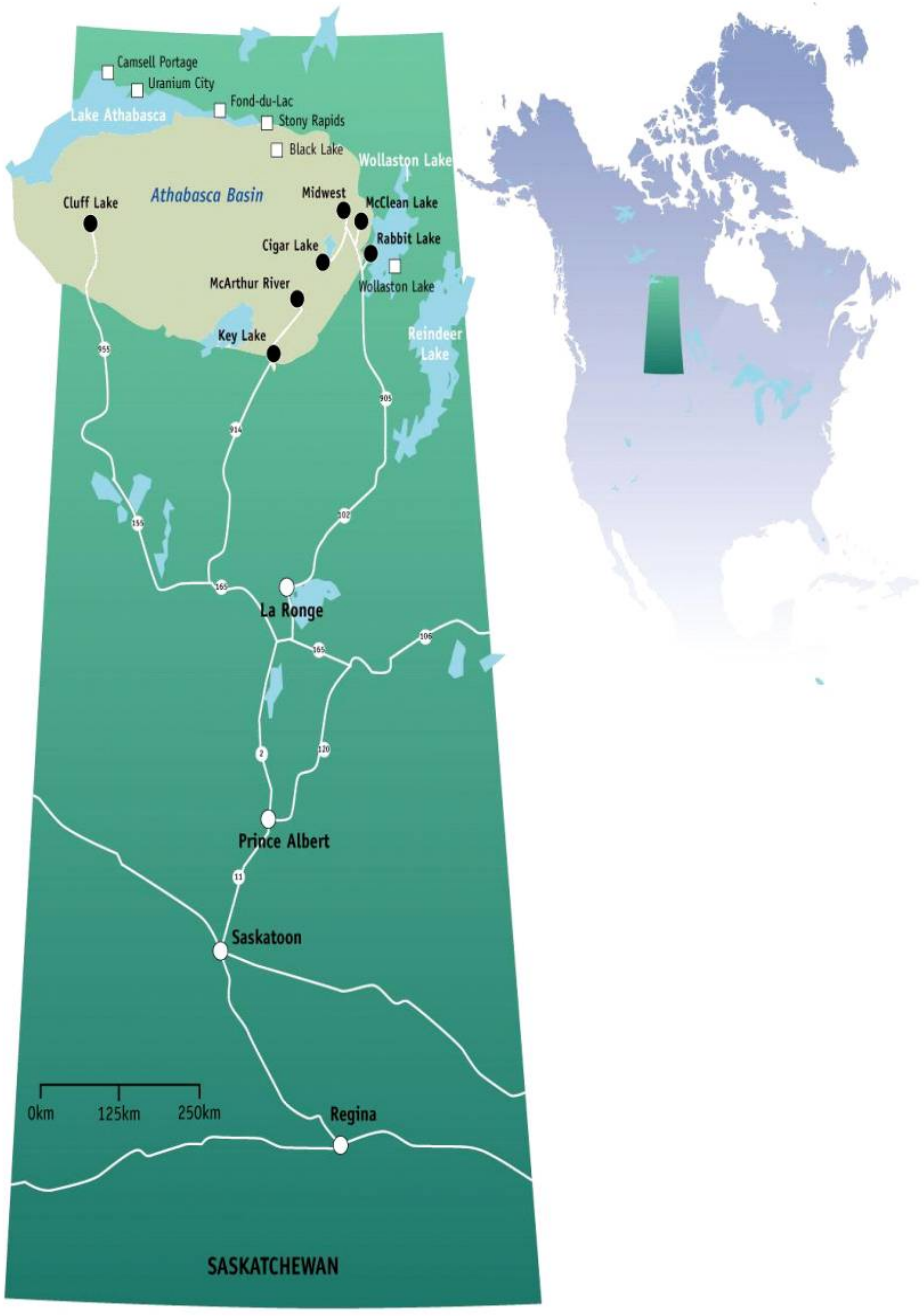



**Figure 1-1** Midwest Project Location

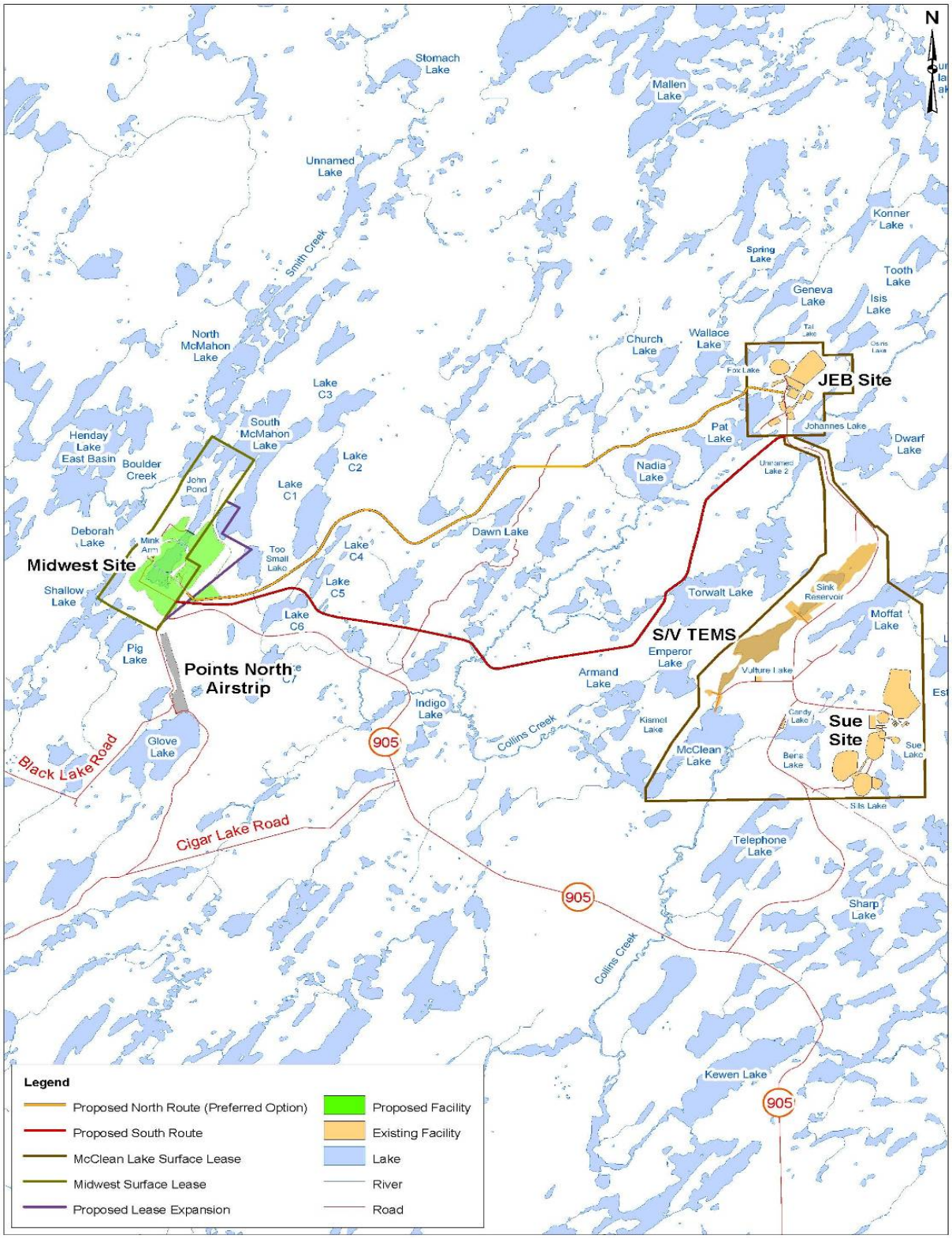



**Figure 1-2** Midwest and McClean Lake Operation Project Locations

# 2 REGULATORY OVERVIEW

The Midwest Project is subject to an EA under the CEA Act and under the SEAA. Under the *Canada-Saskatchewan Agreement on Environmental Assessment Cooperation*, federal and provincial EA processes are coordinated for projects with joint federal and provincial jurisdiction where not limited by individual statutory or process requirements of the respective processes. Under the agreement, the SMOE is the lead agency for the Midwest Project. Through the agreement, a single EA and review process is used to obtain the EA information needed for federal and provincial EA processes. Both the federal and provincial governments are using the information generated through the cooperative EA as the basis for their respective decisions about the project however, each government will retain its ability to make project-related decisions on matters within its own legislative authority.

## 2.1 Provincial EA Process and SEAA Requirements

In Saskatchewan, a change to an approved development that is not consistent with the terms and conditions of a current approval is subject to the provisions of section 16 of the SEAA. As the proposed Midwest Project may require changes to Ministerial Approvals (Approval to Operate Pollutant Control Facilities IO-205 –McClean Lake and IT-31 – Midwest) issued to AREVA by the SMOE, AREVA was directed to seek approval pursuant to section 16(2)(c) of the SEAA to conduct an EA of the proposed mining of the Midwest ore body and to prepare and submit an EIS to the SMOE. Following receipt and technical review of the EIS, Technical Review Comments were prepared that documented the outcomes of the federal and provincial evaluation of the EIS. The EIS, Technical Review Comments and this document, the federal CSR, will be provided to the public for a minimum 30 day review. Comments from the review will be provided to the provincial Minister of the Environment. The project will require the issuance of a ministerial approval under section 15 of the SEAA before proceeding.

Much of the information required for provincial approvals will be included in the federal EA, and provincial approval applications will be made in parallel to the federal approvals process.

## 2.2 Federal EA Process and CEA Act Requirements

The proposed construction, operation (mining and milling) and decommissioning of the Midwest Project is an undertaking in relation to a physical work, and thus is a ‘project’ as defined in section 2 of the CEA Act. Under subsection 5(1) of the CEA Act, a federal EA will be required when a federal authority contemplates certain actions or decisions in relation to the project that would enable it to proceed in whole or in part. The CSR for the Midwest Project was started in 2005 prior to the amendments of the CEA Act coming into force in 2009. Therefore, the comprehensive study is proceeding under the CEA Act that came into force in 1995.

Key environmental authorizations, approvals, and licences are required from the federal government before portions of the Midwest Project can proceed. Prior to a federal authority completing a power, duty, or function, such as issuing an approval, authorization, or permit, an EA of the project must be conducted pursuant to the CEA Act. The CNSC, DFO, TC and NRCan have determined that they may have regulatory decisions to take in relation to the Midwest Project, specifically:

- CNSC authorization of AREVA's proposal may require an amendment to the existing Uranium Mine Operating Licence (UMOL-MINEMILL-MCCLEAN.00/2017) under the NSCA. If the existing licence is amended, the current licence would be revoked. Revoking or amending a licence is a power exercised under the authority set out in subsection 24(2) of the NSCA
- DFO may take action in relation to the authorization under section 35(2) of the *Fisheries Act* for the HADD of fish habitat and a section 32 Authorization under the *Fisheries Act* for the Destruction of Fish by Any Means Other Than Fishing
- NRCan may take action under paragraph 7(1)(a) of the *Explosives Act* to issue a licence for the construction and operation of the explosives factory site
- TC may take action in relation to issuing a NWPA Approval under section 5(3) of the NWPA which allows for interference to navigation

TC determined that the undertaking in relation to the Midwest Project for the dewatering of and the depositing of material in the Mink Arm portion of South McMahon Lake is prohibited as a result of the application of section 22 of the NWPA, which prohibits a person from throwing or depositing any material that is liable to sink to the bottom of any water, any part of which is navigable or that flows into any navigable water. Section 23 of the NWPA provides that the Governor in Council may declare section 22 exempt in whole or in part from the operation of this section when it is shown to the satisfaction of the Governor in Council that the public interest would not be injuriously affected. AREVA has been made aware by TC that in order to proceed with the dewatering and depositing of materials in Mink Arm, AREVA must apply for and receive a section 23 exemption from the Governor in Council. This application is not part of this EA process but can be submitted concurrently with the EA process. The exemption from the Governor in Council cannot be issued until after an EA decision has been made. TC has also determined that approval under sections 6(4) and 10(2), to make the existing dam structure lawful and allow for alteration, respectively, will also be required under the NWPA to enable the Midwest Project to proceed.

AREVA advised DFO, NRCan, TC and CNSC that, due to the timing of the Project, not all of the specific details required for the formal applications for the *Fisheries Act*, *Explosives Act*, and NSCA authorizations will be available. The formal applications under these legislations will be submitted once a Project development decision has been made and the specific details required to complete the applications are available.

As the CNSC, DFO, NRCan and TC have a responsibility to conduct an EA pursuant to paragraphs 5(1) of the CEA Act; these federal departments are considered Responsible Authorities (RAs) for the Midwest Project.

Pursuant to the *Federal Coordination Regulations* under the CEA Act, EC and HC also provided advice in relation to their respective mandates and areas of expertise and are participating in the review of the Midwest Project as Federal Authorities (FAs). Early in the EA process, Aboriginal Affairs and Northern Development Canada (AANDC, formerly Indian and Northern Affairs Canada), provided information on Aboriginal groups that may have an interest in the Midwest Project.

The CEA Agency acted as the federal EA coordinator (FEAC) for the proposed Midwest Project and coordinated the review of activities of the RAs and FAs in accordance with section 12 of the CEA Act and in conjunction with the provincial EA process. The FEAC role was transferred to the CNSC in July 2010.

In February 2009, the Midwest Project was accepted to be managed by the federal Major Projects Management Office (MPMO). The MPMO has administrative and advisory responsibilities under the Cabinet Directive on Improving the Performance of the Regulatory System for Major Resource Projects and is responsible for providing overarching project management and accountability. An MPMO Project Agreement was signed by federal Deputy Ministers in December 2009. The MPMO Project Agreement is an agreement between federal Deputy Ministers that outlines the process by which federal government departments or agencies will carry out their particular roles or responsibilities during the federal regulatory review. This agreement includes a timeline and schedule for the completion of a regulatory review to allow tracking of progress.

***Type of Federal Environmental Assessment***

The proposed Midwest Project includes the construction of a pipeline to transport waste water along a transportation corridor from the Midwest site to the McClean Lake Operation site. The proposed pipeline is considered a waste management system, as defined in section 1 of the CNSC's *Uranium Mines and Mills Regulations*. The lands proposed for the transportation corridor are currently not under CNSC licence. The RAs for the Midwest Project, determined that the proposed Project is described in paragraph 19(a) of the *Comprehensive Study List Regulations* of the CEA Act:

*19. (a) a uranium mine, a uranium mill or a waste management system any of which is on a site that is not within the boundaries of an existing licensed uranium mine or mill*

The RAs recommended to the federal Minister of the Environment that this project should proceed as a comprehensive study and the Minister announced that the comprehensive study was the most appropriate type of EA for the proposed Midwest Project in northern Saskatchewan [5].

Pursuant to section 21(1)(1) of CEA Act, the RAs are required to ensure the conduct of a comprehensive study and CNSC, as the lead RA, prepared this CSR in consultation with DFO, TC, NRCan, EC, HC and the SMOE.

***Comprehensive Study Process***

The provincial Project-Specific Guidelines and the federal Scoping Document (PSG&SD) were developed to provide guidance on the EA and also determined the scope of the assessment and the scope of the factors to be considered (Appendix A). The PSG&SD were finalized following the Minister's decision on the EA Track Report. As per section 17(1) of the CEA Act and section 9(1) of the SEAA, the RAs and the SMOE delegated the conduct of the EA to AREVA and the PSG&SD assisted AREVA in the preparation of their EIS [7]. AREVA's revised final EIS was submitted in October 2011 [8] and the information contained in the EIS and in supplemental information was used to draft this CSR.

The CSR will provide the Minister of the Environment the information and analysis to determine whether the Midwest Project is likely to cause significant adverse environmental effects. The Minister will review the CSR and any comments received from the public and Aboriginal groups and organizations filed in relation to its content. Once the Minister determines that no additional information is necessary or actions are needed to address public or Aboriginal concerns, the Minister will issue an EA decision statement that includes the Minister's opinion as to whether, taking into account the implementation of any mitigation measures that the Minister considers appropriate, the Midwest Project is or is not likely to cause significant adverse environmental effects and any mitigation measures or follow-up program that the Minister considers appropriate.

The Minister will then refer the Midwest Project back to the RAs for a course of action or decision. If it has been determined by the Minister that the Midwest Project is not likely to cause significant adverse environmental effects, an RA may exercise any power or perform any duty or function that would permit the Midwest Project, or part of the Midwest Project, to be carried out, such as issuing a permit or authorization.

Table 2-1 outlines the timelines associated with the Midwest Project EA process to date.

**Table 2-1** Timelines Associated with the Environmental Assessment Process

| Activity | Date |
|---|---|
| Submission of Project proposal by proponent | December 2005 |
| Notice of Commencement (posted on CEAR public registry) | March 2006 |
| Public Review of Project Specific Guidelines and Study Scoping Document (PSG&SD) (30 days) | December 2006 to January 2007 |
| Revised PSG&SD and EA Track Report (30 days) | February to March 2007 |
| Commission Hearing on PSG&SD and EA Track Report | April 2007 |
| Commission Decision and Recommendation to Minister of Environment on PSG&SD and EA Track Report | June 2007 |
| Federal Minister's Decision on EA Track Report | October 2007 |
| Public Funding awarded by the CEA Agency for public participation in the EA of the Midwest Project | October 2007 |
| Draft EIS submitted by AREVA | October 2007 to March 2008 |
| Federal/Provincial comments provided to AREVA | February 2008 and October 2009 |
| Revised EIS submitted by AREVA | February 2010 |
| Federal/Provincial comments provided to AREVA | April 2010 |
| Aboriginal Funding awarded by the CEA Agency for Aboriginal participation in the EA of the Midwest Project | June 2010 |
| Responses to review comments submitted by AREVA | September 2010 |
| Final Revised EIS submitted by AREVA | October 2011 |
| Acceptance of Final Revised EIS by federal and provincial reviewers for the purpose of developing the CSR | October 2011 |
| Completion of draft CSR for review by federal and provincial reviewers | December 30, 2011 |
| Aboriginal review of draft CSR | December 2, 2011 to January 20, 2012 (granted extension) |

# 3 PROJECT BACKGROUND

## 3.1 Midwest Site History

The Midwest site is located near the eastern margin of the Athabasca Basin in northern Saskatchewan, approximately 700 km north of Saskatoon. The Midwest site is located approximately 15 km west of the McClean Lake Operation (figure 1-2). Access to the Midwest and McClean Lake Operation sites is via Provincial Road 905, which is shared with northern residents, other uranium mines and mills, outfitters, and tourists. A 2 km graded access road connects the Midwest site to the end of Provincial Road 905 near Points North, a small airport facility. Both the Midwest site and the McClean Lake Operation are accessible only through a security gate.

The communities in the Athabasca Basin include Camsell Portage, Uranium City, Fond du Lac, Stony Rapids, Black Lake, Hatchet Lake and Wollaston Lake (figure 1-1). The Midwest site is remote, with no permanent residences located nearby. The nearest permanent community is Wollaston Lake, located approximately 50 km by air southeast of the site.

Test mining was conducted between 1988 and 1989 at the Midwest site, which included the development of an underground test mine. Approximately 400 bcm (bank cubic metre) of clean waste rock, remains at the Midwest site from the test mining program. The test mine water treatment plant building and settling ponds used for the test mining program are intact, but no longer in use. The water retention dam across Mink Arm is still in place at the site.

Timelines associated with the Midwest site are described in table 3-1.

**Table 3-1** Midwest Site History

| Year | Activity |
|---|---|
| 1968 | Initial exploration activities in the South McMahon Lake |
| 1978 | Discovery of the Midwest deposit beneath Mink Arm |
| 1981 | EIS for open pit proposal submitted, but not formally reviewed (withdrawn due to market conditions) |
| 1988-1989 | Underground test mining (Mink Arm dewatered, underground development) |
| 1991 | EIS submitted for underground mine, mill and tailings disposal area |
| 1992 | EIS amended to include the complementary development of the Midwest and McClean Lake Projects, which included the milling of Midwest ore and tailings management at McClean Lake Operation |
| 1993 | Joint Panel rejects Midwest proposal due to a number of specific concerns (see Table 1-1) |
| 1995 | "1995 EIS" submitted using the proposed jet-boring in frozen ground mining technique. EIS outlined processing and tailings management of McClean Lake, Cigar Lake and Midwest ores |
| 1997 | EIS reviewed by the Joint Panel and recommended to proceed with processing and tailings management of McClean Lake, Cigar Lake and Midwest ores |
| 1998 | Federal and Provincial governments approve the development of the Midwest Uranium Mine Project and the Cigar Lake Uranium Mine Project. Midwest Mine Project did not proceed because of several economic and social factors, including the cost associated with the jet boring mining technology. The construction of the Cigar Lake mine is ongoing and the JEB Mill expansion was completed in 2006 |
| 2005 | Current Midwest Project description submitted |

## 3.2 McClean Lake Operation History

The McClean Lake Operation is located approximately 15 km east of the Midwest site. The McClean Lake surface lease is approximately 3,680 hectares (ha), of which only about 850 ha is considered developed land due to infrastructure development at the existing McClean Lake Operation. The main operating areas of the McClean Lake Operation includes the JEB and the Sue sites (figure 3-1). The McClean Lake Operation consists of:

- the JEB site - consisting of the JEB Mill, the JEB WTP, and the JEB TMF. Midwest ore will be processed at the JEB Mill, and tailings will be disposed of within the JEB TMF (figure 3-2)
- the Sue site - the current Midwest proposal does not affect the Sue site
- the Sink/Vulture Treated Effluent Management System (S/V TEMS) – all treated mine water and clean dewatering well effluent from the Midwest project will be discharged at S/V TEMS. No change to the operational and management controls currently in place for this system will result from the Midwest Project
- various support facilities for waste management (e.g., waste rock, waste water, hazardous substances, air emission control) and site infrastructure (e.g., roads, electricity, camp facilities). The Midwest Project will not noticeably affect these support facilities and infrastructure

The McClean Lake Project was part of the Joint Panel review from 1991 to 1993 and was given government approval in December 1993. Construction began in 1994 and the JEB ore body was mined from 1995 to 1997. Following regulatory licensing, the mined-out JEB pit was converted into the JEB TMF and milling of the ore at the JEB Mill commenced in 1999. The McClean Lake Operation is currently operating under a Uranium Mine Operating Licence (UMOL-MINEMILL-McClean. 00/2017) issued by the CNSC.

The 1995 Joint Panel review for the Midwest Uranium Mine Project and Cigar Lake Uranium Mine Project proposed processing the ores from the Midwest and Cigar Lake mine sites at the McClean Lake Operation. Government approvals for these two projects were issued in 1998 and licensing for the construction of the expanded JEB Mill to receive ore from Cigar Lake was granted and work was completed in 2006. Construction of the Cigar Lake mine is ongoing.

The 1995 EIS included ore from various sources and the fully developed project entailed a JEB Mill capable of an annual production rate of 24 million lbs $U_3O_8$ equivalent. The current Midwest Project, when added to the production outlined in the 1995 EIS, will result in an annual production capacity of 27 million lbs $U_3O_8$ equivalent with the incoming ore. Further expansion of the JEB Mill will be required to process Midwest ore, either to allow for increased production or to accommodate specific Midwest ore processing requirements.

### 3.2.1 McClean Lake Operation Components to be Used by the Midwest Project

The components of the McClean Lake Operation that will be affected by the proposed Midwest Project include the JEB Mill and associated facilities: the JEB WTP, the JEB TMF and the S/V TEMS.

***JEB Mill***

The initial operating licence for the JEB Mill and TMF was granted in 1999 and the JEB Mill started operation in June 1999. The JEB Mill is assessed and approved to process up to 24 million lbs $U_3O_8$ equivalent annually and is currently constructed and operating at a portion of this approved production capacity. The JEB Mill will require an additional expansion(s) to allow for the increased production rate, and to accommodate specific Midwest ore processing requirements. This proposed mill expansion will result in the JEB Mill capable of processing 27 million lbs $U_3O_8$ annually. With the increased production rate, approximately 46 $m^3$/hr (cubic metres per hour) of fresh water will be required from Pat Lake and approximately 162 $m^3$/hr of treated effluent will be discharged to Sink Reservoir. The intake structure at Pat Lake pumphouse is considered a lawful structure under the NWPA. AREVA does not anticipate or propose any changes will be required to the intake structure.

The JEB Mill is designed as a multi-storey structure with the routine work areas in the upper areas separated by a shielded floor from the processing areas containing radioactive materials below. Mill ventilation is a once-through system which has no re-circulated air. The JEB Mill is composed of a number of circuits that extract uranium from ore and produce a packaged product, referred to as yellowcake. The Mill also consists of four plants – the acid plant, the ammonium sulphate crystallization plant, the oxygen plant, and the ferric sulphate plant. The process required to produce uranium concentrate from the Midwest ore will remain unchanged but minor physical modifications and expansion to the JEB Mill will be required for the processing of Midwest ore.

***JEB Tailings Management Facility***

The tailings management system at McClean Lake Operation is comprised of the tailings preparation circuit within the JEB Mill, the tailings delivery system, and the JEB TMF. The JEB TMF will serve as the repository for all tailings resulting from uranium processing of Midwest ore at the McClean Lake Operation. No changes to the existing tailings management system or TMF will be required for the processing of Midwest ore.

***JEB Water Treatment Plant***

The JEB WTP currently has an approved capacity of 6000 $m^3$/d (cubic metres per day). The WTP removes dissolved metals and suspended solids and discharges treated effluent to the S/V TEMS. No changes are required to the JEB WTP for the processing of Midwest ore or for increasing the uranium production rate to 27 million lbs $U_3O_8$ equivalent per year.

***Sink Vulture Treated Effluent Management System (S/V TEMS)***

The S/V TEMS has been in operation at the McClean Lake Operation since 1996 and is the single common facility for all water to be released from the McClean Lake Operation. The S/V TEMS consists of Sink Reservoir, Vulture Lake, and associated control and

measurement structures. Water is discharged from Sink Reservoir through Vulture Lake and into McClean Lake via control valves and a buried pipeline. Waste water inputs to the S/V TEMS consist of treated effluent from the JEB WTP, the Sue WTP and the JEB dewatering well system. The Sink Reservoir has an active storage capacity of approximately 1.3 million $m^3$ (cubic metres), a total available active storage capacity of approximately 2.1 million $m^3$, and a licensed (regulatory) full water elevation of 442 masl (metres above sea level). Sink Reservoir discharge is managed with a number of environmental protection measures outlined in the Environmental Code of Practice (ECOP). The ECOP ensures the discharge release from Sink Reservoir is controlled to ensure that when the discharge reaches Collins Creek downstream of McClean Lake east basin, it meets a minimum dilution rate of at least 5 parts natural Collins Creek flow to 1 part WTP effluent flow. In addition, a constraint to ensure that reservoir discharge is stopped when natural Collins Creek flow exceeds 4.52 $m^3/s$ was established to protect against stream bed erosion, thus protecting fish habitat.

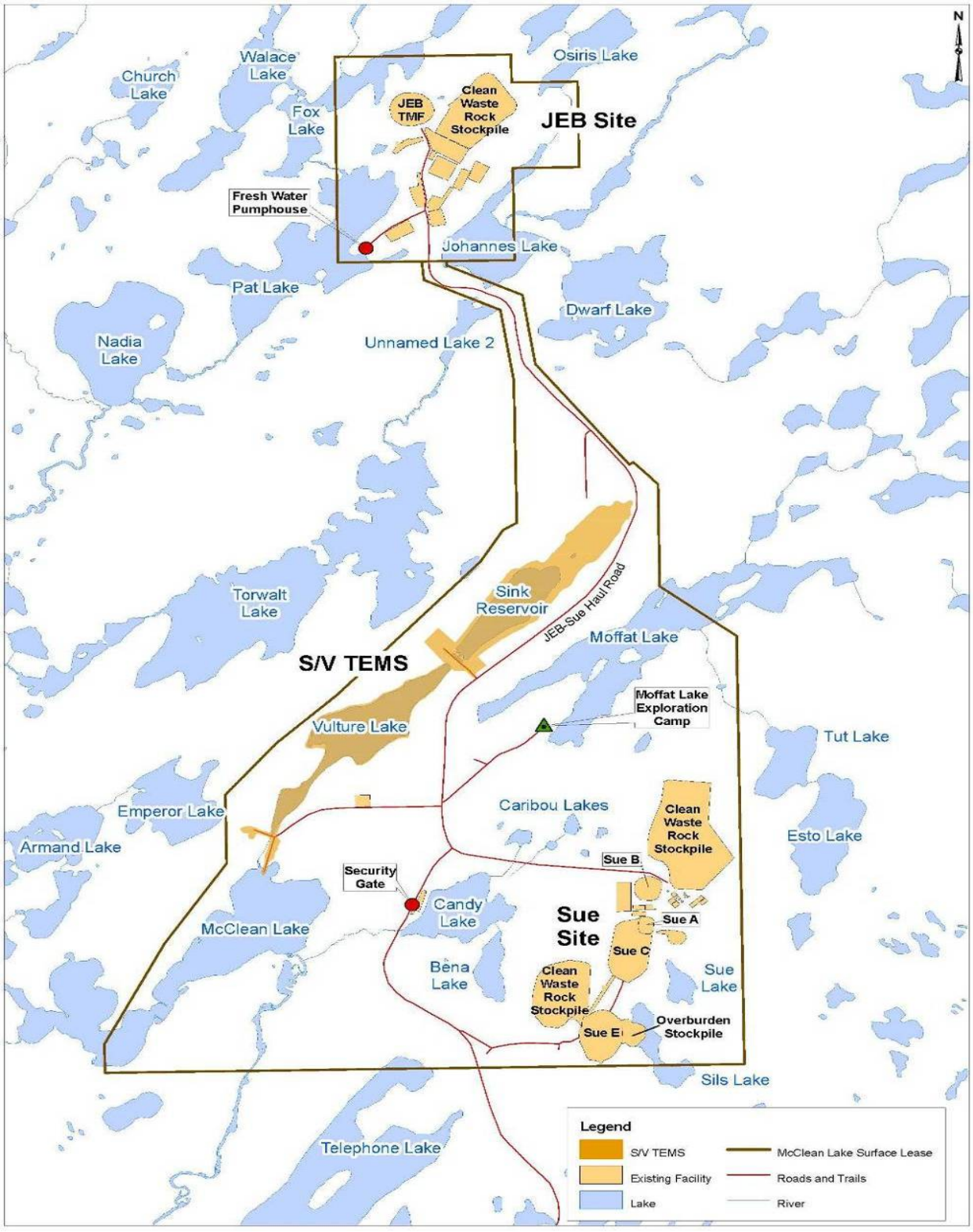



**Figure 3-1** McClean Lake Operation General Site Layout

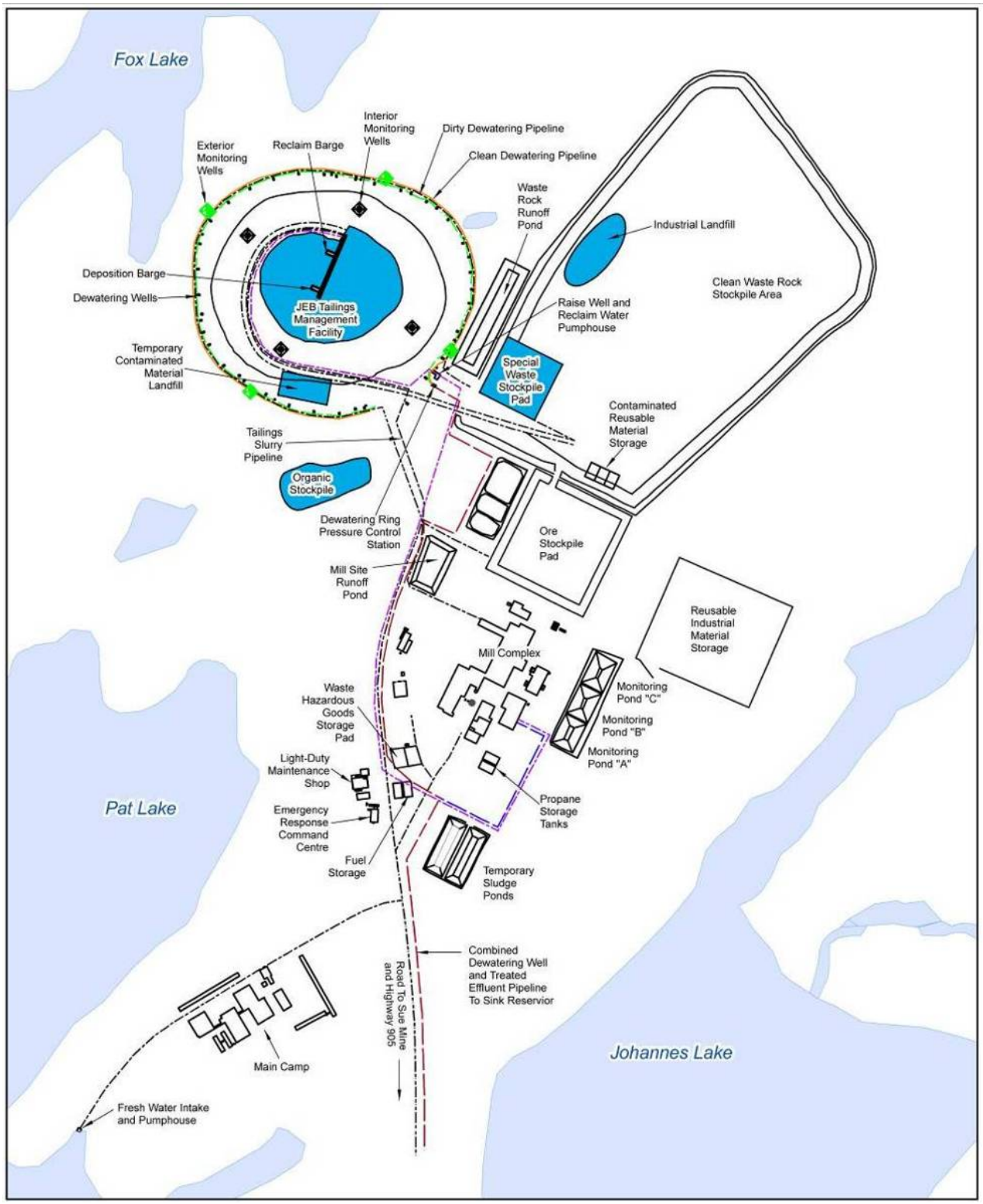



**Figure 3-2** McClean Lake Operation – JEB Site

# 4 PROJECT COMPONENTS AND ACTIVITIES

## 4.1 Project Overview

Key activities for the site preparation, construction, operation, and decommissioning of the Midwest Project are outlined in table 4-1 and quantitative characteristics of the Midwest Project are described in table 4-2.

**Table 4-1** Key Activities for the Midwest Project

| Project Stage | Activities |
|---|---|
| Site Preparation and Construction | ▪ Mink Arm dewatering, including existing dam upgrade and construction of a new secondary retention dam<br>▪ Midwest open pit development<br>▪ construction of water management facilities (perimeter dewatering wells, runoff collection ditches, site runoff pond, and water treatment facilities)<br>▪ site preparation (stockpile construction, site surface infrastructure and utilities)<br>▪ construction of water treatment facilities and reverse osmosis plant with sedimentation ponds and monitoring ponds<br>▪ construction of a transportation and utility corridor, including stream crossings<br>▪ construction material transport<br>▪ modifications at the JEB Mill to accommodate increased production capacity |
| Operation and Maintenance (Midwest Site) | ▪ explosives usage<br>▪ material excavation and ore haulage<br>▪ management of stockpiles (clean waste rock, special waste rock, and ore)<br>▪ wastewater management and treatment<br>▪ waste management (including hazardous materials storage)<br>▪ management of site surface infrastructure, utilities, and equipment<br>▪ management of access roads within site<br>▪ implementation of a fish habitat compensation plan |
| Operation and Maintenance (McClean Lake Operation site) | ▪ processing of Midwest ore at JEB Mill<br>▪ management of JEB TMF<br>▪ wastewater management (S/V TEMS)<br>▪ waste management (contaminated, domestic, sewage)<br>▪ infrastructure (fuel storage, camp, power lines)<br>▪ roads and transportation |
| Decommissioning (Midwest Site) | ▪ Midwest pit closure<br>▪ in-pit disposal of special waste material<br>▪ recontouring of waste rock stockpiles<br>▪ removal of site surface infrastructure and reclamation<br>▪ removal of roads and reclamation<br>▪ removal of waste (contaminated, industrial, domestic) |

| Project Stage | Activities |
|---|---|
| Decommissioning (McClean Lake Operation site) | ▪ closure of JEB TMF<br>▪ decommissioning of the S/V TEMS<br>▪ recontouring of stockpiles<br>▪ removal of milling facility and infrastructure and reclamation<br>▪ removal of roads and reclamation<br>▪ removal of waste (contaminated, industrial, domestic) |

**Table 4-2** Characteristics of the Midwest Project

| Project Component | Criteria | Dimensions |
|---|---|---|
| Existing Midwest surface lease land | Area | 647 ha |
| Open pit design | Length<br>Width<br>Depth<br>Area<br>Total volume excavated material<br>Water inflow in pit | 900 m (north to south)<br>350 m (east to west)<br>215 m<br>44 ha on the surface<br>38 million $m^3$ bcm<br>25,000 $m^3$/day |
| Mink Arm | Area physically disturbed<br>Depth<br>Top of dam<br>Amount of water to achieve dewatered state | 51 ha<br>6.5 m<br>482 masl<br>1.9 million $m^3$ |
| Ore | Yield of ore | 985,000 tonnes of ore averaging 1.7% U for a total resource of 16,500 tonnes U metal (approximately 42 million lbs $U_3O_8$ equivalent) |
| Sediments | Volume | 515,000 $m^3$ |
| Overburden | Volume | 2,000,000 bcm |
| Clean waste stockpile | Volume<br>Area<br>Uranium content<br>Arsenic content | 34,000,000 bcm<br>100 ha (Stockpile A); 75 ha (Stockpile B)<br>< 250 µg/g<br>< 75 µg/g |
| Special waste stockpile | Volume<br>Area<br>Uranium content<br>Arsenic content | 925,000 to 1,400,000 bcm<br>25 ha<br>330 µg/g (between 250 and 850 µg/g)<br>1,200 µg/g |

| Project Component | Criteria | Dimensions |
|---|---|---|
| Ore | Volume | 428,000 bcm |
| | Area | 8 ha |
| | Uranium content | 16,700 µg/g |
| | Arsenic content | 31,300 µg/g |
| Tailings | Volume | 2.2 million $m^3$ |
| | Elevation | 434 masl |
| Road | Length | 17 km |
| | Width | 12.2 m |
| | Area physically disturbed | 305 ha (north) 335 ha (south) |
| General | Area physically disturbed | Additional 210 ha for surface lease expansion |

## 4.2 Midwest Project Site

The Province of Saskatchewan is the owner of the lease lands which the Midwest Project occupies. AREVA is proposing to increase the existing 647 ha of Midwest surface lease lands to allow for the stockpiling of clean waste rock and the construction of the water treatment and support facilities. AREVA considered four site layouts for the Midwest Project EIS (figure 4-1). Selection of the final site layout is dependent on AREVA's ability to acquire additional surface lease with mineral claims currently held by either Fission Energy Corporation or the Dawn Lake Joint Venture and is also dependent on a decision by the Province of Saskatchewan. AREVA's preferred site layout is alternative 3 (figure 4-2), which proposes to increase the surface lease by 210 ha (extending 175 ha and 35 ha on to the surface area above the Fission Energy and Dawn Lake mineral claim areas, respectively).


**Figure 4-1** Midwest Site Layout Options

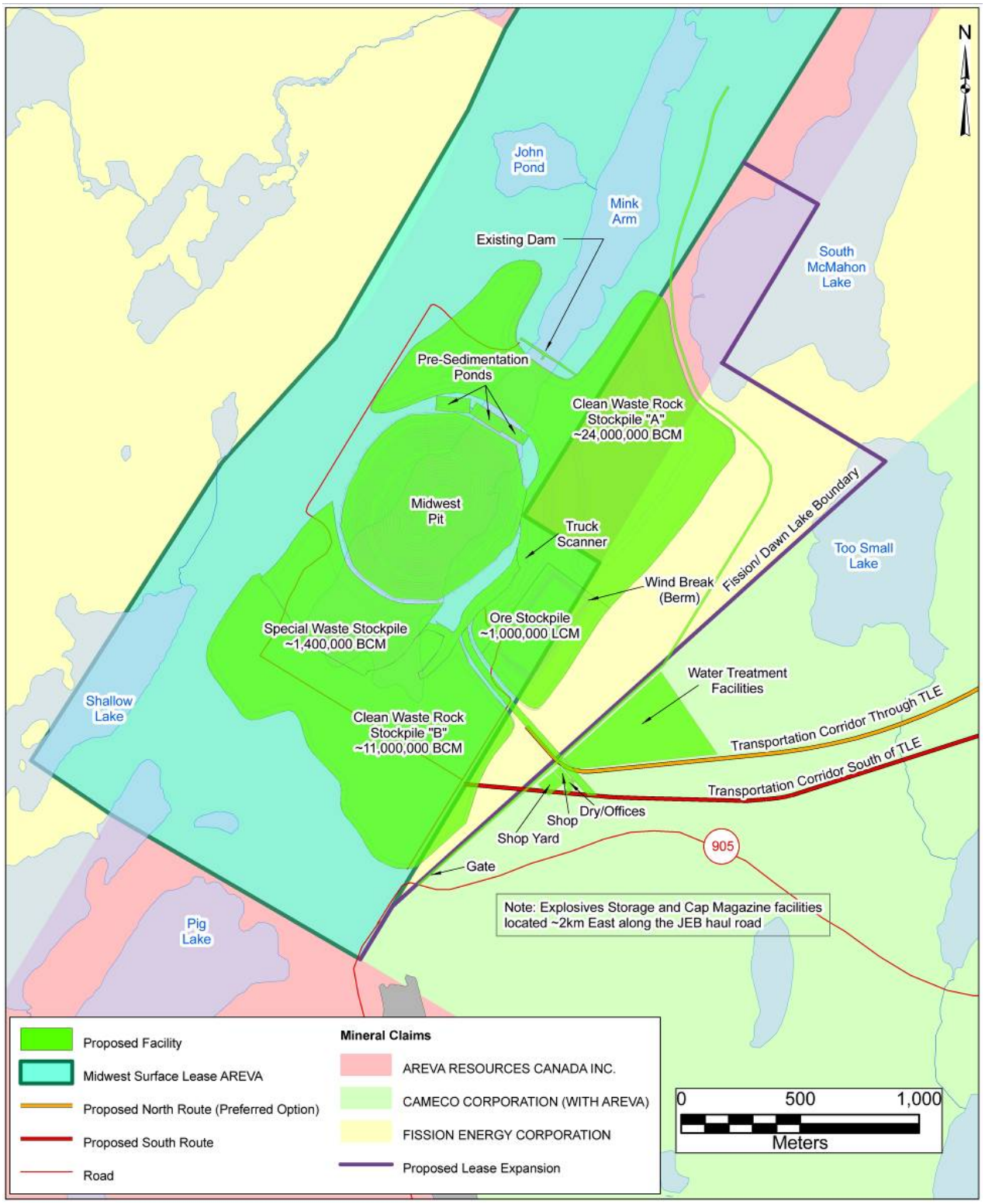



**Figure 4-2** Preferred Site Layout – Option 3

## 4.3 Dewatering of Mink Arm

### 4.3.1 Mink Arm Dam

Test mining was conducted between 1988 and 1989 at the Midwest site, involving an underground test mine. In order to facilitate the safe development of the test mine, it was necessary to dewater a portion of Mink Arm, which involved the construction of a water retention rock core earth fill dam (figure 4-3). Following the completion of test mining, the Mink Arm basin was allowed to reflood and an equalization culvert was installed in the dam in 1991 to re-establish natural drainage to South McMahon Lake. The Mink Arm dam is intact and impedes fish movement between Mink Arm and South McMahon Lake as the only connection between the two basins is the equalization culvert that is accessible to fish only under high-water conditions (figure 4-4). Interaction between Mink Arm and South McMahon Lake has been sufficient to allow an aquatic community to become established since Mink Arm was initially drained.

AREVA is proposing to upgrade the existing dam to ensure slope stability, control seepage, and to further minimize water flowing from South McMahon Lake into the drained section of Mink Arm. The upgraded dam will be designed with a full supply level of 480 masl. As an added safety precaution, considering the size of the proposed pit and to control seepage through the existing dam, a new secondary retention dam will be constructed parallel to the existing dam within the dewatered portion of Mink Arm. The new secondary retention dam will control any seepage through the existing dam and provide a further level of protection in the unlikely event of overtopping of the existing dam. The reinforcement of Mink Arm dam will occur on the Mink Arm side only, thereby avoiding impacts to fish habitat in South McMahon Lake.

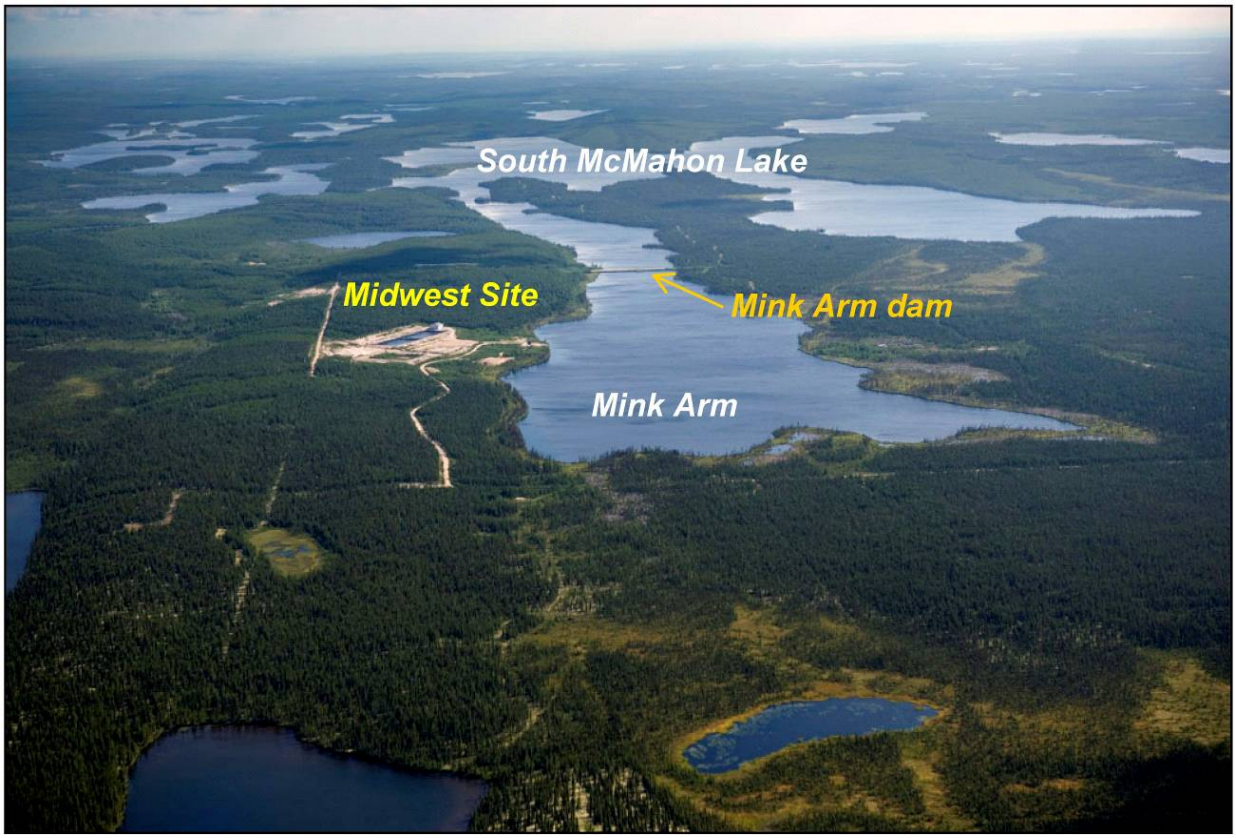



**Figure 4-3** Mink Arm Dam Location


**Figure 4-4** Equalization culvert between Mink Arm and South McMahon Lake

### 4.3.2 Dewatering Method

The Midwest Project is located near the junction of the Smith Creek, Nicholson Creek, and Collins Creek watersheds. The ore body is located under Mink Arm of South McMahon Lake, which drains into North McMahon Lake via Midwest Creek, and from there into Smith Creek. The mean annual flow rate of Midwest Creek is 0.064 $m^3/s$ (5,530 $m^3/d$), while the mean annual flow rate of Smith Creek is 0.687 $m^3/s$ (59,357 $m^3/d$). An assessment completed in 2007 by TC did not identify Midwest Creek or Smith Creek to be navigable waterways.

AREVA's preferred option of dewatering Mink Arm is to discharge as much of Mink Arm surface waters over the dam into the adjacent South McMahon Lake, as was done previously during the test mining program. The water quality between Mink Arm and South McMahon Lake is similar and both meet Saskatchewan Surface Water Quality Objectives (SSWQO) for key parameters. Mink Arm surface water will be pumped via barge and floating pipeline from the southern reach of Mink Arm, over the dam into the northern reach of Mink Arm, which flows into South McMahon Lake. The quality of discharge will be managed to maintain SSWQO in South McMahon Lake. The barge will be situated in the deepest portion of Mink Arm and the intake will be designed to prevent fish entrapment and entrainment of suspended particulate in the diverted water. In order to minimize the potential disruption of fish habitat and scour of lake bed sediments, the discharge pipeline will terminate sufficiently far from the shore line and may be equipped with a diffuser to minimize velocities at the outlet.

The rate of discharge to South McMahon Lake will be determined by the stream flow capacity of Midwest Creek, which drains South McMahon Lake into North McMahon Lake and subsequently into Smith Creek. The upper bounds threshold for Midwest Creek flow during pumping was calculated to be 0.17 $m^3/s$ (mean annual flood), which corresponds to bank full capacity of the stream, and 0.3 $m^3/s$ (1 in 10 year flood). It is estimated that approximately 1.9 million $m^3$ of water, without runoff, will have to be pumped out of Mink Arm to achieve a dewatered state. The pumping duration will depend on the ambient stream flow condition of Midwest Creek and the maximum stream flow rate criterion during dewatering activities. It is anticipated that the pumping duration will range from 28 to 48 weeks by application of the mean annual flood threshold and from 14 to 24 weeks by application of the 1 in 10 year flood threshold. Dewatering flows will be constrained to maintain Midwest Creek flow within the bank full capacity (mean annual flood), but in the event of a wet year, the 1 in 10 year flood level will be adopted as the flow constraint, providing that monitoring of the stream channel demonstrates that excessive stream channel erosion will not occur during a 1 in 10 year discharge.

Midwest Creek is well armoured with cobble and boulder material and a well vegetated floodplain. The proposed flow at the higher threshold value is not expected to have an effect on channel morphology. In addition, changes to downstream riparian vegetation resulting from the discharge of water are anticipated to be within the range of variation associated with natural stream flooding events in the watershed. The effective drainage area of Midwest Creek will be permanently reduced by approximately 25% (including the

area of Mink Arm) and the effective drainage area of Smith Creek will be reduced by about 2 to 3%.

Mink Arm dewatering rates could be accelerated, if required, by also diverting Mink Arm surface waters to the S/V TEMS at the McClean Lake Operation, once the WTP and effluent transfer pipeline are in place.

Based on previous experience, water pumped during the latter part of the dewatering activity is expected to be of higher turbidity. A daily water sample will be collected and measured for pH, total suspended solids (TSS), and conductivity during dewatering of Mink Arm. In order to protect fish and fish habitat in South McMahon Lake, a conservative approach for treating high TSS will be adopted. If TSS exceeds 29 mg/L, water will be directed to the Midwest WTP instead of being released to South McMahon Lake in order to protect fish and fish habitat in South McMahon Lake.

### 4.3.3 Fish, Fish Habitat and Navigation

The Midwest Project will result in the unavoidable loss of fish habitat within Mink Arm due to development of the open pit mine. Unavoidable fish habitat loss is subject to the no net loss guiding principle by which DFO strives to balance unavoidable habitat losses with habitat replacement to prevent further reductions to Canada's fisheries resources. Where fish habitat loss is unavoidable, DFO policy requires habitat compensation and authorization from DFO under the *Fisheries Act* for the HADD of fish habitat. Appendix C outlines AREVA's conceptual fish habitat compensation plan to compensate for the residual effects of the Midwest Project on fish habitat.

Prior to commencement of dewatering activities, a fish removal and transfer program will be undertaken to capture and transfer fish from Mink Arm to South McMahon Lake. Section 9 of the CSR outlines the mitigation plans to minimize any potential HADD to fish and fish habitat during the Mink Arm dewatering process. The fish transfer procedure undertaken to move fish from Mink Arm to South McMahon Lake will be done using non-lethal sampling techniques (e.g. boat electro fishing, trap nets) over a number of days to capture fish in Mink Arm prior to dewatering. When dewatering proceeds, non-lethal fish collection will be conducted intermittently, as the fish remaining in the body of water will become more concentrated and easier to locate and capture as the volume of water in Mink Arm decreases. All captured fish will be transferred to South McMahon Lake in such a way as to minimize stress, including providing time for recovery in a holding tank, keeping holding times short, and gently introducing fish to South McMahon Lake without excessive disruption of sediment. Further details on the fish transfer procedure will be decided in consultation with DFO and the SMOE.

In order to reduce potential effects of Mink Arm dewatering on fish habitat in Midwest Creek, selected large woody debris may be removed from all branches of the creek prior to dewatering. This will be done to improve channel hydraulics, keep water within the main channel of the creek, and minimize potential scour and erosion of the channel. All work will be undertaken in such a manner that the HADD of fish habitat is avoided.

AREVA has been made aware by TC that an Order in Council in accordance with section 23 of the NWPA will be required to dewater the Mink Arm portion of South

McMahon Lake, as the dewatering will permanently impede the public's right to navigate.

## 4.4 Waste Water Management During Mining

An effective dewatering system is essential for the safe and efficient operation of a large scale open pit mine. A hydrological assessment of the Midwest area identified the need for a dual dewatering system, incorporating deep perimeter wells and also an in-pit pumping system. The operation of the dual system will enhance overall slope stability and will be similar to the one currently operating around the JEB TMF dewatering well system.

### 4.4.1 Perimeter Dewatering Wells

The perimeter dewatering well system will be comprised of a ring of approximately 50 dewatering wells around the pit perimeter, drilled to a depth below the bottom elevation of the pit. It is estimated that the total inflow to the proposed open pit will be approximately 20,000 $m^3$/d. The dewatering wells could pump at a rate ranging from 300 $m^3$/day/well to 500 $m^3$/day/well over the 5 year expected period of open pit mining. Based on experience from the JEB site, it is anticipated that a large portion of the dewatering wells will produce clean water, appropriate for direct discharge; however the dewatering well and treatment systems for the Midwest Project is being designed under the conservative assumption that all water will require treatment. The Midwest dewatering well system water quality will be managed under the same regime that is currently in place for the JEB TMF dewatering system. All water will be routinely sampled to determine if the water meets McClean Lake Operation Approval to Operate Pollutant Control Facility criteria, which is issued by the province of Saskatchewan. It is anticipated that the quality of water pumped from Mink Arm will be within the SSWQO, with the exception of turbidity and suspended solids during the spring runoff, when natural background levels themselves exceed the criteria.

### 4.4.2 In-Pit Sump Dewatering

Dewatering wells will not entirely intercept the groundwater flow through the pit. It is estimated that on average, about 5,000 $m^3$/d of water may need to be handled by the in-pit sump dewatering system. The in-pit sump dewatering system will incorporate the use of the existing shaft from the test mine, ditches, and sumps to collect and manage water at active working benches (mining areas). The sumps will be equipped with high capacity submersible pumps and discharge pipelines. All water encountered within the confines of the pit, including groundwater seepage, precipitation, and runoff will be diverted to the sump dewatering system. Booster pump capacity will be incorporated into the in-pit sump dewatering system as mining progresses to the lower benches. All water collected in the pit sumps will be pumped to three lined 30,000 $m^3$/d pre-sedimentation ponds located along the northern edge of the pit crest. Water from the pre-sedimentation ponds will be directed to the Midwest WTP for removal of suspended particulate and dissolved substances.

### 4.4.3 Waste Water Management Facilities at Midwest

A variety of water flows, of variable quality, will be generated during the mining of the Midwest ore deposit. The Midwest site will be constructed to collect and contain contaminated or potentially contaminated waters produced from mining and other ancillary activities. The development and operation of the Midwest open pit mine will generate approximately 25,000 $m^3$/d of water from the different sources (see figure 4-5). Estimates of operational waste water flows generated from the Midwest site, excluding pre-operational Mink Arm dewatering volumes, include:

- the development of a pit dewatering well system will generate an estimated 20,000 $m^3$/d of dewatering water, potentially all of which may require treatment
- mine sump dewatering will generate an estimated 5,000 $m^3$/d, all of which will require treatment
- approximately 340 $m^3$/d of site runoff water and leachate will be generated from the waste rock piles, all of which will require treatment

During the first three years of mining, the dewatering wells will intercept most of the groundwater flow through the pit and the in-pit sump dewatering effort will be limited. At the end of mining, the dewatering wells may not entirely intercept the groundwater flow in the lower levels of the pit. Subsequently, the in-pit sump capacity is expected to increase. In addition, 340 $m^3$/d of site runoff water is expected to be collected during operation based on average precipitation rates and the catchment area associated with the proposed surface development.

Diversion and collection ditches will be constructed, as required, to collect site surface runoff water. Two site run-off ponds with storage capacities of 15,000 $m^3$ and 20,000 $m^3$ will be designed to receive runoff water collected from the clean waste, special waste and ore stockpiles and from runoff from other site infrastructure facilities. All water collected in the site runoff ponds will be routed to the Midwest WTP. In the event of an intense precipitation event that exceeds pumping capacity at the WTP, overflow from all site catchments will be designed to ultimately report to the pit, thus ensuring containment of site runoff water.

As naturally occurring groundwater in the area contains variable concentrations of dissolved metals, water may require treatment prior to release to the receiving environment. The preferred water treatment management involves:

- on-site treatment of contaminated water at a WTP
- potential on-site release of clean water (e.g. clean dewatering well water) within the constraints of the Midwest Creek flows
- transfer and off-site release at the S/V TEMS at the McClean Lake Operation

Contaminated groundwater, in-pit sump water, and potentially contaminated surface runoff will be treated at a WTP located at the Midwest site. The WTP will include a multi-stage reverse osmosis (RO) treatment process that will have the capacity to treat all 25,000 $m^3$/d of water generated at the site. The RO process will produce two water streams: high quality RO treated water (permeate) and a small volume of concentrated brine solution.

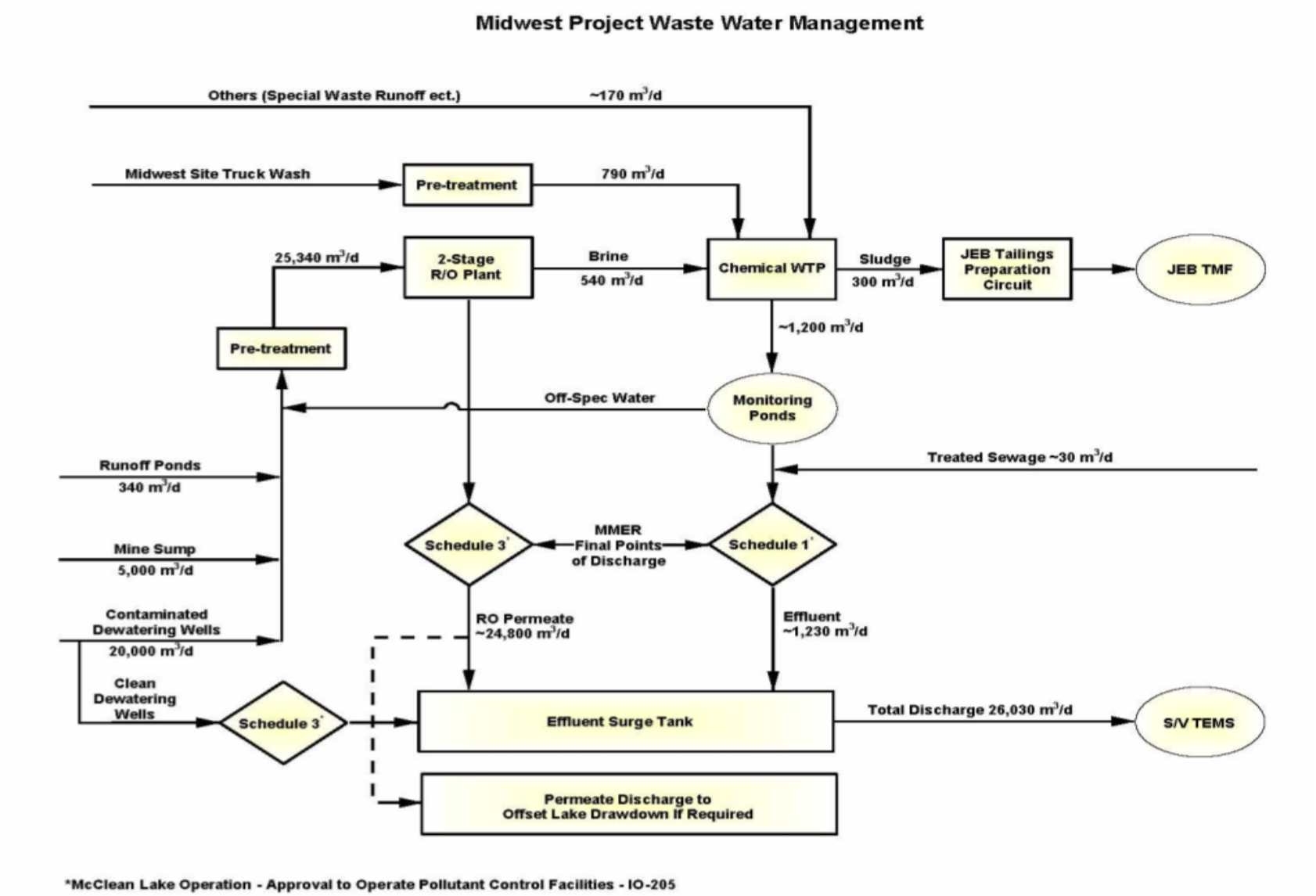



**Figure 4-5** Midwest Water Treatment System

Clean permeate from the RO process will eventually be discharged to the S/V TEMS at the McClean Lake Operation or, if required, will be available to route to local lakes (Too Small, Shallow and/or South McMahon Lakes) to offset potential lake level dewatering effects (section 8.3.2). The quality of the treated water (permeate) is expected to meet the CCME water quality guidelines. RO permeate will be monitored at the final point of discharge for compliance with CNSC licence limits (*Metal Mining and Effluent Regulation* (MMER) discharge criteria (Schedule 3) and any additional site specific limits) and provincial licence requirements (McClean Lake Operation's Provincial Approval to Operate Pollutant Control Facilities (IO-205)) prior to being transferred to the effluent surge tank.

The concentrated brine solution, which will contain dissolved constituents, will be further treated in a conventional chemical WTP at the Midwest site for removal of trace elements. Treated effluent from the chemical WTP will be directed to one of three effluent monitoring ponds, each with a capacity of 1,200 $m^3$ and a retention time of 24 hours. Water that meets discharge criteria (CNSC and provincial licence requirements) will be pumped to an effluent surge tank to be combined with RO permeate for discharge to the S/V TEMS. Treated water that does not meet MMER and IO-205 Schedule 1 will be recycled to a settling pond for re-treatment.

The points of compliance with respect to treated effluent licence limits (whether CNSC or provincial) will apply to treated effluent as it leaves the treatment plants (RO or chemical) prior to any mixing with clean water sources. The quality of effluent from the Midwest chemical water treatment process is expected to be similar to that produced by the JEB WTP. The quality of combined waters, that is the RO permeate, clean dewatering water and treated water released from the chemical water treatment plant, is expected to meet the CCME water quality guidelines and SSWQO for the protection of aquatic life. These releases will also be governed by the McClean Lake Operation's CNSC licence and Provincial Approval to Operate Pollutant Control Facilities.

Any solid and liquid wastes produced from the WTP will be thickened and stored in a sludge mix tank. Approximately 120 $m^3$/d of sludge will be produced, stored in a sludge mix tank and then trucked to the JEB Mill where it will be unloaded into a sludge tank at the JEB Mill, treated and then discharged to the JEB TMF. It is estimated that at peak treatment capacity, up to four to five loads of sludge will be trucked to the JEB Mill on a daily basis.

A 37,500 $m^3$ contingency pond will be constructed on the southeast corner of the Midwest pit, along the access road to the pit. This contingency pond will be kept empty and will be reserved for untreated water storage in case of upsets or unexpected shutdowns of the WTP. In the event that the JEB Mill is shutdown and unable to receive sludge, the contingency pond will be used as contingency storage (approximately 125 days) of sludge.

### 4.4.4 Transfer of Treated Water from the Midwest Site

Clean dewatering well water, clean RO permeate, and treated effluent will be combined in the effluent surge tank prior to being transferred via pipeline to the S/V TEMS. The effluent surge tank will be monitored with conductivity probes in the effluent surge tank and if contamination is detected, will be recycled to the WTP for re-treatment. The quality of the combined clean dewatering water, the RO permeate and conventional chemical WTP effluent is expected to meet CCME water quality guidelines. The combined water will be transported via a single walled, high density polyethylene (HDPE) insulated and heat traced pipeline along the proposed transportation and utility corridor for discharge to the S/V TEMS at the McClean Lake Operation. The utility corridor will be designed to handle 25,000 $m^3$/d. A formal pipeline maintenance and spill prevention/detection program will be documented, reviewed by the relevant regulators and implemented.

### 4.4.5 Waste Water Management at McClean Lake Operation

The preferred Midwest site waste water management option is the release of treated effluent to the existing McClean Lake Operation S/V TEMS. The S/V TEMS consists of Sink Reservoir, Vulture Lake and all structures and connecting pipelines from Sink Reservoir to the east basin of McClean Lake (figure 4-6). The S/V TEMS provides a means of storing effluent, as required, to minimize the effects to the receiving environment while allowing water treatment to proceed. Waste water inputs to the S/V TEMS consist of treated effluents from the JEB WTP, the Sue WTP, and the JEB dewatering well system. Discharge from Sink Reservoir is governed by a number of environmental protection measures outlined in the McClean Lake Operation Environmental Code of Practice (ECOP, more details provided in section 10). The release from Sink Reservoir is controlled to ensure that a minimum dilution ratio of 5 parts Collins Creek flow to 1 part treated effluent flow (not including dewatering water, natural runoff, and RO permeate) is maintained in Collins Creek. In addition, the ECOP lists a maximum combined flow constraint based on the Collins Creek bank full capacity. The high flow constraint in Collins Creek (4.52 $m^3$/s at which time Sink Reservoir discharge ceases) was established to protect against stream bed erosion and to protect fish habitat.

It is not anticipated that any changes will be required to the JEB WTP or S/V TEMS operational and management controls that are currently in place to manage the collection, treatment and release of waste waters at the McClean Lake Operation to accommodate the effluent generated at the Midwest site.

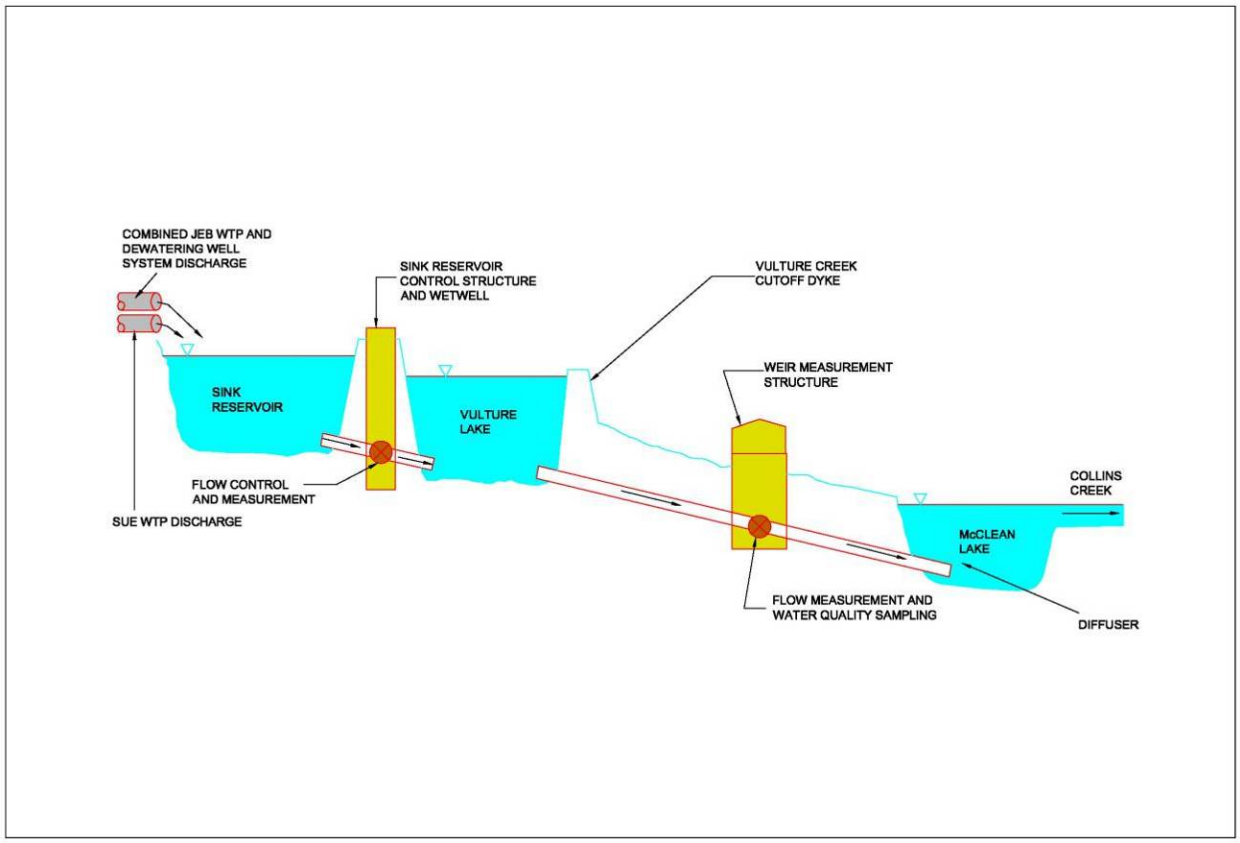



**Figure 4-6** Sink Vulture Treated Effluent Management System (S/V TEMS)

## 4.5 Open Pit Mine Development

AREVA is proposing to mine the Midwest uranium deposit through conventional open pit mining (blast, load, haul) as it is a proven and reliable mining method and has been successfully used at the McClean Lake Operation. Production will yield approximately 16,500 tonnes U or 42 million lbs $U_3O_8$ equivalent.

AREVA is proposing a two-phase approach to the mine design in order to access the ore as early as feasible. The development of the Midwest open pit, including mining, is expected to take approximately five years. The phase 1 pit will be designed to recover approximately one-third of the ore reserve within the first two years of the pit development. The phase 2 pit will be designed to recover the remainder of the ore in the subsequent three year period. Safety or catchment berms will be constructed as the pit is continuously mined by sequentially removing 12 to 15 m benches of rock. The open pit design incorporates catchment berms, ranging in width from 6 to 10 m, which will enhance slope stability and act as catchment ledges for possible falling rock. An access ramp (truck haul road) will enter the pit initially from the south (during phase 1) and the east (during phase 2) in a clockwise direction. Introduction of the Midwest ore into the mill feed will commence once ore mining begins. Midwest ore is expected to be milled in the following five to seven years.

Dewatering wells will be installed prior to pit development to advance draw down of the water table before mining commences. Upon drawdown of the water in Mink Arm, the

new secondary retention dam will be constructed. Once Mink Arm has been dewatered, lake sediments and overburden will be stripped to expose the underlying bedrock. The underlying bedrock will be drilled and then blasted using ammonium nitrate based explosives. Material excavated from the pit will be classified as clean waste rock, special waste rock, or ore. Material mined at all stages of the pit development will be sampled and monitored to ensure proper classification and separation.

During the initial stages of pit development, explosives may be supplied from the McClean Lake Operation. However, on-site explosives facilities will be constructed in accordance with federal and provincial regulations to ensure an uninterrupted supply of explosives for the mining operations. The proposed facilities will contain a 20,000 kg capacity explosives magazine, a magazine for blasting accessories, bulk storage silos (260,000 kg capacity) and a garage to house explosives delivery vehicles. Access to the Midwest site is currently and will continue to be restricted and controlled.

Power distribution to the Midwest site will be provided by SaskPower. A new 115kV/25kV substation and upgrades to the existing power line will be required to accommodate the Midwest Project and it is expected that design and installation will be completed in 2 to 3 years. Licensing and permitting will be completed separately by SaskPower. Four 2000 kW 600 V diesel generators will be installed to provide back-up generation for the Midwest site. Back-up power generators will be operated only during power outages.

Buildings containing offices, a warehouse, maintenance shops, fuel storage, and a kitchen, will be erected adjacent to the Midwest pit. The transportation corridor proposed to be constructed between the Midwest site and McClean Lake Operation will permit the use of the JEB camp to house the Midwest Project personnel. Appropriate telecommunication systems will be established at the Midwest site to support surface infrastructure. Fresh and potable water supply will be drawn from a groundwater source via a screened well. Liquid sewage will be chlorinated, treated and discharged to Sink Reservoir. Solid sewage will be removed by a vacuum truck on a periodic basis and deposited in the existing sewage solids management area at the JEB site.

### 4.5.1 Waste Rock and Ore

Waste rock must be excavated to gain access to the ore body during mining operations. Waste rock will be categorized as overburden, clean waste rock and special waste rock. Overburden refers to unconsolidated surficial soils that lie above the bedrock; clean waste rock refers to mined bedrock with low contaminant content and no acid generating potential; and special waste rock refers to material with significant contaminant content or acid generating potential. The criteria used to distinguish clean waste rock from special waste rock and ore is based on uranium content, propensity to be acid generating and arsenic content (see table 4-2). Nickel is not considered explicitly in the segregation criteria because mineralogical data shows that arsenide minerals also contain nickel. In addition, the arsenic surface water quality objective for the protection of aquatic life is stricter than that of nickel. As such, screening for arsenic will also conservatively protect aquatic life with respect to nickel.

During the development of the Midwest open pit, mined material will be routinely monitored to ensure that clean waste rock, special waste rock and ore are effectively

segregated. The waste rock segregation procedure proposed for the Midwest Project will involve the use of both radiometric probing for uranium detection and portable X-ray fluorescence (XRF) analysis for arsenic detection.

***Overburden and Sediments***

Approximately 2 to 7 m of overburden and sediments will be excavated. Uncontaminated overburden material will be used to build site roads and form the base of two clean waste rock stockpiles. Sediment chemistry results indicate that arsenic, a contaminant of concern (COC), may be present in levels that exceed soil quality guidelines. These sediments may be mixed with overburden material to be used to form the base of the special waste rock stockpile.

***Clean Waste Rock***

Two clean waste rock stockpiles (Stockpile A and B) will be constructed at the Midwest site to accommodate 34,000,000 $m^3$ of clean waste rock. Rigorous segregation procedures will ensure that clean waste rock placed on these two surface stockpiles will meet the segregation criteria used to ensure long term environmental protection. Stockpile A, approximately 100 ha in area, will be located to the north of the Midwest pit; Stockpile B, approximately 75 ha in area, will be located to the south of the pit (figure 4-2). Both stockpiles will be surrounded by perimeter ditches and berms to collect runoff water from the stockpiles and to prevent surface runoff from mixing with runoff water from the stockpiles. Stockpile construction will follow a layered approach to increase stability and sustain vegetative growth. Stockpile A will be two lifts high and stockpile B will be a single lift high. It is expected that the stockpiles will be constructed in 20 m lifts, with 20 m wide catchments. This configuration will result in a stable stockpile face with an overall slope of 4:1, suitable to sustain vegetative growth. Clean waste rock characterization has shown that there is virtually no risk of acid generation from this material and the risk of problematic concentrations of arsenic leaching from surface stockpiles is very low, even if the rock is stored on land. However, as part of the long term clean waste rock management plan, monitoring of water quality will be conducted to confirm the acceptability of surface disposal and the monitoring of the groundwater monitoring wells will be conducted to confirm groundwater quality.

***Special Waste Rock***

Special waste rock may contain quantities of sulphur, arsenic, nickel, uranium and other COCs that may affect surface water quality if stored indefinitely in surface stockpiles. Analyses have shown that arsenic is the primary COC in Midwest waste rock and may be present in levels that exceed soil quality guidelines. Concentrations of COCs in leachate from the special waste stockpile will be intercepted and treated at the Midwest WTP. Special waste rock will be managed along the south perimeter of the Midwest pit and cover an area of 25 ha within an area of potential future pit pushback (figure 4-2). It is estimated that the volume of special waste rock will be between 925,000 to 1,400,000 $m^3$ (bcm) and will be located on an unlined pad, consistent with the management practice previously employed at the McClean Lake Operation for the temporary storage of the Sue C special waste rock. The base of the special waste rock stockpile will be constructed with low permeability native material. To ensure containment of surface water runoff and leachates from the special waste rock stockpile, a site collection runoff area for the

special waste rock stockpile will be constructed approximately 75 m from the pit. Surface runoff will be diverted and collected at the site runoff collection area. During the period of active mining, the special waste rock stockpile and the site runoff collection area will be hydraulically contained within the footprint of the pit by the groundwater drawdown. Any contaminated infiltration will be intercepted by the in-pit sump system for treatment at the Midwest WTP. Pit development and the mining sequence will be planned to minimize the volume of special waste rock that will be hauled out of the pit to this stockpile area.

***Ore***

Any material having uranium content greater than 850 µg/g U is classified as ore. Ore will be radiometrically scanned, sorted by grade, and hauled to a lined ore transfer pad. The ore transfer pad will be 8 ha in area, constructed on the lower lift of the clean waste rock Stockpile A and surrounded by a lined perimeter ditch designed to contain any runoff from the pad. All haul trucks loaded with ore material will be scanned by an overhead scanner, which will have the capacity to classify the load as waste or special waste, and low, medium, or high grade ore material. All ore will be transported to the JEB Mill for processing.

### 4.5.2 Special Waste Rock Management

Previous assessments and characterization studies of other uranium deposits in the Athabasca region have shown that some of the special waste rock can be a source of acid and metals release as a result of sulphide mineral oxidation if the rock is permanently deposited on surface stockpiles.

The special waste rock stockpile will temporarily contain special waste rock for a period of three to four years. The proposed decommissioning plan for the special waste rock states that the special waste rock will be placed in the mined-out pit, covered with a two-metre till cap and the pit flooded to its natural equilibrium elevation. Once flooded, the final depth of water in the Midwest pit will be approximately 143 m, with a surface area of 415,000 $m^2$. Simulations of the post-decommissioning effect of the pit lake on the groundwater flow regime suggest that the Midwest pit lake will not be connected to South McMahon Lake but will act as an isolated surface water body. As such, the impact of the submerged special waste rock on the post-decommissioning groundwater flow is predicted to be limited. The Midwest pit will not be a fish bearing water body as the reflooded Midwest pit will not be connected to any other fish bearing water bodies and the pit lake will not be stocked with fish.

Throughout the operation of the facility the proponent will be required to continue studies of site hydrogeology as well as the geochemistry and leaching behaviour of the special waste to further inform decisions with respect to the final decommission options assessed when applying for a Licence to Decommission from the CNSC. Improved understanding of the site-specific hydrogeology and geochemical behaviour of the special waste will be applied to assess the benefits and trade-offs associated with more advanced alternatives including that of backfilling with clean waste rock over the deposited special waste.

To ensure that all impacted soil in the area of the special waste rock stockpile will be placed in the Midwest pit, the soil below the special waste stockpile will be excavated

and radiological measurements will be conducted, followed by further excavation of material, if necessary, until a defined criterion is reached. This criterion will be established between the regulators and AREVA.

This in-pit disposal approach is consistent with what has been approved for special waste rock management at the McClean Lake Operation. As a backup decommissioning plan, special waste rock will be placed in the mined-out pit and the pit will be entirely backfilled using a portion of clean waste rock.

## 4.6 Transportation Corridor from the Midwest Site to the JEB Site

The Joint Panel Report in 1997 expressed concern over public safety with regards to the previous proposal of hauling ore on Provincial Road 905 (see table 3-2). For the Midwest Project, AREVA is proposing to construct a transportation corridor between the Midwest site and the McClean Lake Operation, which is considered a significant improvement to the 1995 EIS. The proposed single transportation and utility corridor, approximately 17 km in length, will provide an effluent pipeline for the transport of treated mine water, an electrical power line corridor, and will connect the Midwest site, where ore will be mined, to the JEB Mill site at the McClean Lake Operation, where ore will be processed. No permanent camp at the Midwest site will be required as the transportation corridor will allow direct access to the McClean Lake JEB camp. The transportation corridor will reduce travel time and travel distance from about 40 km via the existing Provincial Road 905 to about 16 km.

AREVA is proposing to apply to have the corridor designated as a private road, which would be developed and operated by AREVA with restricted and controlled access. This designation is being applied to address safety issues and concerns with using the road to haul ore. Access to the transportation corridor will be located beyond the site security gate at both the Midwest site and McClean Lake Operation and access by members of the public will require prior permission, as per the current practice for the existing site access road at the McClean Lake Operation.

Environmental inventory of the proposed road corridor have been completed, including a heritage resource impact assessment, rare plant surveys, raptor nesting areas, water management at crossings, and fish habitat assessments at crossings.

Two routing options, the “north” route and the “south” route are being proposed (figure 4-7). Both options are dependent on AREVA acquiring additional surface lease from the province covering the corridor and the right of way between the two sites (approximately 305 to 335 ha). The north route is the preferred option as it is the most direct route between the Midwest site and McClean Lake Operation (17 km) and has less stream crossings (5 for the north and 6 for the south). The proposed north route originally ran through an area that was subject to a Treaty Land Entitlement (TLE) but this is no longer being offered by the Province. Both the north route and the south route transect two navigable stream crossings, as identified by TC. Stream crossings along the proposed transportation corridor will result in the unavoidable loss of fish habitat at culverts along the proposed transportation corridor crossings. It is estimated that the total loss of fish habitat for the north route will be approximately 662 $m^2$ and for the south route will be approximately 680 $m^2$. Implementation of best available technologies and

practices (BATs and BAPs) will minimize the impact on fish habitat during road construction. As well, consideration for maintaining navigability on stream crossings will be incorporated into the design of crossing structures across navigable waterways (section 9). Navigable culverts and clear span bridges have been proposed for navigable crossings along both the north and south transportation corridor options, therefore navigability of stream crossings will not be affected. Culverts and clear span bridges will also not impede fish passage. Table 4-3 outlines the fish habitat and navigability summary of the potential watercourse crossings.

For Crossing N4, in order to maintain navigation, it will be necessary to split the effluent pipeline from the transportation corridor. The pipeline will traverse the stream on a dedicated clear-span trestle adjacent to the road crossing, which will allow for a shorter culvert configuration.

The overall width of the road will be 12.2 m, which is wider than typical provincial roads and will be able to accommodate either a fleet of CAT 777's (90 tonne mining trucks) or tractor-trailer units that will be used to haul Midwest ore. Ore haulage will involve on average 15 truck loads per day between years 3 and 6. If the transportation corridor receives private designation, current regulatory standards for transportation of radioactive substances will not apply. In order to limit access by vehicles at the intersection of non-operational trails and access points along the transportation corridor, berms will be constructed.

It is anticipated that the number of trips per day between the two sites will be approximately 76 round trips/day. The combined distance travelled annually by all vehicles will be approximately 943,000 km.

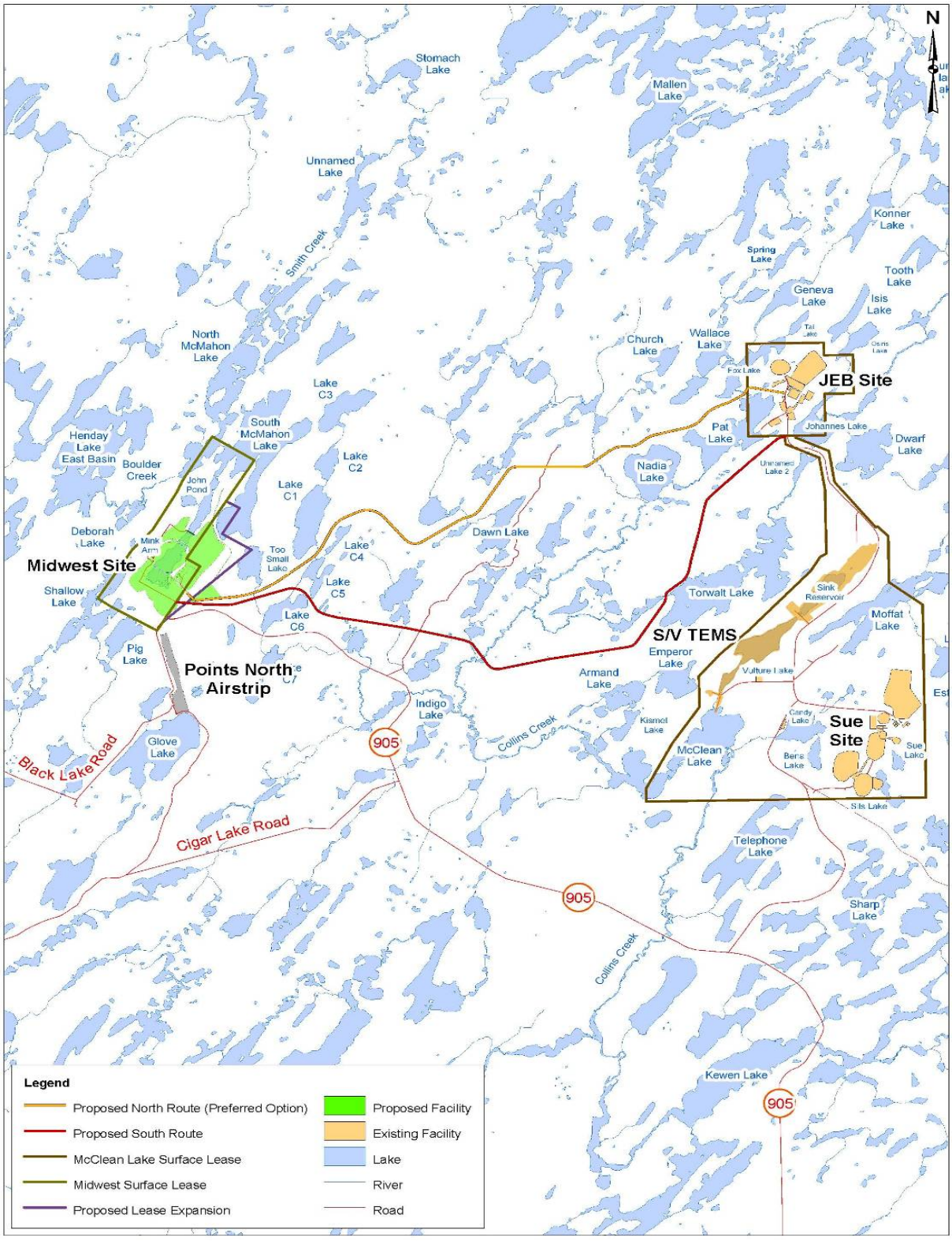



**Figure 4-7** Proposed North and South Transportation and Utility Corridor

**Table 4-3** Fish Habitat and Navigability Summary of Potential Watercourse Crossing

| Crossing | Location | Crossing Structure | Fish Observed | Area of Fish Habitat Affected | Navigable |
|---|---|---|---|---|---|
| Proposed North Route (preferred) | | | | | |
| N1 | Located across an open fen with an upstream drainage of 3.38 $km^2$ | culvert<br>will meet requirement for 1 in 25 year flood event | No fish observed | No fish habitat value | No |
| N2 | Unnamed stream with an upstream drainage area of 14.6 $km^2$ | culvert<br>will meet requirement for fish passage and 1 in 25 year flood event | Northern pike | Approximately 254 $m^2$ | No |
| N3 | Located through dense vegetation with an upstream drainage area of 8.06 $km^2$ | culvert<br>will meet requirement for fish passage and 1 in 25 year flood event | Slimy sculpin | Approximately 143 $m^2$ | No |
| N4 | May be considered a navigable watercourse with an upstream drainage area of 33.4 $km^2$ | culvert<br>will meet requirement for fish passage and 1 in 25 year flood event | Burbot<br>Slimy sculpin | Approximately 265 $m^2$ | Yes |
| N5 | May be considered a navigable watercourse located along the outlet of Fox Lake with an upstream drainage area of 29.15 $km^2$ | clear span bridge | White sucker<br>Burbot<br>Slimy sculpin | No impacts as the bridge will span the full width of the stream | Yes |
| Proposed South Route (alternate) | | | | | |
| S1 | Located across a large open fen with an upstream drainage area of 3.38 $km^2$ | culvert<br>will meet requirement for 1 in 25 year flood event | No fish sampling as insufficient water levels | No fish habitat value | No |
| S2 | Located across a treed bog with an upstream drainage area of 16.2 $km^2$ | culvert<br>will meet requirement for fish passage and 1 in 25 year flood event | Burbot | Approximately 182 $m^2$ | No |
| S3 | Located across an unconfined channel with an upstream drainage area of 2.50 $km^2$ | culvert<br>will meet requirement for fish passage and 1 in 25 year flood event | Burbot | Approximately 234 $m^2$ | No |

| Crossing | Location | Crossing Structure | Fish Observed | Area of Fish Habitat Affected | Navigable |
|---|---|---|---|---|---|
| S4 | May be a navigable watercourse located across an unconfined channel with an upstream drainage area of 14.76 $km^2$ | culvert<br>Will meet requirement for fish passage and 1 in 25 year flood event | Burbot<br>Trout<br>Perch<br>Ninespine stickleback | Approximately 264 $m^2$ | No |
| S5 | Located along Collins Creek with an upstream drainage area of 134.04 $km^2$ | clear span bridge<br>will span the full width of the stream | Northern pike<br>Burbot<br>Slimy sculpin | No impacts as the bridge will span the full width of the stream | Yes |
| S6 | May be a navigable watercourse<br>located at the outlet of Torwalt Lake with an upstream drainage area of 44.48 $km^2$ | clear span bridge<br>16.7 m wide x 58.7 m (will span the full width of the stream) | Northern pike<br>Burbot<br>Lake chub<br>Slimy sculpin<br>Emerald shiner | No impacts as the bridge will span the full width of the stream | Yes |

## 4.7 Milling of the Midwest Ore at the JEB Mill

The undiluted uranium ore from the Midwest site will be transported to the JEB Mill in haul trucks via the transportation corridor for processing into yellowcake. The JEB Mill will be expanded to allow for the proposed increase in production from the currently approved 24 million lbs $U_3O_8$ equivalent to an annual uranium production capacity of 27 million lbs $U_3O_8$ equivalent and to accommodate specific Midwest ore processing requirements. The process required to produce uranium concentrate from Midwest ore remains unchanged; however facility and equipment expansion and modification will be required.

Minor modifications of the JEB Mill will be required to accommodate the Midwest ore. These modifications include the addition of a new neutral slurry thickener, five additional leach tanks, additional counter-current mixer-settler extraction units, and additional covered storage capacity for yellowcake drums. With the modifications to the JEB Mill to accommodate the Midwest ore, two new processes are being considered: a new precipitation, filtration and packaging process to produce molybdenum as a by-product and circuitry for nickel/cobalt recovery, where nickel and cobalt would be shipped to off-site smelters as a by-product.

Two additional modifications to the JEB Mill utility circuits will be required to process the Midwest ore, which include the acid plant and the ferric sulphate plant. The acid plant produces sulphuric acid that is used in the mill and the WTP. The acid plant was designed for an annual production of 24 million lbs $U_3O_8$. Minor modifications will be required to the acid plant to accommodate the increased production. The ferric sulphate plant produces ferric sulphate solution which is used in the tailings preparation and WTP. As this plant was constructed in 2006, it will be upgraded through the addition of a third reactor tank to accommodate the Midwest ore.

## 4.8 Tailings Management

Tailings are a waste product resulting from milling of uranium ore and are comprised of leach residue solids, waste solutions, and chemical precipitates. As the Midwest ore will be hauled to the JEB Mill for processing, the resulting tailings will be managed at the JEB site, as was approved in the 1995 EIS. The JEB tailings management system is comprised of tailings preparation within the JEB mill, the tailings delivery system, and disposal at the JEB TMF. The tailings preparation is used to treat and neutralize tailings for the removal of soluble contaminants and to thicken the resulting tailings slurry prior to disposal. Following preparation, the tailings are pumped from the mill for disposal. All tailings resulting from uranium processing of Midwest ore at the McClean Lake Operation will be deposited in the JEB TMF. The operation of the JEB TMF has gone through an EA and is a licensed facility under the CNSC. No change to the JEB TMF tailings preparation or disposal is required to accommodate the Midwest ore.

The JEB TMF was designed to minimize environmental effects due to tailings disposal throughout operations and for the decommissioned facility, through the application of a number of mitigation measures. Table 4-4 outlines the mitigation measures currently incorporated into the design of the overall system.

**Table 4-4** Mitigation Measures for JEB Tailings Management Facility

| Tailings Management System | Mitigation Measures |
|---|---|
| Tailings Preparation | ▪ the natural surround design of the TMF is an in-pit disposal method that uses natural host rock to provide a preferential flow path for groundwater around the consolidated tailings mass<br>▪ tailings produced have a low hydraulic conductivity to provide a suitable hydraulic conductivity contrast between the tailings and host rock<br>▪ tailings are thickened in order to minimize segregation of the tailings during deposition and to minimize the long-term solute flux out of the TMF<br>▪ the tailings preparation process involves the addition of ferric sulphate and lime to control the solution pH within the range of 7.5 to 8.5 and control nickel and other trace metals. Under these conditions, arsenic and other COCs are precipitated as chemical and mineral phases which results in a low pore water concentration. Barium chloride is added to the neutralization circuit to remove radium-226 from solution.<br>▪ the pond water level within the TMF is maintained below that in the surrounding aquifer to ensure a continuous inflow of groundwater and to ensure contaminants are contained and not released from the TMF to the receiving environment during the operational phase |
| Tailings Placement | ▪ in-pit disposal provides better isolation and security to dedicated above-ground tailings disposal and it reduces worker exposure to dust, gamma radiation, and radon<br>▪ tailings are placed near the centre of the TMF to reduce the effect of segregation by isolating coarse zones from active groundwater flow<br>▪ tailings slurry are injected just below the top of the previously placed tailings (tremied). The tremie placement of tailings reduces the degree of segregation of tailings and reduces the overall hydraulic conductivity of the tailings mass<br>▪ water levels in and around the TMF are controlled through a combination of pumping water from the dewatering wells and pumping reclaim water back from the TMF pond to the mill or WTP |

| Tailings Management System | Mitigation Measures |
|---|---|
| | ▪ nine observation wells are associated with the TMF to monitor groundwater hydraulic gradients and groundwater quality |
| Tailings Decommissioning | ▪ a compacted till cover will be placed over the placed tailings for final decommissioning to allow enhanced consolidation of the tailings mass which may result in lower tailings hydraulic conductivity<br>▪ age testing of mill tailings has been carried out to assess the long-term stability of the arsenic in the produced tailings. Test results indicate low long-term pore water contaminant concentrations in tailings |

Extensive field and laboratory test work has been done to characterize the tailings properties. The Tailings Optimization and Validation Program (TOVP, more details provided in section 10) was developed to optimize the tailings preparation process in the JEB Mill, validate predictions of the properties of tailings disposed within the JEB TMF, and verify predictions of long term environmental effects on the receiving environment. There are nine observation wells associated with the JEB TMF, which are used to monitor groundwater hydraulic head gradients and groundwater quality in and around the JEB TMF. Groundwater from the JEB site initially discharges to the north basin of Fox Lake and Pat Lake and ultimately into Collins Creek.

## 4.9 Air Emissions

Airborne emission control systems in place at the McClean Lake Operation will be applied to mining of the Midwest deposit and milling of the ore at the JEB Mill. Air emission sources include the acid plant, the JEB mill and airborne emissions related to mining and ore haulage. The acid plant is a source of sulphur dioxide emissions to the atmosphere. Sulphur dioxide emissions are controlled through proper plant operations, including an in-stack detector. No changes to the acid plant are expected for the processing of the Midwest ore. Five areas of the JEB Mill have been identified as potential sources of particulate emissions to the atmosphere: the scrubber system, the ore receiving and grinding area, the yellowcake calciner, and the yellowcake packaging areas. No changes to the mill airborne emission abatement equipment are expected for the processing of Midwest ore. Mining activities, including blasting, ore and waste hauling, service vehicle traffic, and wind generated dust from ore and waste stockpiles, may affect air quality. Appropriate dust suppression measures will be taken, as are currently employed at the McClean Lake Operation, to maintain air quality within accepted standards.

## 4.10 Waste Management

Waste materials at the Midwest site will be handled and disposed of according to the waste management program at the McClean Lake Operation. Domestic waste will be incinerated, recycled or disposed of in a landfill. Industrial wastes from the Midwest site will be disposed of in the industrial waste landfill located within a designated portion of the clean waste rock stockpile. Conventional waste materials originating from mining, milling and water treatment areas at the Midwest site may be chemically or radiologically contaminated. These materials will be collected in dumpsters and buried at the landfill located at the perimeter of the JEB TMF. Hazardous substances and waste dangerous goods will be collected and stored in designated containers and transported by a licensed carrier for recycling or disposal at an off-site registered facility.

## 4.11 Hazardous Materials

Numerous hazardous materials are currently stored at the McClean Lake Operation and are expected to be required at the Midwest site for the mining and processing of Midwest ore. These hazardous materials are primarily in the form of fuel and reagents and include explosives, compressed gasses, flammable liquids and solids, oxidants, toxic and poison, radioactives, and corrosives. On-site storage of these materials is not expected to interact directly with the environment under normal operating conditions due to preventative design features such as secondary containment.

## 4.12 Navigable Waters

AREVA filed a NWPA Application for Proposed Works Associated with the Midwest Project with TC. The aspects of the Midwest Project included in the application are:

- the existing Mink Arm dam
- upgrades to the Mink Arm dam
- construction of a new secondary retention dam at Mink Arm
- dewatering of Mink Arm
- crossing N4 and N5 along the proposed transportation corridor (preferred route)
- crossing S4, S5 and S6 along the proposed transportation corridor (alternative route)

The existing Mink Arm dam was constructed in 1988 and will be upgraded to further minimize water flowing from South McMahon Lake into the drained section of Mink Arm. A new secondary retention dam will be constructed within the dewatered Mink Arm, parallel to the existing dam, in order to reinforce the existing dam.

TC has communicated to AREVA that a section 23 exemption of the NWPA from the Governor in Council will be required to dewater the Mink Arm portion of South McMahon Lake, as the dewatering results in permanently impeding the public's right to navigate. AREVA will submit the application to request a section 23 exemption to TC but this application does not form part of the EA process.

TC's NWPA Request for Project Review identified two stream crossings along the north route (the preferred route), as navigable: Crossings N4 and N5. To comply with TC

requirements, the proposed configuration for Crossing N4 is a culvert and the proposed configuration for Crossing N5 is a clear span bridge.

## 4.13 Operational Programs

The McClean Lake Operation is governed by an integrated quality management system (IQMS) for all production and support activities (table 4-5). Process activities are either mine/surface operations or mill operations. Support services activities are required to support the process and include general infrastructure, radiation protection, training, personnel, health, safety, and environmental protection. Key programs in place at the McClean Operation that will be applied to the Midwest Project are described in table 4-6. It is not anticipated that changes to the existing programs will be required for activities related to mining the Midwest open pit and processing the ore.

## 4.14 Conceptual Decommissioning and Reclamation Plan

The intent of decommissioning and reclamation is to render harmless all mining-related facilities for which there is no beneficial use and return the land to a stable, self-sustaining condition suitable for traditional uses, taking social and economic factors into consideration. The Midwest and McClean Lake Operation sites will meet air, soil, and water quality objectives at designated locations and will be safe for non-human and human use. Prior to development, the site was used for sporadic hunting, trapping and fishing and following decommissioning, these activities can be continued.

It is AREVA's intent to begin reclamation in areas soon after mining or other activities are complete in order to have a significant portion of the decommissioning work done when the operation ceases. Detailed decommissioning cost estimates for the Midwest site and the transportation corridor will be completed during licensing. Once the project has been decommissioned and reclaimed, the site will enter a period of post-decommissioning monitoring to demonstrate that the site is safe to be returned to the province. The province will provide long term institutional care of the site.

A summary of the decommissioning plan for common facilities is provided in table 4-5. All common facilities will be dismantled, with contaminated material disposed of in the JEB TMF, uncontaminated material buried on site, recyclable and hazardous waste material sent off-site and covers constructed over various facilities. Roads and selected cleared areas will be scarified and revegetated.

A summary of the decommissioning plan for common facilities, the Midwest site and JEB site is provided in table 4-6 to table 4-8. All stockpiles will be recontoured, buildings and equipment will be dismantled and salvaged, contaminated material will be disposed in the mined-out Midwest pit or the JEB TMF. Both the Midwest and JEB WTPs will be used during decommissioning and will be dismantled and disposed of in the Midwest pit and the JEB TMF when no longer needed. A till cap will be constructed over the wastes in the Midwest pit and the pit will be allowed to re-flood naturally. The Mink Arm dam will be left intact upon completion of mining activities to serve as a barrier between South McMahon Lake and the disturbed area.

The JEB TMF will be decommissioned following termination of milling operations at McClean Lake Operation. Decommissioning will involve backfilling the TMF with clean

waste rock above the tailings mass and installing a compacted till cover at surface to promote revegetation.

Containment and control structures will be removed from Sink Reservoir and Vulture Lake and flows will be allowed to return to natural drainage patterns once treated effluent discharge to Sink Reservoir is no longer required. All adequate protection will be taken to protect downstream fish habitat from siltation during removal of the control and containment structures.

**Table 4-5** McClean Lake Operation Integrated Quality Management System (IQMS)

| Program | Program Description |
|---|---|
| McClean Lake Environmental Management System (EMS – ISO 14001:2004) | The EMS provides the structure for control of environmental issues, both current and future. Establishment of the EMS involved an examination of possible environmental effects as a result of interactions between the operation and the environment.<br>Once the significant interactions were identified and grouped, appropriate environmental protection objectives were established. |
| Environmental Protection Program (EPP) | The EPP at the McClean Lake Operation includes environmental monitoring and compliance assessment, operation of the S/V TEMS, and various waste management facilities. In addition, conventional wastes produced are also managed, including storage and disposal of domestic, industrial, chemically or radiologically contaminated waste, hazardous substances and waste dangerous goods. |
| Radiation Protection | The program is designed to meet the regulatory requirements of the NSCA and associated regulations and the internal requirements of AREVA. The program monitors the effectiveness of design features and operational practices, and educates workers on radiation safety. Program elements consist of day-to-day operational practices and procedures that are employed to monitor and prevent radiation hazards to workers. A nuclear energy worker (NEW) is defined as a person with "a reasonable probability that the person may receive a dose (occupational) of radiation that is greater than the prescribed limit for the general public (i.e. 1 mSv/y)". NEWs are limited to a maximum annual effective dose of 50 mSv in a one year period and cannot exceed 100 mSv in a 5 year period. |
| Occupational Health and Safety | The program is designed to meet legislated requirements, internal standards of McClean Lake Operation, and provide a healthy and safe workplace for all employees. Program activities include medical surveillance programs, physical conditions inspections and workplace monitoring of contaminants such as dusts, fumes, mists, temperature extremes and noise. Other activities include accident investigations, safety statistics, risk assessments, safety meetings, hazard analysis, safety training, change management procedures and emergency preparedness. |
| Training | The McClean Lake Operation has a systematic process for identifying and providing the training required by site employees. |
| Emergency Preparedness | An Emergency Response Team is maintained on site and trains regularly. High-risk hazards are identified and attended to and each major geographical area within the McClean Lake Operation has a |

| Program | Program Description |
|---|---|
| | designated marshalling point and that its location is well communicated to employees, contractors and visitors. |
| Security | Security at McClean Lake Operation includes monitoring and controlling vehicles and personnel coming onto the site; night patrol of all outlying areas and the camp facility and monitoring and controlling vehicles and personnel leaving the site. |
| Public Information and Employee Awareness | The corporate office in Saskatoon carries out formal, written communication with the public and employees through weekly and monthly publications. A web site (www.areva.ca) is also maintained. Informal communications with the public and employees are carried out by site and corporate employees. Scheduled meetings, tours and on site presentations are carried out with Environmental Quality Committees and the Athabasca Working Group. In addition the La Ronge office works with local communities on matters of interest. |

**Table 4-6** Summary of Decommissioning Plan for Common Facilities

| Facility | Conceptual Decommissioning Plan |
|---|---|
| Power lines and substations | Electrical services will be dismantled from the mine site to the main transmission line. Substations and transformer stations will be dismantled, transformers will be removed and the poles taken down and electrical equipment will be salvaged and sold or buried on site. |
| Utilities | Surface and above surface utility lines and conduits will be dismantled and salvaged; underground lines will be blown clean and/or made safe and capped. |
| Site roads | Culverts will be removed and replaced with drive-through cross ditches; road fill slopes and berms will be recontoured for long-term stability and to promote drainage; travelways will be scarified to promote vegetation. |
| Core storage areas | Cores will be disposed in the JEB TMF and racks and fences removed during building disassembly. |
| Tanks | Storage tanks will be salvaged and removed from the site after their contents have been salvaged or disposed of appropriately. |
| Gatehouse | The gatehouse, which regulates traffic in and out of the site, will be the last building to be dismantled; all salvageable material will be removed, and the remainder buried or burned. |

| Facility | Conceptual Decommissioning Plan |
|---|---|
| Piezometers, access casings, boreholes | They will be maintained in operational condition through decommissioning and post-decommissioning as they pose no environmental concern. |
| Dewatering wells | Dewatering system will be shut down and dismantled after in-pit tailings cover has been constructed. The wells will be capped with reinforced concrete plugs. |
| Miscellaneous pipelines | Contaminated pipelines will be cut into manageable sections and disposed of in the JEB TMF. Pipelines used to transfer treated waters will be placed in the JEB TMF, Midwest pit and/or Sue C pit. |
| Explosive plant and magazines | They are owned by the explosives contractor, who will demobilize the facility upon completion of their usage. |
| Storage ponds | Contaminated sediments, liners, and ditches will be removed and disposed in the JEB TMF or Midwest pit. Unlined ponds will be graded and may be used for burial of uncontaminated materials. |
| Solids waste disposal area | Active industrial landfill trench in the JEB clean waste rock pile will be backfilled with clean rock, graded, and revegetated. Any material that cannot be recycled, cleaned, or salvaged will be placed in the JEB TMF. Recyclable and hazardous materials will be sent off site. Sewage solids will be utilized for reclamation activities. Remediated hydrocarbon contaminated soil will be used to reclaim the site. |
| Cleared areas | Roads and selected cleared areas will be scarified and revegetated. |
| JEB permanent camp | Salvageable materials, furniture and equipment will be removed, scanned and tagged for removal from site. The remaining material will be hauled to the landfill and burned. |
| Moffat exploration camp | Salvageable material will be removed; septic tanks will be pumped out and buried remaining material will be hauled to the landfill and burned; area will be revegetated. |

**Table 4-7** Summary of Decommissioning Plan for the Midwest Site

| Facility | Conceptual Decommissioning Plan |
|---|---|
| Organics stockpile | Remaining organics will be used for site revegetation. |
| Overburden and waste rock disposal area | Upper exposed benches will be scarified to promote vegetation and the side slopes will be recontoured to stabilize the slopes. Drainage will be directed towards the Midwest pit through existing ditches. |
| Ore storage area | Contaminated material, including the liner, will be disposed in the Midwest pit. The area will be graded and revegetated. |
| Water treatment plant | Midwest WTP will be used during decommissioning. When it is no longer needed, it will be dismantled, and salvageable equipment and material salvaged to be sold. Non salvageable material will be disposed in the Midwest pit, JEB TMF or Sue C pit. |
| Maintenance shop, office buildings | Maintenance shop and office will be dismantled and equipment salvaged, with the remaining material either burned or disposed in the Midwest pit. |
| Midwest pit | Special waste deposited in the Midwest pit will be capped with till and the pit will be allowed to flood to natural water levels |
| Mink Arm dam | The Mink Arm dam will be left in place, providing a barrier between South McMahon Lake and the decommissioned mining area. |

**Table 4-8** Summary of Decommissioning Plan for the JEB Site

| Facility | Conceptual Decommissioning Plan |
|---|---|
| Organics stockpile | Remaining organics will be used for site revegetation. |
| Overburden and waste rock disposal area | Upper exposed benches will be scarified to promote vegetation and the side slopes will be recontoured to stabilize the slopes. Drainage will be directed towards the JEB TMF through existing ditches. |
| Ore storage area | Contaminated material, including the liner, will be disposed in the JEB TMF. The area will be graded and revegetated. |
| Special waste pad | Remaining special waste will be disposed in the Sue C pit. Contaminated base material will be disposed in the JEB TMF. The area will be graded and revegetated. |
| JEB Mill and associated infrastructure | Equipment and process tanks will be decontaminated and salvaged as much as possible. Non-salvageable equipment and tanks will be disposed in the JEB TMF. The extent of contamination will be determined and cleaned up. |
| Water treatment plant | JEB WTP will be used during decommissioning. When it is no longer needed, it will be dismantled, and salvageable equipment and material sold. Non-salvageable material will be disposed in the sludge disposal area adjacent to the JEB TMF. |
| Concrete batch plant area | It is owned and operated by on-site construction contractors, and will be removed by the contractor when it is no longer needed. Site gravel quarries will be contoured, as needed. |
| Maintenance, office buildings | They will be dismantled and equipment salvaged, with the remaining material either burned, disposed in the JEB TMF or in excavated pits at the JEB site. |

## 4.15 Project Schedule

Once regulatory approval is obtained and a development decision has been made, pre-development activities will commence and will include:

- upgrading the existing Mink Arm dam
- construction of the new secondary retention dam parallel to the existing dam
- dewatering of Mink Arm, pending an Order in Council is received as per section 23 of the NWPA
- construction of the transportation and utility corridor, effluent transfer pipeline installation and power line installation
- construction of the Midwest water treatment plant
- development of the Midwest site facilities
- expansion of the JEB Mill
- implementation of the fish habitat compensation plan, pending all authorizations

Construction of the expanded JEB Mill will begin after regulatory approvals are received and a corporate development decision has been made. It is anticipated that the expanded JEB Mill could be operational within 18 months of initial construction.

The development of the Midwest open pit is expected to be mined in five years, with ore initially accessed after two years. Introduction of Midwest ore into the JEB Mill feed will commence once ore mining begins. The Midwest ore is expected to be milled in the following five to seven years at the proposed increased JEB Mill production capacity of 27 million lbs per year $U_3O_8$ equivalent.

The proposed FHCP, which involves restoring connectivity at Montreal River weir through the construction of a pool and riffle fishway will occur within a two-year timeframe of habitat loss, contingent on the prevailing river flow regime and construction logistics.

Decommissioning of the Midwest site is expected to last 2 years followed by 5 years of post-decommissioning monitoring, or until it can be demonstrated that the site is safe and can be returned to the province of Saskatchewan.

# 5 PROJECT ALTERNATIVES

## 5.1 Alternatives to the Project

Unlike other types of projects for which project alternatives might be available, mines are unique because ore bodies have a fixed location, and the only way to proceed with a mining venture is to mine the ore body in place. As such, the only alternatives to the Midwest Project are to:

- proceed with the project in the near-term
- delay the project until circumstances are more favourable
- abandon the project

AREVA has indicated that the development of the Midwest Project has been temporarily postponed due to economic factors, including low uranium prices and increased development costs.

## 5.2 Alternative Means of Carrying Out the Project

In accordance with the CEA Act, the comprehensive study process must include consideration of the alternative means of carrying out the proposed Project that are technically and economically feasible and the environmental effects of any such alternative means. Table 5-1 outlines a matrix of the technically and viable alternatives considered and the environmental effects of each alternative.

### 5.2.1 Mining Alternatives

AREVA is conducting studies on a Mining Equipment Development program to develop and evaluate an underground jet-boring technology deployed from surface to extract ore from small ore bodies that cannot be economically recovered using conventional open pit and underground methods. If this program is successful and economically feasible, this technology could be applied as a replacement or in conjunction with open pit mining at Midwest. As a possible alternative, this mining approach could be used to access Midwest ore sooner by deploying this technology during pit development.

### 5.2.2 Site Configuration

Three proposed site layout alternatives were considered to minimize the environmental disturbance related to the Midwest Project. In order to continue to facilitate the use of the Mink Arm dam, each alternative involved acquiring additional surface lease area from the province for the placement of waste rock stockpiles and construction of the water treatment and support facilities. The expanded surface lease area involves surface areas above the mineral rights staked by Fission Energy and the Dawn Lake Joint Venture (Dawn Lake).

Alternative 1 would require a 175 ha expansion of the Midwest surface lease, extending into surface areas above the Fission Energy mineral claim area. Alternative 2 would have required a surface lease expansion of 35 ha into surface areas above the Dawn Lake mineral claim area for placement of site infrastructure and the infilling of John Pond for the management of waste rock. Alternative 2 is no longer being considered as a result of

regulatory constraints and the unfavourable view of the infilling of John Pond. Alternative 3, AREVA's preferred option, will require an additional 210 ha – 175 ha and 35 ha of expansion into surface areas above the Fission Energy and Dawn Lake mineral claims area, respectively. To date, consent has only been obtained from Dawn Lake.

### 5.2.3 Transportation and Utility Corridor

Two corridor routes for transporting ore from the Midwest Project to the JEB Mill site were considered. The proposed north route (figure 4-7), at approximately 16.8 km, is the preferred option, as it is the most direct route between the Midwest and JEB site, runs a shorter distance, has a smaller overall footprint, and has less stream crossings. The proposed north route originally ran through an area that was subject to a Treaty Land Entitlement (TLE) but this is no longer being offered by the Province to the Peter Ballantyne Cree Nation. The proposed south route was originally proposed to circumvent the TLE selection in the event that access through this block of land could not be acquired.

### 5.2.4 Special Waste Rock Disposal

Upon completion of mining the Midwest deposit, the preferred option for the long term disposal of special waste rock involves placing all special waste rock in the mined-out Midwest pit. A two-meter compacted till cap would be placed on top of the waste rock upon decommissioning. Following decommissioning, the Midwest pit would be re-flooded. As an alternative to this decommissioning plan, the Midwest pit could be entirely backfilled. All special waste rock would be placed at the bottom of the pit and a fraction of the clean waste rock would be used to entirely backfill the pit to surface. The fully backfilled pit is a backup decommissioning plan for the Midwest pit, should the pit lake water quality become unacceptable and should the WTP be unable to treat the pit lake water.

### 5.2.5 Waste Water Management

Several waste water management options were identified to minimize waste water volumes and manage waste water resulting from mining activities at the Midwest site. These options included pit sump dewatering, perimeter dewatering and injection wells, perimeter dewatering wells and in-pit sump mine water dewatering, and frozen barrier.

It is anticipated that mine inflow may approach 25,000 $m^3$/d. Based on this volume, pit sump dewatering was not considered due to the large quantity of water expected to collect in the pit. Perimeter dewatering and injection wells were also considered unfeasible, as several difficulties associated with re-injecting collected water into the sandstone aquifer were identified, including the ability to effectively dewater the pit and the need to increase the footprint of the mine to accommodate the injection wells. The option to install perimeter dewatering wells in conjunction with in-pit sump dewatering was considered to be the preferred option to manage the pit inflows for the Midwest Project. This method would reduce the total inflow to the pit during mining and thus would reduce the amount of contaminated sump water that would require treatment.

A potentially economically viable alternative to the preferred option is to develop a frozen barrier surrounding the Midwest pit. The frozen barrier would extend from the

surface, through the sandstone units and into the basement rocks. It is anticipated that the frozen barrier would reduce the dewatering requirements from 25,000 to 2,500 $m^3$/d, as only water in storage inside the wall would need to be removed. This option remains a viable alternative to be reviewed as the project advances closer to development.

### 5.2.6 Water Treatment Methods and Discharge Locations

Two alternative discharge locations for effluent release from the Midwest Project were investigated. The first alternative considered developing South McMahon Lake into a reservoir for the storage and controlled release of effluent to the Smith Creek watershed. In order to develop the storage volume in South McMahon Lake to make it a reservoir, the lake level would have to be lowered by one metre. In addition, release from the storage reservoir would have to be regulated to ensure that a minimum dilution rate was maintained within Smith Creek. This dilution rate would be a minimum of 5 parts of Smith Creek flow for every 1 part of WTP effluent flow. Based on this dilution rate, there would be insufficient storage capacity at the reservoir to satisfy the dilution requirements. AREVA acknowledged that lowering the water level in South McMahon Lake would result in disruption of fish habitat. Based on this assessment, the conversion of South McMahon Lake to a reservoir for the storage and discharge of waste water generated at the Midwest site is not preferred.

The second alternative evaluated the use of the existing S/V TEMS at the McClean Lake Operation to manage waste water originating from the Midwest Project. The S/V TEMS currently receives all discharges from the McClean Lake Operation, including clean dewatering well water, JEB WTP effluent, and Sue WTP effluent. This alternative considered the combined flows from the JEB and Sue WTPs, the JEB dewatering well system and the estimated waste water flows from the Midwest Project. Sink Reservoir has an active storage capacity of 1.3 million $m^3$ and a total available active storage capacity of 2.1 million $m^3$. As set out in the ECOP, Sink Reservoir has a 441.5 masl administrative level, 442 masl regulatory level, and 443 masl emergency spillway elevation. Based on analysis completed on average Collins Creek flow conditions, the current discharge constraints can be maintained without increasing the capacity of the S/V TEMS.

In conjunction with the evaluation of discharge alternatives, two WTP configurations were evaluated. It was assessed that of the estimated 25,000 $m^3$/d of water generated at the Midwest site, approximately 16,700 $m^3$/d (two-thirds) would require treatment, with the remaining clean water released directly to a designated reservoir. One configuration considered using a three-stage conventional WTP, similar to the JEB WTP. It was determined that construction of a conventional WTP to process the contaminated water from the Midwest Project could not be accommodated within the Smith Creek watershed or the S/V TEMS.

The second configuration considered using a RO process with a capacity to treat all 25,000 $m^3$/d of water generated at the Midwest site. The use of a RO process could be accommodated by the Smith Creek watershed, with the conversion of South McMahon Lake to a reservoir, or in the Collins Creek watershed through the existing S/V TEMS. As stated, the conversion of South McMahon Lake to a reservoir was no longer considered as it would require significant effort to lower the lake level. As such, the

preferred treatment of waste water is the RO process with subsequent treatment in a conventional chemical water treatment plant, and discharge of the combined waters at the S/V TEMS.

### 5.2.7 Fish Habitat Compensation

The Midwest Project will result in unavoidable HADD of fish habitat through the dewatering of Mink Arm to allow for the development of an open pit mine and through the loss of habitat at stream crossings along the proposed haul route. To compensate for the Midwest Project's loss of fish habitat, two conceptual plans were proposed to meet DFO's compensation hierarchy in early versions of the draft Midwest EIS. These alternatives were the Too Small Lake alternative, which proposed the expansion and deepening of the existing basin and stocking of an existing lake; and the Sue E Pit/Sils Lake alternative, which proposed flooding the mined out Sue E pit and connecting it to Sils Lake and stocking the system with fish. Neither the Too Small Lake nor Sue E Pit/Sils Lake options were supported by the SMOE. DFO was willing to work with AREVA to pursue these options but had concerns regarding the uncertainty of success.

AREVA proposed a third conceptual fish habitat compensation plan to the SMOE, DFO and TC to restore connectivity at the Montreal River weir, located approximately 20 km north of Montreal Lake, and maintain water levels in Montreal Lake by constructing an engineered pool and riffle fishway and stabilizing the existing weir. A pool and riffle fishway is a natural type of in-stream structure constructed from gravel, cobble, and boulders which is used to reduce high flow velocities and upstream slope. The pool and riffle fishway will span the full width of the Montreal River and maintain the weir's current spill elevation, thereby preserving up to 7,000 ha of fish habitat in Montreal Lake.

The compensation plan will be considered successful when the pool and riffle post-construction as-built report demonstrates that the criteria of the DFO-approved design have been met. If it is determined that the as-built does not meet the DFO design criteria, efforts will be undertaken to correct any variance from design. If necessary, a contingency plan will be implemented to ensure that the loss of fish habitat within Mink Arm is fully offset. Monitoring for fish passage will be an important part of the compensation plan, in order to determine fish movement at the pool and riffle fishway and determine the extent to which the fishway may affect local fish populations.

**Table 5-1** Summary of Evaluation of Alternative Means of Carrying out the Midwest Project

| Alternative | Discussion | Summary |
|---|---|---|
| **Site Configuration** | | |
| Summary of Site Layout Alternatives | There were three proposed site layout alternatives considered which were chosen and designed to minimize environmental disturbance and continue with the use of the existing Mink Arm dam thereby limiting the disruption of fish habitat in Mink Arm to an area previously altered. All alternatives involve acquiring additional surface lease for the placement of waste rock and other infrastructure. The proposed expanded surface lease area involves surface areas above the mineral rights staked by Fission Energy and by the Dawn Lake Joint Venture. | |
| Alternative #1 | Similar layout and site design as the preferred Alternative (#3), but carries some uncertainties related to placement of WTP and the ability to obtain the surface lease area from the Province of Saskatchewan due to the mineral rights being held by a junior exploration company. | Carried through the assessment, although not the Preferred site layout alternative, this remains a viable alternative |
| Alternative #2 | This alternative resulted in the infilling of John Pond due to the placement of overburden and of waste rock. Due to regulatory constraints and the unfavourable view of the infilling of John Pond, this option is no longer being considered by AREVA for the purpose of this assessment. | Screened Out |
| Alternative #3 | Similar layout and site design as Alternative #3, however placement of WTP in a different area and avoids the infilling of John Pond. Also requires AREVA to obtain surface lease area from the Province of Saskatchewan of area where mineral rights are being held by a junior exploration company. | Carried through the assessment and is the Preferred site layout alternative |
| **Transportation and Utility Corridor from Midwest Site to the JEB Site** | | |
| Summary of Transportation and Utility Corridor Routes Alternatives | A transportation and utility corridor is proposed to provide a dedicated haul road, approximately 17 km in length, between the Midwest site and the McClean Lake Operation's JEB Mill. Both require additional surface lease and new surface disturbance. AREVA assessed both route options, taking into consideration disturbance of rare plants, nesting areas and heritage resources along the route, number of crossings (navigable waterways) and the potential for HADD of fish habitat based on aquatic assessment at stream crossings. | |

| Alternative | Discussion | Summary |
|---|---|---|
| | It is expected that both routes will be acceptable with the application of appropriate mitigation measures and compensation. | |
| North Route | At time of initial submission this route crossed an area which was subject to a treaty land entitlement (TLE) selection by the Peter Ballantyne Cree Nation (PBCN).<br>This route is the most direct, has fewer number of stream crossings and therefore has a smaller overall footprint.<br>The TLE selection by the PBN is no longer being applicable. | Carried through the assessment and is the Preferred Transportation and Utility Corridor Route |
| South Route | This route was originally proposed to avoid the area encompassed by the TLE selection.<br>This route has a greater distance and impacts more stream crossings and is less favourable based on increased footprint. | Carried through the assessment but is not the Preferred Transportation and Utility Corridor Route |
| **Special Waste Rock Disposal Plan Alternatives** | | |
| Summary of Special Waste Rock Disposal Plan Alternatives | During operations waste rock, classified as special waste rock, will be stockpiled for future management. | |
| Placement at the bottom of the mined out open pit, then backfilling the pit entirely, using a portion of clean waste rock | Groundwater flow conditions for a fully backfilled pit appear to be very similar to groundwater flow conditions for partially backfilled pit.<br>This alternative is presented as a contingency decommissioning plan should the pit lake water quality evolve unacceptably and should the water treatment plant be unable to treat the pit lake water | Carried through the assessment as a back up alternative for special waste rock disposal |
| Placement in bottom of mined out open pit; cover with till and re-flood naturally | Consistent with what has previously been approved for waste rock disposal at the McClean Lake Operation and is economically favourable. | Carried through the assessment and is the Preferred alternative for special waste rock disposal |

| Alternative | Discussion | Summary |
|---|---|---|
| **Waste Water Management Alternatives** | | |
| Summary of Waste Water Management Alternatives | An effective mine dewatering system is important for the safe and efficient operation of a large scale open pit mine. A number of management options were identified to minimize waste water volumes and manage waste water resulting from mining activities at the Midwest site; that require treatment.<br>These options were evaluated based on feasibility and expected environmental performance.<br>A hydrogeological assessment of the Midwest area indicated the need for a deep perimeter well dewatering system to intercept groundwater before it flows into the pit. This will also improve pit slope stability. Dewatering wells/intercept wells have demonstrated good performance at McClean Lake Operation. Perimeter dewatering wells are included as aspects of the two of the alternatives. | |
| Perimeter Dewatering and Injection Wells | Interception of inflows and disposal by re-injecting back into the sandstone aquifer. Main benefit of this alternative is the reduction in volume of water that would be treated and released.<br>The heterogeneous fractured nature of the sandstone aquifer in the area introduces a great deal of uncertainty as to the ability of the aquifer to accept injection water and the potential effects of this alternative to both the environment and operations.<br>A preliminary assessment of this water management strategy indicated that the injection of dewatering well effluent with an outer perimeter of injection wells would likely compromise the ability to effectively dewater the pit.<br>Due to the uncertainty associated with this alternative, it was considered unfeasible. | Screened Out |

| Alternative | Discussion | Summary |
|---|---|---|
| Perimeter Dewatering Wells and Pit Sump Mine Water Collection | The use of inceptor wells provides an opportunity to minimize the amount of inflow requiring treatment, and improving pit wall stability. Pit sumps will collect and manage water at active mining areas.<br>It is expected that a large fraction of the inceptor wells will produce 'clean' water appropriate for direct discharge. | Carried through the assessment and is the Preferred alternative for managing inflows. |
| Frozen Ground Wall | Potentially economically viable alternative. Reducing dewatering requirements, resulting in minimal hydrologic effects on nearby surface water bodies. Technical uncertainties could result in substantial project delays.<br>If proven economically feasible this alternative could be considered. | Carried through the assessment as a potentially Preferred alternative for managing inflows, pending economics. |
| Pit Sump Dewatering | Although the simplest approach, by allowing groundwater and runoff inflows to be collected by a sump located at the bottom and then pumped to the water treatment plant. With no potential to intercept clean water, this alternative is not practical considering the large quantities of water expected. | Screened Out |
| **Evaluation of Water Treatment Methods and Alternative Discharge Locations** | | |
| Summary of Water Treatment Methods and Discharge Locations | Two alternative discharge locations for effluent release were investigated:<br>▪ discharge at the Midwest Project site, or<br>▪ discharge at the McClean Lake Operation (S/V TEMS)<br>Two water treatment plant (WTP) configurations were evaluated:<br>▪ Reverse Osmosis with conventional WTP, or<br>▪ Conventional WTP<br>* it is estimated that 25,000 $m^3$/d of water will be generated at the Midwest site, with approximately two-thirds (16,700 $m^3$/d) of the water produced requires treatment, with the remaining clean water released directly to a reservoir.<br>* the transfer of water from Midwest to McClean Lake Operation for treatment at the JEB WTP was considered but is not favourable due to the need to transport contaminated water long distances and the associated risks.<br>*A waste water management system consisting of a RO process to generate high quality permeate water and a | |

| Alternative | Discussion | Summary |
|---|---|---|
| | relatively small volume of concentrated brine solution, with subsequent treatment in a conventional chemical water treatment plant, and discharge of the combined waters at S/V TEMS is the preferred waste water management option. With the potential of the on-site release of clean-water (identified as a mitigation measure for potential drawdown of surface waterbodies. | |
| **Treatment Process** | | |
| Reverse Osmosis Process; with a conventional chemical WTP | RO process produces two water streams: clean, high quality RO permeate water and a relatively small volume of concentrated brine solution which would be transferred to a conventional chemical WTP for removal of trace elements.<br>With RO permeate quality considered equivalent to clean DW water at JEB it is expected that there will be adequate storage capacity at Sink Reservoir.<br>Produces clean water that could be discharged on-site, as a mitigation measure for any potential surface water draw down from dewatering.<br>With the implementation of a Reverse Osmosis process to generate high quality permeate, and a small volume of relatively concentrated brine solution, with subsequent treatment in a conventional WTP, the discharge of waste water from the Midwest Project can be accommodated either in the Smith Creek watershed, with the conversion of South McMahon Lake to a reservoir, or in the Collins Creek watershed through the existing S/V TEMS. | Preferred alternative for Water Treatment Method. |
| Conventional WTP | The assessment of discharge volumes and locations indicates that construction of a conventional treatment plant to process contaminated water from the Midwest Project cannot be accommodated within the Smith Creek watershed, or within the S/V TEMS.<br>The resulting storage volumes in Sink Reservoir for the conventional water treatment flow scenario which assumes two-thirds of the water will require treatment. This analysis indicates that there is inadequate storage capacity within Sink Reservoir. The analysis indicates that under all Collins Creek flow regimes there is the potential that not all water would be released within a year and there would be an additional cumulative storage requirement. | Not the Preferred alternative for Water Treatment Method. |

| Alternative | Discussion | Summary |
|---|---|---|
| | Based on this analysis, this alternative is not a preferred alternative and is not investigated further. | |
| **Discharge Location** | | |
| Developing South McMahon Lake into a reservoir for the storage and controlled release of effluent to the Smith Creek watershed | Conversion of South McMahon Lake to a reservoir would require significant effort to both lower the existing lake level, and facilitate the construction of a control structure to control discharge and would result in significant harmful alteration, disruption and destruction of fish habitat.<br>The addition of a secondary discharge location will also increase the spatial scale of potential effects from treated effluent discharge. | Not the Preferred Alternative for Discharge Location of treated effluent. |
| Use of the existing McClean Lake Operation S/V TEMS | Will not require the creation a new reservoir or new treated effluent discharge location, thus reducing environmental foot print by elimination of the potential effects in Smith Creek drainage and limiting the spatial scale of potential effects from treated effluent discharge to a single watershed. | Preferred Alternative for Discharge Location for treated effluent. |
| **Haul Truck Alternatives for the Transport of Midwest Ore** | | |
| Summary of Haul Truck Alternatives | To identify the most suitable truck fleet for hauling ore from the Midwest site to the JEB mill, an economic trade-off study was completed | |
| 90 tonne mining fleet | Continued use of the 90 tonne mining fleet being used at the McClean Lake Operation | Decision to be made at licensing, therefore the corridor design considers the requirements of using either CAT 777's or the tractor-trailer units. |
| Purchasing a fleet of tractor-trailer units | New purchase | |
| **Fish Habitat Compensation Alternatives** | | |
| Summary of Fish Habitat Compensation Alternatives | In conjunction with relocation, redesign and mitigation, the harmful alteration, disruption or destruction (HADD) of fish habitat associated with the Midwest Project has been minimized to the extent possible. The residual effects of the Midwest Project on fish habitat are limited to the loss of fish habitat along haul road stream crossings and | |

| Alternative | Discussion | Summary |
|---|---|---|
| | the permanent loss of habitat within Mink Arm of South McMahon Lake in order to access the ore body by open pit mining. | |
| Restoring connectivity at the Montreal River weir | Preferred Alternative put forward in Final EIS (September 2011). | Preferred Alternative for Fish Habitat Compensation Plans. |
| Expansion of Too Small Lake | Preferred Alternative assessed and put forward in Draft EIS (February 2010). | Previously Preferred Alternative that was not considered favourable by regulators and members of the public and therefore not carried forward in the Final EIS. |
| Use of a mined out open pit (Sue E/Sils Lake) | Previously put forward as an Alternative. Not carried forward in Final EIS based on technical uncertainties and public perception. | Not carried forward in Final EIS as an Alternative. |

# 6 SCOPE OF THE ASSESSMENT

Scoping is a procedural step in the EA process under the CEA Act and it establishes the boundaries of the federal EA. The scope identifies what elements of the proposal to consider and include and what environmental components are likely to be affected.

The scope of the project refers to those components of the project that are considered to be part of the project for the purposes of the EA. The scope of the assessment includes the factors to be considered in the EA and the scope of those factors, including their temporal and geographic extent. The scope has been established in accordance with sections 15 and 16 of the CEA Act.

## 6.1 Scope of the Project

The scope of the Midwest Project was defined in the PSG&SD that were approved by the federal Minister of the Environment, in consultation with the President of the CNSC. The Midwest Project includes the physical works and activities associated with the construction, operation and decommissioning (including closure and reclamation) of:

- the Midwest mine, including all associated facilities and ancillary work
- dewatering of Mink Arm and pumping of Mink Arm water to South McMahon Lake
- the RO mine water treatment plant at the Midwest site
- waste rock management facilities located at the Midwest site
- transportation corridor and the transport of ore along it by truck
- the waste management system that is proposed for transporting waste water from the Midwest site to the S/V TEMS at McClean Lake Operation
- modifications to the JEB Mill at McClean Lake Operation to accommodate the Midwest ore
- any modifications to the JEB TMF to accommodate the Midwest ore
- all physical works and undertakings associated with the Fish Habitat Compensation Plan

Many of the physical works and activities associated with the Midwest Project are integrated with the current and planned activities at the McClean Lake Operation under its current licence, including mining activity, ore handling and tailings management.

## 6.2 Scope of the Assessment

Section 16(3) of the CEA Act requires RAs determine the scope of the factors to be taken into consideration in the EA of a proposed project. As specified in the PSG&SD, an EA conducted as a comprehensive study shall include consideration of the following factors:

- the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out
- the significance of the effects
- comments from the public and Aboriginal groups that are received in accordance with CEA Act and its regulations
- measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project
- a consideration of the need for the project and alternatives to the project
- the purpose of the project
- alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternatives
- the need for, and the requirements of any follow-up program in respect of the project
- the capacity of the renewable resources that are likely to be significantly affected by the project to meet the needs of the present and those of the future

As defined under the CEA Act, "environmental effect" means, in respect of a project:

a) any change that the Project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act* (SARA)

b) any effects of any change referred to in the bullet above on:

   i. health and socio-economic conditions

   ii. physical and cultural heritage

   iii. the current use of lands and resources for traditional purposes by Aboriginal persons

   iv. any structure, site or thing that is of historical, archaeological, paleontological or architectural significance

c) any change to the Project that may be caused by the environment

## 6.3 Scope of the Factors to be Considered

The scope of factors to be considered during the assessment of the Midwest Project identifies the environmental components that are likely to be affected, including:

- climate, meteorology and air quality
- geology and hydrogeology
- surface hydrology and water quality
- fish and fish habitat
- terrestrial environment
- socio-economic environment
- heritage resources
- land and resource use, including Aboriginal traditional use

Navigable waters was included in the Scope of the Factors to be Considered following discussions with Transport Canada during the review of the Midwest Project.

***Effects of the Environment on the Project***

In addition to evaluating the effects of the Midwest Project on the environment, the effects that the environment may have on the Midwest Project were also considered. The assessment of the effects of the environment included identifying the environmental factors deemed to have a possible consequence on the Midwest Project, the likelihood and severity of their occurrence, and mitigation measures planned to minimize their impact.

***Environmental Effects of Accidents and Malfunctions***

Pursuant to CEA Act, consideration of the environmental effects of any potential project-related accidents or malfunctions is required. The assessment includes consideration of the potential accidents, malfunctions and unplanned events that could occur in any phase of the Midwest Project, the likelihood and circumstances under which these events could occur, and the environmental effects that may result from such events.

***Capacity of Renewable Resources***

Under the CEA Act, the comprehensive study EA includes consideration of the capacity of renewable resources that are likely to be significantly affected by the Midwest Project to meet the needs of the present and those of the future.

***Cumulative Effects Assessment***

Under the CEA Act, the comprehensive study EA must consider cumulative environmental effects that are likely to result from the Midwest Project in combination of other projects or activities that have been or will be carried out.

## 6.4 Spatial Boundaries

The spatial boundaries for the Midwest Project encompass the areas of the environment reasonably expected to be affected by the Project, or which are considered relevant to the assessment of cumulative environmental effects. Table 6-1 describes the spatial boundaries for the Midwest Project.

## 6.5 Temporal Boundaries

The temporal boundaries for an environmental assessment define the time periods for which likely project-specific and cumulative effects would be considered. Three temporal periods have been defined for the Midwest Project: the pre-development period, the operational period, and the post-operational period. Table 6-2 describes the temporal boundaries for the Midwest Project.

**Table 6-1** Spatial Boundaries for the Midwest Project

| Spatial Boundary | Location | Key Features |
|---|---|---|
| Regional Assessment Boundary | Athabasca Basin Ecoregion, including Wollaston Lake and Lake Athabasca (figure 6-1). | Includes the Midwest Project and the McClean Lake Operation, as well as other current uranium operations, including Rabbit Lake, Key Lake, McArthur River, Cluff Lake (decommissioned) and Cigar Lake (under construction).<br>The regional assessment boundary also includes six Athabasca communities – Hatchet Lake First Nation, Black Lake First Nation and Fond du Lac First Nation; and the Northern Settlements of Wollaston Lake, Uranium City and Camsell Portage, and the Northern Hamlet of Stony Rapids. Hatchet Lake is the closest to the Midwest Project site at approximately 60 km and Camsell Portage is the farthest at approximately 330 km. |
| Local Assessment Boundary | Local surface water drainage systems within the Midwest Project and the McClean Lake Operation (figure 6-2). | Drainage systems include the upper Collins Creek and Moffatt Creek watersheds for the McClean Lake local study area and the Smith Creek and Nicholson Creek watersheds for the Midwest Project local study area. The Midwest Project local assessment boundary covers approximately 66,800 ha. |
| Site Assessment Boundary | Midwest Project and McClean Lake Operation surface lease boundaries, connected by the surface lease for the transportation and utilities corridor (figure 6-3). | Area which contains all existing and proposed infrastructure required for mining, milling, and support activities. The Midwest Project and McClean Lake Operation surface lease areas cover approximately 4,350 ha. |

**Table 6-2** Temporal Boundaries for the Midwest Project

| Temporal Period | Characterization |
|---|---|
| Pre-Development Period | Environmental baseline characterization period. For the McClean Lake Operation, characterization of the baseline conditions is represented by data collected prior to 1996. For the Midwest Project, the majority of the information collected to date is representative of pre-development baseline information. |
| Operational Period | Extends from the end of the pre-development phase (1996) until the completion of mining, milling and related activities, approximately 2045.<br><br>At the Midwest Project, mining activities, once initiated, are anticipated to take approximately 5 years, followed by approximately 3 years of special waste management and decommissioning activities.<br><br>At McClean Lake Operation, the operational period began in 1996 with the initiation of mining. Activities include the milling of Sue A, the mining and milling of Sue E, Sue B and preparing for future projects: McClean Lake underground ore, Cigar Lake ore and Midwest ore. McClean Lake Operation's operational period will span an additional 40 years, to approximately 2045 and includes management of waste rock and tailings from each of these ore sources. |
| Post-Operational Period | Decommissioning until approximately 2056 and post-decommissioning to approximately 15,000 years into the future.<br><br>At the Midwest site, waste water management activities will continue until the end of the life of the McClean Lake Operation, which will be 2045.<br><br>Decommissioning of the McClean Lake site is anticipated to last eleven years, from 2045 to 2056. As some of the potential effects are anticipated to be long-term, such as groundwater transport of constituents from tailings and waste rock to surface waters, a 15,000 year time period was chosen to capture peak predicted constituent concentrations. |


**Figure 6-1** Regional Assessment Boundary

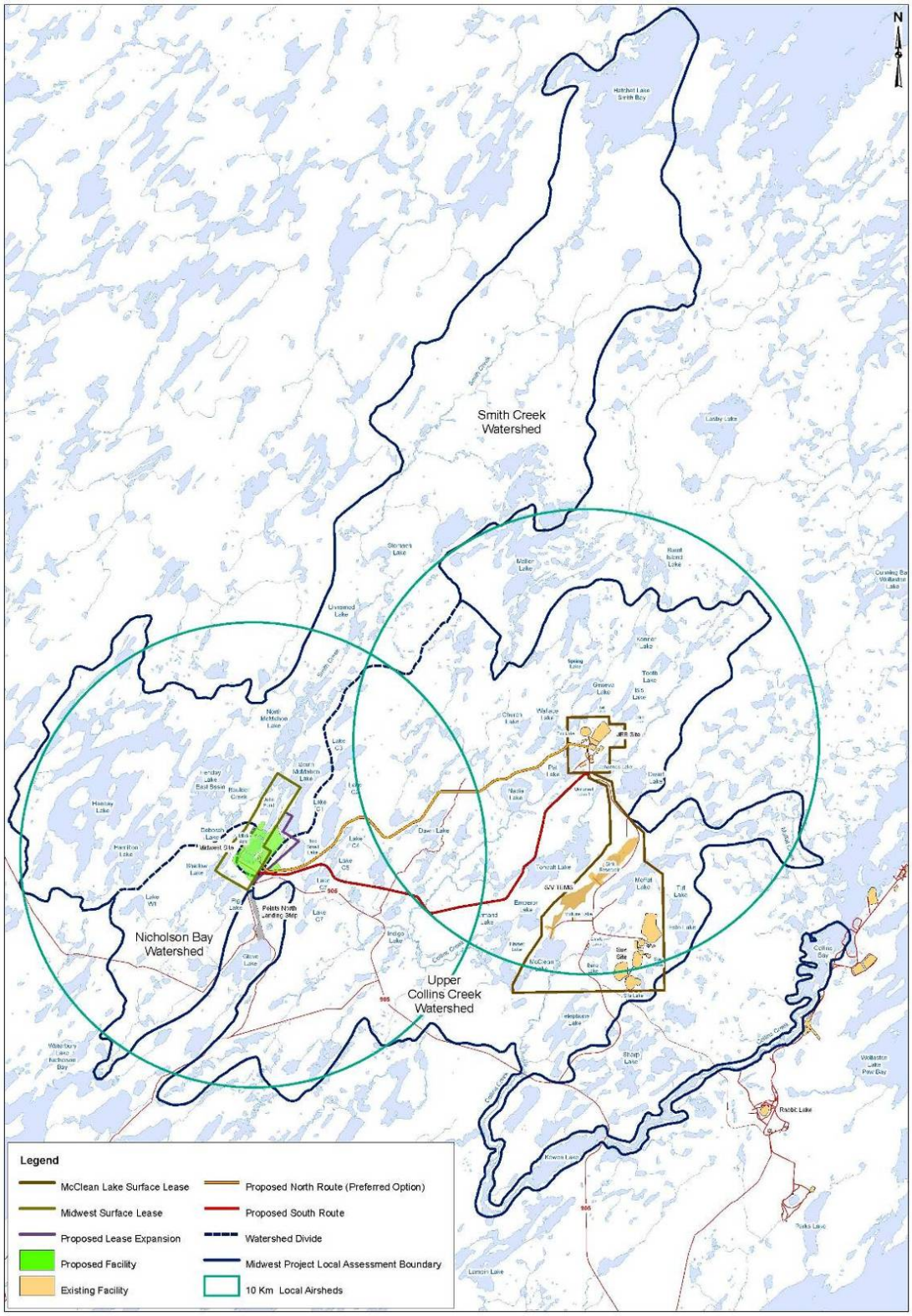



**Figure 6-2** Local Assessment Boundary

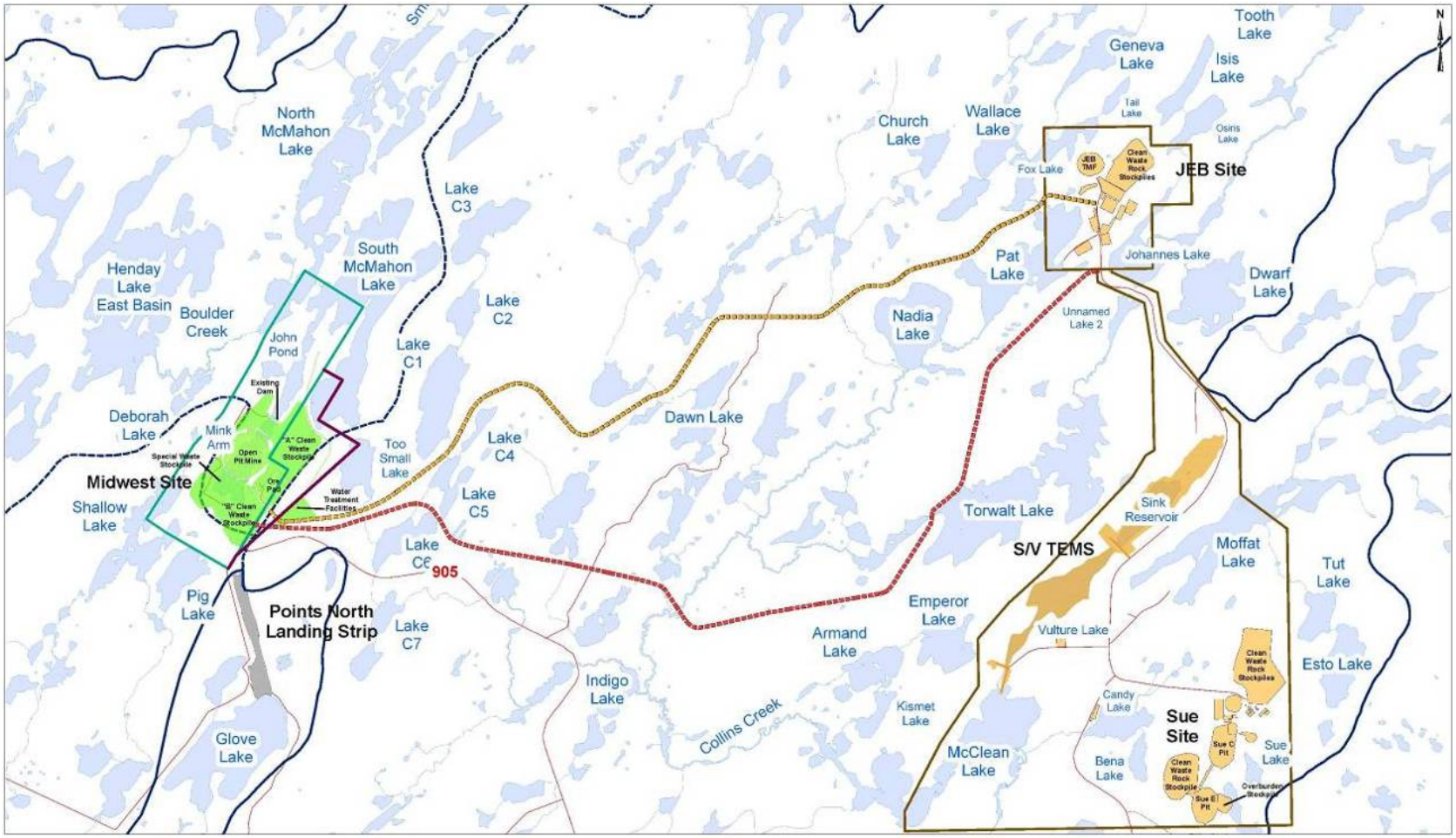



**Figure 6.3** Site Assessment Boundary

# 7 CONSULTATION

In accordance with the CEA Act, the RAs have ensured that public participation, as required for comprehensive studies, has been conducted. As well, under the *Canada-Saskatchewan Agreement on Environmental Assessment Cooperation*, the SMOE is the lead for this EA, which is also subject to the provincial public participation process.

The Crown also has a duty to consult, and where appropriate, accommodate, when it has knowledge that its proposed conduct might adversely impact potential or established Aboriginal or treaty rights. Federal departments involved with the Midwest Project participated in a whole-of-government approach to uphold the honour of the Crown and consider Aboriginal peoples' potential or established Aboriginal or treaty rights pursuant to section 35 of the *Constitution Act, 1982*. This approach is described in the MPMO Midwest Project Agreement. Following the whole-of-government approach, Aboriginal consultation was integrated into the EA process to ensure that a coordinated, transparent, effective and efficient process was undertaken. The role of the Crown Consultation Coordinator (CCC), which is to coordinate consultation activities on behalf of the RAs and the SMOE and act as a single point of contact for Aboriginal communities and organizations, was originally assigned to the CEA Agency, and then transferred to CNSC in September 2010.

While proponents do not bear the Crown's legal obligation to consult with Aboriginal peoples under section 35 of the *Constitution Act*, *1982*, their role to engage Aboriginal peoples is important to the effectiveness of the Crown's decision-making. Proponent's consultation activities are therefore important and can inform and assist the Crown in its consultation activities.

Throughout the EA process, AREVA, the RAs, SMOE and the CEA Agency met with Athabasca Basin communities, Athabasca stakeholder groups and Aboriginal groups and organizations to provide information on the Midwest Project, to discuss the potential environmental effects and to encourage participation in the EA review.

## 7.1 Consultation Process

With support from AREVA, the SMOE, the other RAs and AANDC, the CCC created a distribution list of Aboriginal communities and organizations identified as having an interest in the Midwest Project based on their past or current interest in similar projects, and the potential or established Aboriginal or treaty rights. The distribution list was updated throughout the review process. The list Aboriginal communities and organizations identified for engagement and consultation were:

***Athabasca Basin Communities***

The Athabasca Basin is a region in northern Saskatchewan spanning approximately 100,000 $km^2$. The Athabasca Basin communities were identified as primary impact communities in the Human Resources Development Agreement (HRDA) contained within the McClean Lake Operation surface lease agreement. The HRDA identifies the Athabasca Basin communities as communities from which the residents form the labour pool having the highest priority for recruitment positions available at northern Saskatchewan's mine sites and is not related to potential impacts from project

development. Community engagement initiatives for the Midwest Project have focused, and will continue to focus, on residents of these seven Athabasca Basin communities:

- Hatchet Lake Denesuline First Nation
- Black Lake Denesuline First Nation
- Fond du Lac Denesuline First Nation
- Northern Settlement of Camsell Portage
- Northern Settlement of Wollaston Lake
- Northern Settlement of Uranium City
- Northern Hamlet of Stony Rapids

***Additional Aboriginal Communities and Organizations***

Groups that were later added to the engagement and consultation list in order to be inclusive and/or because they expressed interest in the Midwest Project, were:

- Prince Albert Grand Council (PAGC)
- Métis Nation of Saskatchewan (MN-S), including La Ronge and Buffalo Narrows
- Peter Ballantyne Cree Nation (PBCN)
- Barrenlands First Nation (Manitoba)
- Northlands First Nation (Manitoba)

Additional Aboriginal communities and organizations were notified of the proposed Midwest Project, due to the location of the proposed FHCP. As the proposed FHCP is expected to result in improvements to fish populations in the vicinity of Montreal Lake, it is unlikely that changes will cause adverse impacts to any potential or established Aboriginal or treaty rights. The following groups were notified:

- Montreal Lake Cree Nation
- Métis Local 20-Timber Bay
- Métis Local 16-Weyakwin

***Other Stakeholder and Interest Groups***

Direct communications with a number of groups and committees takes place on a regular basis and include:

- Athabasca Working Group (AWG)
- Northern Saskatchewan Environmental Quality Committee (NSEQC), including the sub-committee Athabasca Environmental Quality Committee (EQC)
- Athabasca Economic Development and Training Corporation (AEDTC)

The EQC, AWG and AEDTC members are representative of northern impact communities. These committees represent the communities' interests in various areas.

Other interest groups who have been kept informed of the Midwest Project include:

- Employees at McClean Lake Operation
- Northern Labour Market Committee
- Mineral Sector Steering Committee
- Northern Apprenticeship Committee
- Athabasca Land Use Planning (ALUP) Interim Committee

## 7.2 AREVA-Led Consultation

As outlined in table 3-1, the Midwest Project was part of a Joint Panel review of uranium developments in northern Saskatchewan in 1991 and 1997 conducted by the federal and provincial governments.

Cogema (now AREVA) conducted extensive stakeholder consultations individually and with Cameco Corporation and Cigar Lake Mining Corporation as part of the Joint Panel reviews with the Athabasca Basin communities and stakeholders in other parts of the province.

The currently proposed Midwest Project has been subject to consultation activities and review since 2005. Public participation activities have been aimed at the Athabasca Basin communities, as they were identified as primary impact communities in the HRDA. Additional efforts have been made to engage with other interested members of the public and stakeholder groups.

A community and stakeholder consultation program was submitted to the CEA Agency and SMOE in July 2006 for review to determine its acceptability early in the EA process. The plan described the public consultation activities undertaken to date and outlined additional activities planned. The public consultation plan was reviewed by regulatory agencies and was approved by the CEA Agency and SMOE.

AREVA has organized a number of community information meetings individually and jointly with Cameco Corporation in Athabasca Basin communities, other northern communities and in the cities of La Ronge and Saskatoon. At these meetings, plans for the upcoming year are discussed, environmental assessment activities are outlined, and members of the public are engaged in discussions to address any questions that may arise. Table D-2 in Appendix D outlines the consultation activities undertaken by AREVA and table D-3 outlines the key issues raised during consultation activities and AREVA's and the Crown's response.

Additional project-specific activities led by AREVA include articles in AREVA's published newsletters: Communiqué and Community Update. Information on the Midwest Project is posted on AREVA's Internet website (www.arevaresources.com), which is updated regularly.

## 7.3 Crown-Led Consultation

The CEA Act requires that the public be provided with three formal participation opportunities: one at the outset of the process, one during the comprehensive study and a

final opportunity to review and comment on the CSR. Under the harmonization agreement, the Midwest Project is also subject to the provincial public participation process.

The provincial public participation process provides a public consultation period. Concurrent to the federally legislated 30-day public comment and Aboriginal engagement on the CSR, the SMOE will release AREVA's EIS and the provincial Technical Review Comments for a 30-day public consultation period. Aboriginal communities and organizations, northern communities and other stakeholders will be notified of both the provincial and federal public review period on the CNSC, CEA Agency and SMOE websites.

A public registry for the EA has been established, including the identification of the Midwest Project on the Canadian Environmental Assessment Registry (CEAR), which can be accessed on the Internet website for the CEA Agency (www.ceaa.gc.ca). The CEAR reference number for the Midwest Project is 06-03-17519. Information on the Midwest Project can also be found on the CNSC website (www.nuclearsafety.ca) and on the SMOE website (www.environment.gov.sk.ca). The Midwest Project is also part of the MPMO and the Midwest Project's status can be tracked on the MPMO website (www.mpmo-bggp.gc.ca).

The documentation developed for this EA includes:

- Project Specific Guidelines and Scoping Document (PSG&SD)
- EA Track Report
- EIS (draft and revised)
- Addendum to the EIS (representing the technical review comments and AREVA's disposition of these comments)
- CSR (draft, revised and final, representing the federal EA document)
- Technical Review Comments (representing the provincial EA document)
- Future CNSC Commission hearing on AREVA's licence application

### 7.3.1 Federal Participant Funding Program

Funding to participate in the EA review of the Midwest Project was made available to the public and Aboriginal communities and organizations through the CEA Agency's Participant Funding Program (PFP) and Aboriginal Funding Envelope (AFE). Funding opportunities were offered in two phases to assist in the review of the PSG&SD (Phase I) or to enable Aboriginal applicants to participate in the EA process, specifically to enable Aboriginal communities and organizations to review AREVA's EIS and the federal CSR and to support Aboriginal consultation activities (Phase II, AFE Funding).

The CEA Agency awarded $20,000 to two applicants under the PFP funding (Peter Ballantyne Cree Nation and the Inter-Church Uranium Committee Educational Co-operative). Both applicants submitted comments on the PSG&SD during the public comment periods (see Appendix I, Appendix A) and submitted oral interventions during the public hearing on the PSG&SD and EA Track Report (see table D-1, Appendix D).

Three additional applicants (Métis Nation of Saskatchewan (MN-S), Prince Albert Grand Council and the Barren Lands First Nation) were awarded a total of $41,000 in funding through the AFE. The MN-S subsequently withdrew their application. The Athabasca Land Use Planning and Management (represented by the PAGC) and the PBCN submitted comments on AREVA's EIS. A summary of key issues, AREVA's and the Crown's response can be found in table D-3, Appendix D. The Athabasca Denesuline of the Athabasca Regional Government (ARG), representing the Black Lake Denesuline First Nation, Fond du Lac Denesuline First Nation, Hatchet Lake Denesuline First Nation, Northern Hamlet of Stony Rapids, Northern Settlement of Wollaston Lake, Northern Settlement of Camsell Portage, Northern Settlement of Uranium City, and members of the PAGC, submitted comments on the draft CSR. A summary of these comments and the Crown's response can be found in table D-1, Appendix D.

### 7.3.2 Public Consultation Process

The RAs and the SMOE solicited pubic comments on the PSG&SD and the EA Track Report. The documents were provided directly to the distribution list of stakeholders and were also made available at First Nations and Northern Hamlet offices in the Athabasca Basin region and at the SMOE office in La Ronge. Notices of the public comment period were advertised on the CNSC, CEA Agency and SMOE websites and through radio broadcasts in the north and newspaper advertisements. Comments received on the PSG&SD and EA Track Report during the public comment period (from December 2006 to January 2007 for the draft PSG&SD and from February 2007 to March 2007 for the revised PSG&SD and EA Track Report) were considered and incorporated into the final PSG&SD report, where appropriate (see Appendix I of Appendix A).

In April 2007, a public hearing on the PSG&SD and EA Track Report was held by the Commission of the CNSC. Six interventions were presented to the Commission, three individuals and three organizations. Key issues raised and responses can be found in table D-2, Appendix D. Following the public hearing and taking into consideration the comments received on the PSG&SD and EA Track Report, the Commission of the CNSC recommended to the federal Minister of the Environment to continue the Midwest Project as a comprehensive study and did not recommend referring the Project to a mediator or review panel. The revised PSG&SD and EA Track Report were approved by the federal Minister of the Environment in October 2007.

The public will be invited to provide comments on the content, conclusions and recommendations of the CSR when the CEA Agency announces the legislated 30-day public comment and Aboriginal engagement period on the CSR. A summary of the comments received will be provided to the Minister of the Environment to inform the EA decision statement.

### 7.3.3 Aboriginal Consultation Process

Groups identified for engagement and consultation were informed of the Midwest Project, the regulatory review and Aboriginal engagement and consultation processes. AREVA, SMOE, the CEA Agency and the RAs and FAs made themselves available to meet with groups throughout the regulatory review process.

As stated, the RAs and the SMOE solicited comments on the PSG&SD and the EA Track Report. PBCN received PFP funding and provided comments on the PSG&SD and submitted an oral intervention at the CNSC Commission hearing. The interests were project-specific as AREVA's original project proposal included the construction of the transportation and utility corridor across land selected for Treaty Land Entitlement (TLE) by the PBCN. This TLE is no longer being offered by the Province of Saskatchewan.

In November 2007, the CEA Agency sent a letter to the identified Aboriginal communities and organizations confirming that each group had received previous project information through the EQC meetings, as each community had a representative on the Committee, and that each community had been sent a copy of the PSG&SD for the Midwest Project. As per the MPMO Project Agreement, identified Aboriginal groups were provided an opportunity to comment on AREVA's draft Environmental Impact Statement. Comments were received from PBCN and the PAGC and a summary of key issues raised and AREVA's and the federal response is provided in table D-3, Appendix D.

In 2009, the CEA Agency as the CCC, and SMOE advised AREVA that consultation with Aboriginal communities and organizations was required on the revised EIS as a procedural aspect of the Crown's Duty to Consult. A number of Aboriginal communities and organizations were identified by the Crown as potentially having interest in the Midwest Project. The CCC and SMOE engaged with these identified Aboriginal communities and organizations through written correspondence and information exchange. Dual purpose meetings were agreed upon for the purpose of providing an update on EIS findings and as part of the Crown Consultation process. The groups were provided Project information, encouraged to participate in the EA process, notified of the PFP opportunities and were also requested by the CCC and SMOE to identify any adverse impacts that the Project may cause to any potential or established Aboriginal or treaty rights.

In 2010, focused meetings with community leaders and open house style meetings were held by AREVA and attended by representatives of the federal and provincial Crown with Aboriginal leadership in the Athabasca Basin to provide information about the status of the Midwest Project, provide information on the EIS findings and the FHCP and present results and conclusions.

In November 2010, at the request of the Chief of the Barren Lands First Nation, the CNSC and CEA Agency met with both the Barren Lands First Nation and Northlands First Nation to discuss ongoing and future projects in northern Saskatchewan, the CNSC's mandate and the Crown's duty to consult.

In October 2011, AREVA conducted open houses in the Athabasca Basin communities (Fond du Lac, Black Lake and Stony Rapids) to provide information related to ongoing and proposed projects at the McClean Lake Operation. The open houses and request for meetings with community and leadership included information sharing and dialogue on the Midwest Project EA and the FHCP being proposed for the Midwest Project.

To facilitate a broad range of participation in these engagement activities, live Dene and Cree translation was provided in many northern communities and information pamphlets summarizing ongoing and upcoming projects, also translated in Dene and Cree, were

provided. The community meetings were widely publicized through newspaper and radio advertisements, letters to the community leaders, posters, and invitations to EQC members.

In December 2011, CD copies of the Draft CSR along with a letter providing an update of the Midwest Project, including an explanation of the comprehensive study process, the proposed fish habitat compensation plan and the section 23 exemption under the NWPA was sent to all Aboriginal groups identified in the distribution list. Aboriginal groups that received PFP funding (PAGC, PBCN and Barren Lands First Nation) were couriered a hard copy of the Draft CSR. Aboriginal engagement on the Draft CSR was identified as a milestone in the MPMO Project Agreement. Comments on the Draft CSR were only received from the ARG. A summary of these comments and the Crown's response can be found in table D-2, Appendix D.

## 7.4 Summary of Comments Received

Comments received from the public and Aboriginal communities and organizations during the review of the EIS and throughout the EA process were considered in the development of the CSR (see Appendix D). Comments generally related to the methodology of the EA process as well as specific environmental concerns. The following key issues were raised:

- impacts on barrenland caribou
- long-term effects of contaminants of concern, with respect to bioaccumulation from aquatic plants and aquatic wildlife
- impacts of pollutants in terms of bioaccumulation through the food chain
- management considerations for rare species
- potential effects on terrestrial biota and waterfowl
- type of flora included in EIS
- adequate consultation
- Aboriginal traditional land use
- use of local knowledge
- impacts on Aboriginal or treaty rights
- socio-economic considerations (future employment and training opportunities)
- assurance of continued safety and consideration for human health
- importance of continued consultation and involvement of Aboriginal peoples throughout life of the project
- human health concerns related to waste rock leaching and human health impacts from gas emissions, vehicle use and air quality

While a number of the key issues raised above could potentially affect potential or established Aboriginal or treaty rights, findings remain that this project is unlikely to cause adverse impacts to these rights. This conclusion is based on information outlined

in the EIS including the follow-up and monitoring program, and through AREVA's consultation program. Throughout the EA process, AREVA and the federal and provincial governments have met with Athabasca Basin communities, Athabasca stakeholder groups and Aboriginal communities and organizations to provide information on the Midwest project, to discuss the potential environmental effects, to encourage participation in the EA review and to request information as to how the Project, as proposed, could cause adverse impacts to potential or established Aboriginal or treaty rights. To date, only two traditional users have been identified for both the Midwest site and McClean Lake Operation and Trapper Compensation Agreements with AREVA are in place. No other specific information has been provided by Aboriginal communities and organizations with respect to how the Midwest Project could potentially impact any potential or established Aboriginal or treaty rights.

Following review of the draft CSR, this CSR was prepared, which incorporates comments received from the public and Aboriginal communities and organizations. This CSR will be transmitted to the federal Minister of the Environment and will be subject to a 30-day public review and Aboriginal engagement led by the CEA Agency. All public, Aboriginal communities and organizations comments received on the CSR will be analyzed and posted on the CEAR for the Minister of the Environment's consideration prior to taking a decision on the EA.

The Crown will continue to monitor the Midwest Project and the effectiveness of the required mitigation measures to ensure that consultation and accommodation obligations remain commensurate with the Crown's assessment of the potential adverse impacts of the Project on potential or established Aboriginal or treaty rights. If new information is presented following the completion of the comprehensive study that would result in changes to the Crown's assessment, additional consultation and accommodation measures may be considered.

## 7.5 Conclusion

The RAs have considered the information provided by the public and Aboriginal communities and organizations in making a determination of significance of effects in relation to areas of federal interest within the scope of the project. It is the opinion of the RAs that the issues raised by the public and Aboriginal communities and organizations have been adequately addressed through the comprehensive study process.

Based on the information received, the RAs are of the opinion that any obligations related to the duty to consult have been met for this project to date. Through the EA process, only two traditional users have been identified for both the Midwest site and McClean Lake Operation and Trapper Compensation Agreements with AREVA are in place. No other specific information has been provided by Aboriginal communities and organizations with respect to how the Midwest Project could potentially impact any potential or established Aboriginal or treaty rights. All federal regulatory agencies are responsible for engaging Aboriginal groups prior to making decisions that may have an adverse impact on a potential or established Aboriginal or treaty right. The RAs and SMOE will continue to engage and encourage the participation of Aboriginal peoples after decisions are made, as appropriate.

Discussions between the RAs and Aboriginal communities and organizations will continue during the review of the CSR. All comments received on the CSR will be analyzed and posted on CEAR for the Minister of the Environment's consideration prior to taking a decision on the EA. Consultation with Aboriginal communities and organizations will continue, as appropriate, to ensure duty to consult obligations are met during subsequent regulatory phases of the Midwest Project which will require authorizations, permitting and licensing.

# 8 DESCRIPTION OF THE ENVIRONMENT

The Midwest Project involves activities which will occur across both the Midwest site and the McClean Lake Operation. As such, both areas were combined and the local assessment boundary was used to provide a description of the existing environment which may be reasonably affected by the proposed Project. The local assessment boundary includes the local surface water drainage systems within the Midwest Project and the McClean Lake Operation. These drainage systems include the Upper Collins Creek and Moffatt Creek watersheds for the McClean Lake study area and the Smith Creek and Nicholson Creek watersheds for the Midwest Project study area (figure 8-1).

The description of the existing environment considers three sources of data:

- Midwest Baseline Data – baseline investigations conducted from 1994 to 2005 to characterize the environmental components within the Midwest Project area
- McClean Lake Operation Baseline Data – baseline investigations conducted between 1979 and 1994 to characterize the environmental components within the McClean Lake Operation area
- McClean Lake Operation Operational Data – operational monitoring at the McClean Lake Operation conducted between 1997 and 2005, including a comprehensive operational monitoring program. The McClean Lake Operation Environmental Monitoring Program (EMP) was implemented in 1996 following the start of mining activities at the McClean Lake Operation

In addition to the existing Midwest Baseline Data, supplemental investigations were conducted between 2003 and 2007 to update environmental baseline information in the vicinity of the Midwest Project. This included completing rare plant surveys, a heritage resource impact assessment, surveys of raptor nesting areas, collecting details on water management at crossings and aquatic surveys and fish habitat assessments along the proposed transportation corridor options.

The existing environment is presented in terms of the atmospheric, geological/hydrogeological, aquatic, terrestrial, human, and socio-economic environment. In describing the existing environment, references are made to types of monitoring locations and spatial assessment boundaries. Monitoring locations could be either:

- *reference areas* – control locations not considered to be influenced by mining and milling activities (e.g. Konner Lake, northeast of the JEB site; Mallen Lake northwest of the JEB site)
- *exposure areas* – locations anticipated to be influenced by mining and milling activities (e.g. Sink Reservoir; Vulture Lake; McClean Lake east basin; Kewen Lake, south of the S/V TEMS)

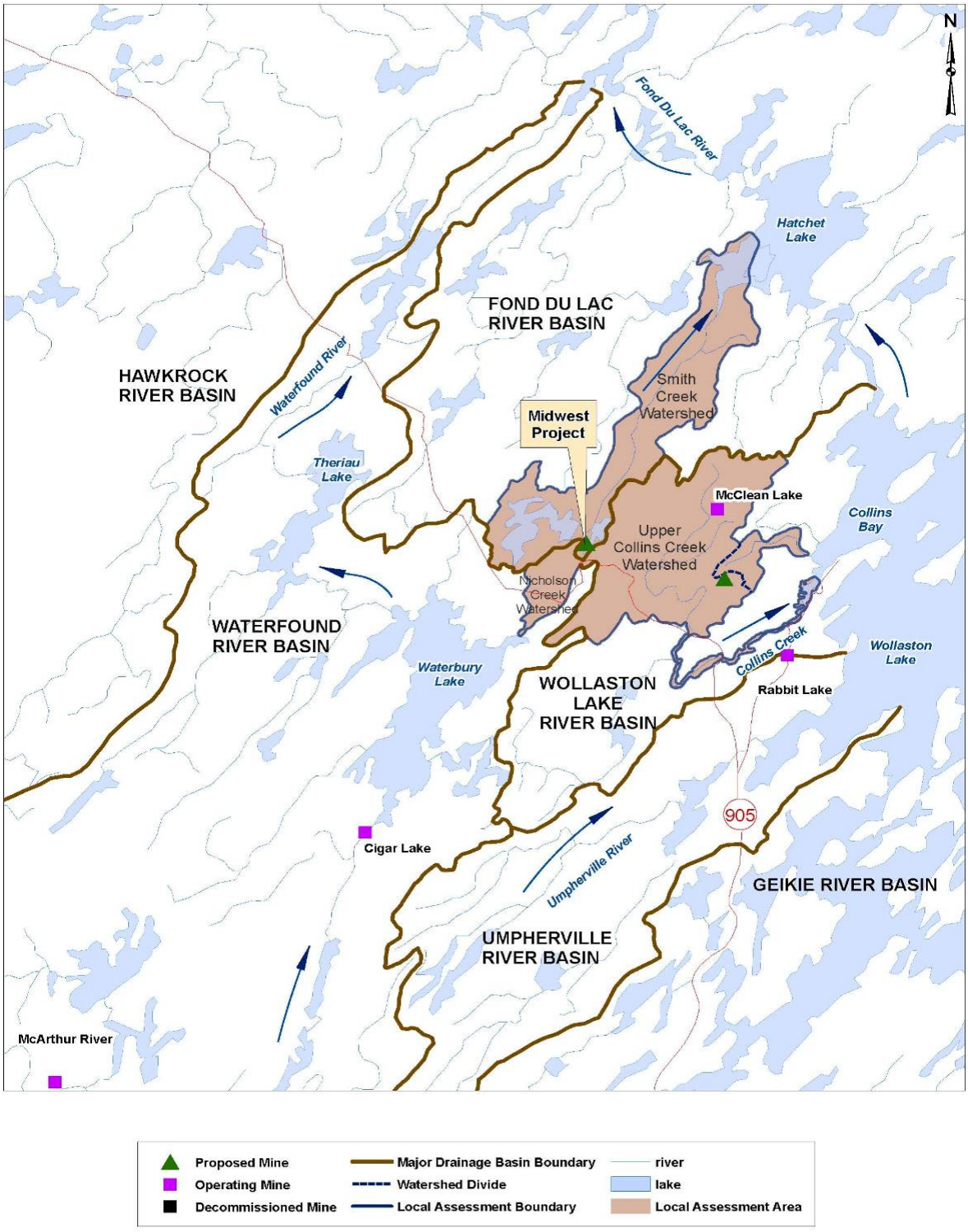



**Figure 8-1** Local Surface Water Drainage Systems – Midwest Project and McClean Lake Operation

## 8.1 Valued Ecosystem Components

Valued Ecosystem Components (VECs) are those aspects of the natural and socio-economic environment that are valued for social, cultural, economic or ecological reasons. VECs are recognized as having additional sensitivity to activity in and around their surrounding habitat and have the potential to be adversely affected by project development. VECs form the basis of environmental baseline and monitoring studies and help to focus the environmental effects assessment.

VECs for the Midwest Project were selected through a review of existing information, baseline data analyses and consultation with Aboriginal communities and organizations, northern residents, community leaders and public servants from the local area. Based on input from Aboriginal groups, the list of VECs was modified to include barren-ground caribou, as the proposed transportation corridor would be located on the fringes of their migration route. The final list of VECs which was used in the assessment of the effects of the Midwest Project is presented in table 8-1.

VECs were broadly categorized under six key components: atmospheric, hydrogeological/geological, aquatic, terrestrial, human, and socio-economic environments. Within each of the key components, a number of sub-components exist that identify the pathway that may lead to a VEC. Assessment endpoints were chosen to represent biotic populations and communities. For example, surface water is considered a sub-component of the aquatic environment that is a pathway for effects to a VEC, such as a particular species of fish.

**Table 8-1** List of VEC for this Project

| Environmental Component | Sub-Component | VEC + Assessment Endpoint |
|---|---|---|
| Atmospheric Environment | ▪ air quality<br>▪ noise quality | ▪ no VEC selected |
| Geological/ Hydrogeological Environment | ▪ long-term transport of COCs to surface water<br>▪ groundwater levels | ▪ no VEC selected |
| Aquatic Environment – Physical | ▪ surface hydrology<br>▪ surface water and sediment quality<br>▪ stream flow/lake level<br>▪ drainage alteration | ▪ Pondweed (Macrophyte)<br>▪ Chironomids (Benthic Invertebrate)<br>▪ Green Algae (Phytoplankton)<br>▪ Daphnids (Zooplankton)<br>▪ Northern Pike and Lake Trout (Predatory Fish)<br>▪ White Sucker and Lake Whitefish (Bottom Feeding Fish)<br>▪ Mallard, Merganser, Scaup (Aquatic Birds) |
| Aquatic Environment – Biological | ▪ aquatic biota<br>▪ aquatic habitat | |
| Terrestrial Environment | ▪ soil<br>▪ vegetation<br>▪ wildlife | ▪ Blueberry, Labrador Tea, Lichen (Terrestrial Plants)<br>▪ Bald Eagle, Ptarmigan (Terrestrial Birds)<br>▪ Caribou, Snowshoe Hare, Moose, Wolf, Black Bear, Lynx (Terrestrial Mammals)<br>▪ Muskrat, Beaver, Mink (Aquatic Mammals) |
| Human Environment | ▪ human health – chemical and radiological<br>▪ physical hazards | ▪ Mine workers<br>▪ Members of the Public |
| Socio-Economic Environment | ▪ land and resource use<br>▪ heritage resources<br>▪ navigation | ▪ no VEC selected |

# 8.2 Atmospheric Environment

## 8.2.1 Climate

Climatological and meteorological parameters, including wind speed and direction, temperature, and precipitation are important to establish climatic conditions and determine dispersion patterns of air emissions that may affect local and regional air quality. The climate and meteorology information collected from 1997 to 2005 from the McClean Lake Operation on-site meteorological station was used for the Midwest Project, due to the close proximity of the two sites.

The predominant winds are from the west-northwest and the northwest, at an average wind speed of 14 km/h. The average annual temperature at the McClean Lake Operation between 1997 and 2005 was -2.3$^{o}$C, with average monthly temperatures below freezing from October through April. Extreme temperatures ranged from -44$^{o}$C to 34.4$^{o}$C. The average annual precipitation measured at the Collins Bay meteorological station from 1997 to 2005 was 526.8 mm.

## 8.2.2 Air Quality

Ambient air quality in the local assessment boundary was determined using baseline monitoring data (Midwest and McClean Lake) and current McClean Lake Operation monitoring results. Data are available for total suspended particulates (TSP), airborne elements (metals and radionuclides), radon, and sulphur dioxide ($SO_2$) concentrations.

***TSP and Airborne Elements***

All TSP measurements at the Midwest and McClean Lake Operation sites were lower than the annual Saskatchewan Ambient Air Quality Standard (AAQS – provincial) and the National Ambient Air Quality Objective (AAQO – federal) of 70 ug/ $m^3$.

Concentrations of metals and radionuclides measured were representative of background values.

***Radon***

Radon monitoring near the Midwest site was carried out in 1979 as well as during the test mine phase (1988 to 1990) and continues currently. Higher results were obtained near the test mine shaft and exhaust and from damaged filters.

During the test mine phase, radon concentrations were measured at the mine exhaust location and locations on-site and off-site. During the test mine phase, radon concentrations, as expected, were high at the mine exhaust location (between 7570 and 26,932 Bq/$m^3$). Radon concentrations at off-site sampling locations were determined to be approximately the same as the on-site sampling locations. The off-site sampling locations averaged 22 Bq/$m^3$ and on-site sampling locations averaged 32 Bq/$m^3$, indicating that the higher radon concentrations from the mine exhaust were being appropriately dissipated to minimize radiation exposure to workers and the public.

***Sulphur Dioxide***

$SO_2$ monitoring at the McClean Lake Operation was initiated upon start-up of the acid production plant in 1999 and since that time, a continuous $SO_2$ analyzer has operated

southeast of the JEB Mill. The lowest annual average concentration was recorded in 2004 (0.3 ppb) and the highest in 1999 (4.4 ppb) and the mean annual concentrations were well below the annual provincial AAQS of 10 ppb.

$SO_2$ monitoring in the vicinity of the Midwest site was comparable to regional data and representative of background values.

## 8.3 Geological and Hydrogeological Environment

### 8.3.1 Geology

The Midwest deposit is approximately 200 m long in the north/south direction and up to 50 m wide and is located at a depth of approximately 200 m below Mink Arm. The thickness of the deposit varies from 2 to 20 m.

The Midwest Project area is located at the edge of the Athabasca Plains Physiographic Region of the Canadian Shield. The geology of the Midwest area consists of 3 units: 5 to 20 m of overburden (glacial till deposits), underlain by approximately 200 m of Athabasca sandstone, underlain by basement rock. Uranium mineralization within the Midwest deposit typically occurs at the unconformity between the metamorphosed basement rock and the overlying sandstones and conglomerates.

### 8.3.2 Hydrogeology

The Midwest Project is located in a gently undulating, formerly glaciated terrain occupied by numerous lakes. Lakes represent between 10% and 30% of the surface area and their presence influences the shallow groundwater flow regime. The Midwest Project is located near the junction of the Smith Creek, Nicholson Creek, and Collins Creek watersheds (figure 8-1). The ore body is located under Mink Arm of South McMahon Lake which drains into North McMahon Lake via Midwest Creek, and from there into Smith Creek.

***Groundwater Flow***

The groundwater regime in the Midwest area consists of two flow systems: the shallow groundwater flow system and the deep groundwater flow system. The shallow groundwater flow system occurs in the overburden and mimics the local topography and surface drainage. The main surface water bodies in the project area include Henday Lake, Collins Creek, and Wollaston Lake. The shallow groundwater flow regime is controlled by recharge from precipitation and interactions with numerous lakes. The deep groundwater flow system is located in the underlying bedrock. Groundwater flow is generally horizontal and in the southeast direction towards Collins Creek.

***Groundwater Quality***

Groundwater quality in the Midwest area is affected by the chemistry of the host rock (surficial materials, sandstone, mineralized rock, and ore zone rock) and the length of time that groundwater is in contact with the host rock. Groundwater samples taken from surficial deposits and sandstone bedrock in the Midwest area had a relatively low major ion concentration and a relatively high iron and manganese concentration (greater than 1 mg/L iron and 0.5 mg/L manganese). Groundwater samples taken from mineralized rock

had higher concentrations of radionuclides and trace elements, including arsenic, lead-210, and polonium-210.

Groundwater at the McClean Lake Operation has higher concentrations of chloride in basement rock, indicating older groundwater than that encountered in the overlying sandstone. In the JEB area, the pre-mining average chloride concentration was 2.6 mg/L in the basement rock and 0.7 mg/L in the sandstone. Heavy metals and other trace elements were found to occur in low concentrations in groundwater; however arsenic, uranium and other radionuclides concentrations were elevated in contrast to background collected prior to the onset of mining activities.

## 8.4 Aquatic Environment - Physical

### 8.4.1 Surface Hydrology

The local assessment boundary is defined based on the local surface water drainage systems within which the Midwest Project and the McClean Lake Operation are situated. The surface water drainage system includes the Smith Creek, Nicholson Creek, Collins Creek, and Moffatt Creek watershed (figure 8-1).

The Smith Creek watershed defines the northern and western portions of the local assessment boundary and includes Smith Creek, Midwest Creek, Boulder Creek, John Pond, Henday Lake, Hamilton Lake, South and North McMahan Lake, Stomach Lake and Smith Bay of Hatchet Lake. John Pond was the final point of treated effluent discharge during the 1988 to 1989 test mine phase.

The Nicholson Creek watershed defines the southern portion of the local assessment boundary and includes Shallow Lake, Pig Lake and W1 Lake.

The Collins Creek and Moffatt Creek watersheds define the eastern portion of the local assessment boundary. Collins Creek watershed includes several large lakes, including McClean Lake, Kewen Lake, and Collins Creek which drains into Wollaston Lake. Collins Creek is the receiving stream for treated effluent from the S/V TEMS.

Moffat Creek watershed includes Moffat Lake, Tut Lake, Esto Lake and Moffat Creek.

### 8.4.2 Streamflow and Lake Levels

***Midwest Baseline Data***

Streamflow monitoring was completed at creeks in the Midwest Project local study area, including Smith, Midwest, John Pond, Boulder, and Nicholson creeks. The mean annual floods for Smith, Midwest, John Pond, Boulder, and Nicholson creeks were 2.05, 0.19, 0.013, 1.58, and 0.72 $m^3/s$, respectively.

Lake level monitoring was completed at several lakes near the Midwest site to establish baseline lake water elevations to monitor potential future changes in surface water elevations. Variations in the lake levels may be related to climate and also beaver activity in the local assessment boundary. Overall, based on monitoring records, surface water elevation changes of approximately 0.4 m were representative of normal variability.

***McClean Lake Operation Baseline and Operational Monitoring Data***

The McClean Lake Operation has the potential to modify local surface hydrology through water use, dewatering activities, and treated effluent release. As part of the McClean Lake Operation EMP, several hydrological monitoring programs have been implemented to address the potential influences of mining activities on the surface hydrology within the vicinity of the McClean Lake Operation.

Streamflow monitoring was completed at creeks in the McClean Lake Operation local study area including Collins, Vulture, Pat, Fox, Torwarlt, and Candy creeks. All monitoring stations were selected based on their significance as tributaries of Collins Creek and location relative to mining and milling activity. Streamflow values measured within the Collins Creek watershed were slightly influenced by inputs to Sink Reservoir from the Sue and JEB WTP and withdrawals from Pat Lake due to mining and milling activities.

As part of McClean Lake Operation's EMP, a lake level monitoring program was implemented to address the potential influences of dewatering activities on water bodies within the vicinity of the McClean Lake Operation. Lake levels are monitored at 19 locations near the McClean Lake Operation and in Collins Creek. Mallen and Indigo Lakes are considered reference lakes, as they are located beyond any possible influences from mining operations and are upstream of treated effluent release. Surface water elevation changes in the reference lakes were approximately 0.62 m for Indigo Lake and 0.53 m for Mallen Lake.

### 8.4.3 Water Quality

Water quality is defined by both the physical (temperature, dissolved oxygen, conductivity, and pH) and chemical (nutrients, major ions, metals, and radionuclides) characteristics of water. Water quality data have been collected since 1978 in the local assessment boundary.

***Midwest Baseline Data***

Most lakes in the vicinity of the Midwest site (Smith Creek and Nicholson Creek watershed) exhibited reduced dissolved oxygen concentrations during periods of ice cover, as is common in shallow boreal zone waterbodies. During the open water season, dissolved oxygen for all lakes met the Canadian Water Quality Guideline (CWQG) and Saskatchewan Surface Water Quality Objective (SSWQO) of 6.5 mg/L. Water quality data in the vicinity of the Midwest site showed low concentrations of nutrients in all waterbodies. Concentrations of most metals in water bodies in the Project area were below applicable CWQG and SSWQO. Radionuclide levels for lakes in the vicinity of the Midwest site were representative of background conditions and were below water quality guidelines.

***McClean Lake Baseline and Operational Monitoring Data***

The McClean Lake Operation water quality monitoring program provides data to identify potential influences of the mining and milling operations on the surface water quality, with treated effluent discharge as the primary influence on the water quality at the McClean Lake site (primary exposure area) and secondary influences from atmospheric

emissions and groundwater contaminant transport from mining and milling operations (secondary exposure areas).

Water quality trends in the McClean Lake Operation indicate that water quality in the primary exposure areas has remained within the range of the 1991 and 1995 EA predictions. Cadmium, copper, lead, vanadium, lead-210, arsenic, selenium, and uranium remained at or below detection limits at all water bodies examined in the primary exposure area. In general, the influence of treated effluent discharge on the primary exposure water bodies has been less than originally predicted. Water quality at the outlets from Sink Reservoir and Vulture Lake indicate no significant changes in ammonia, arsenic, molybdenum, nickel, radium-226, sulphate or TDS, as identified in the most recent Status of the Environment review periods.

Water quality monitoring in the secondary exposure areas indicate that the concentrations of metals and radionuclides are either below detection limits, at or below CWQG and SSWQO or within the range of reference areas. There is no evidence of impacts to surface water quality in the secondary exposure areas resulting from air emissions or groundwater contaminant transport.

### 8.4.4 Sediment Quality

***Midwest Baseline Data***

The majority of lakes in the vicinity of the Midwest site have a particle size composition dominated by silt/clay. Nutrients and ions in sediments showed minor variations between water bodies sampled. Concentrations of metals and trace elements were also in the same range as other water bodies in the area. Naturally elevated arsenic concentrations were measured in water bodies in the vicinity of the Midwest site, indicating high natural background levels.

Of the water bodies sampled during the sediment monitoring program, Mink Arm contained the highest levels of thorium-230, radium-226 and uranium. These results suggest that exploration, dewatering, and/or test mining activities may have had an influence on sediment quality. The sediment data collected during the pre-test mine and during the post-test mine for North and South McMahon Lakes indicate that the influence of test mining did not extend downstream of Mink Arm into these water bodies.

***McClean Lake Operation Baseline and Operational Monitoring Data***

In 1995, a sediment quality monitoring program was established to characterize sediment chemistry within reference areas (Mallen Lake, McClean Lake west basin and Konner Lake) and primary and secondary exposure areas (Sink Reservoir, Vulture Lake, McClean Lake east basin and Kewen Lake).

The majority of lakes in the vicinity of the McClean Lake Operation have a particle size composition dominated by silt/clay, similar to the Midwest site. As observed for lakes in the vicinity of the Midwest site, elevated arsenic concentrations were measured in some McClean Lake Operation reference lakes, suggesting high natural background levels. Radionuclide levels were lower in lakes in the McClean Lake Operation reference area compared to lakes in the vicinity of the Midwest site.

During the McClean Lake Operation operational period, 16 sediment quality parameters have consistently been examined in both the reference and exposure areas. Sediment quality results showed that treated effluent is having an effect on water bodies downstream of McClean Lake Operation. Calcium and sodium concentrations were elevated in Sink Reservoir, Vulture Lake and McClean Lake east basin compared to reference areas. This is consistent with the use of calcium in the effluent treatment process to remove heavy metals. Arsenic concentrations in the sediment were elevated in Sink Reservoir (24.4 µg/g) but remained below the maximum mean predicted concentration of 410 µg/g for Sink Reservoir. Mean molybdenum concentrations in sediment were higher in the primary and secondary exposure areas than in reference areas. Optimization of the JEB WTP process, partly undertaken to address molybdenum, has resulted in a substantial reduction in molybdenum releases (4 mg/L to 0.3 mg/L). It is anticipated that through time, these changes will stabilize and reduce sediment molybdenum concentration downstream of the treated effluent. Mean uranium concentrations in the sediment of Sink Reservoir and Vulture Lake measured 10.22 and 6.2 µg/g, respectively, which were higher than the reference areas but below the Lowest Effect Level (measure below which sediment biota are safe) of 104.4 µg/g. Mean selenium concentrations in sediment from Sink Reservoir and Vulture Lake were higher than reference areas but below the LEL. The elevated concentrations indicate that treated effluent release is influencing sediment metal/metalloid concentrations downstream of treated effluent discharge.

Uranium, molybedenum and selenium are presently the focus of enhanced regulatory and company over-site to ensure that they do not reach environmental levels that have been measured at older uranium mining and milling operations.

## 8.5 Aquatic Environment - Biological

Aquatic baseline studies within the local assessment boundary have focused on water, sediment, plankton, aquatic vegetation, benthic invertebrates, fish and fish habitat. A number of aquatic species were identified as VECs, including pondweed, chironomids, green algae, daphnids, northern pike, lake trout, white sucker and lake whitefish (see table 8-1).

### 8.5.1 Plankton and Zooplankton Community Composition

Plankton refers to the small, microscopic organisms that live suspended in open water. Phytoplankton refers to the open water algal component, while zooplankton refers to the animals that live suspended in the open water. Phytoplankton and zooplankton samples were collected from 14 lakes in the vicinity of the Midwest site and at the McClean Lake Operation. Zooplankton monitoring is not a component of the McClean Lake Operation EMP.

In most lakes sampled in the vicinity of the Midwest site and in the McClean Lake Operation reference lakes, the dominant phytoplankton communities were golden-brown algae, with blue-green algae the next most abundant species. Rotifers the most dominant zooplankton taxa in all water bodies sampled.

In general, the composition of the phytoplankton and zooplankton community in the lakes in the vicinity of the Midwest site and the McClean Lake Operation were typical of other lakes in northern Saskatchewan.

### 8.5.2 Aquatic Macrophyte Community Composition

Aquatic macrophyte communities are an integral component of aquatic environments and contribute to primary productivity by providing habitat for benthic invertebrates and fish. As such, aquatic macrophytes are a potential pathway for the transfer of COC to consumers and VECs. Macrophyte surveys were completed to characterize the aquatic macrophyte community in streams and lakes near the Midwest site. Monitoring aquatic vegetation chemistry is not a component of the McClean Lake Operation EMP.

None of the aquatic macrophytes in the vicinity of the Midwest site are listed as endangered, threatened or of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or under the SARA. Six species found were ranked as rare or rare to uncommon by the Saskatchewan Conservation Data Centre (SKCDC), including water awlwort, water lobelia, few-flowered sedge, ribbon-leaf pondweed, flatleaf pondweed, and Canada waterweed. SKCDC has documented occurrences of two species ranked as rare in the vicinity of the Midwest site. These two species are Berchtold's pondweed and floating bur-reed.

Radiological samples were collected using sedge samples, as sedge was the predominant aquatic macrophyte species in the lakes. The highest radium-226 and uranium levels were measured in Mink Arm in 1988. Samples were taken before the dewatering of Mink Arm, therefore, the high levels were not a result of test mining activities but may reflect the extensive exploration activity that has occurred in the area. Sedge radionuclide levels in the vicinity of the Midwest site were within the range of baseline values measured in sedge samples taken from the McClean Lake Operation reference areas.

### 8.5.3 Benthic Invertebrate Community Composition

Benthic invertebrates are small aquatic animals that live on the bottom of lakes and streams and are an important component of fish habitat and can be an indicator of ecological health. Both lake and stream benthic invertebrate sampling programs were completed in the vicinity of the Midwest site. At the McClean Lake Operation, permanent benthic invertebrate sampling stations have been established as part of the EMP.

***Midwest Baseline Data***

Benthic invertebrate community composition varied by season in lakes in the vicinity of the Midwest site. Lakes in the vicinity of the Midwest site had similar mean benthic invertebrate density (number of organisms/$m^2$), ranging from 949 to 14,901 organisms/$m^2$ and similar mean taxonomic richness (number of taxa), with approximately 7 to 8 taxa in most lakes.

Benthic invertebrate community composition also varied by season in streams in the vicinity of the Midwest site. The average density of stream benthic invertebrates ranged

from 8,318 to 17,788 organisms/$m^2$. The average taxonomic richness was similar between creeks, with approximately 15 taxa.

***McClean Lake Operation Baseline and Operational Monitoring Data***

Lakes and creeks sampled in the McClean Lake Operation reference areas had higher mean benthic invertebrate density and richness than the lakes and creeks in the vicinity of the Midwest site. Benthic invertebrate community composition for the McClean Lake Operation baseline data varied by season, similar to the Midwest baseline data. The benthic invertebrate density ranged from 538 to 7,512 organisms/$m^2$ and taxonomic richness ranged from 2.8 to 9.5 taxa.

Benthic invertebrate community monitoring at Collins Creek indicates slight increases in total abundance and slight differences in community composition in exposure sites compared to reference sites. Water quality characteristics reviewed indicate the potential for a slight stimulatory effect related to differences in temperature and nutrient content between reference and exposures sites. A specialized Investigation of Cause program has been established to investigate the potential for mine effluent influences on temperature and nutrients as part of the McClean Lake Environmental Effects Monitoring (EEM) Program under the oversight of the MMER EEM TAP (Technical Advisory Panel, consisting of CNSC, EC and SMOE).

### 8.5.4 Fish Community Composition

Fish are a potential pathway for the transfer of COCs to consumers and VECs. Fish community composition and population characteristics were completed in lakes in the vicinity of the Midwest site. In 2006, a stream crossing assessment was completed along the two potential transportation corridor options between the Midwest site and the McClean Lake Operation. In 2009, additional information for the proposed FHCP was completed, including an investigation of fish movement through the Mink Arm dam equalization culvert and a survey of the fish population in Mink Arm. At the McClean Lake Operation, initial fish community baseline surveys were completed between 1970 and 1990 to assess the potential influence of treated effluent discharge on downstream fish communities. Small-bodied fish surveys have been completed every three years at the McClean Lake Operation since 1999.

A total of 18 species of fish are known to occur in lakes within the local assessment boundary (table 8-2). None of the species are listed as endangered, threatened or of special concern by COSEWIC or under SARA. Deepwater sculpin, found in Hatchet Lake (Midwest Project area), is a provincially tracked species and is ranked as rare by the SKCDC. Lakes in the vicinity of the Midwest site and the McClean Lake Operation show similar fish species composition. Northern pike and white sucker are the most widespread species and lake whitefish is found in the majority of lakes sampled.

Fish tissue chemistry has also been analyzed to characterize baseline conditions, as the accumulation of metals and radionuclides in fish is an important component of potential food chain transfer to wildlife and humans.

**Table 8-2** List of Fish Species Surveyed in the Local Assessment Boundary

| Family | Common Name |
|---|---|
| Salmonidae | Lake Trout<br>Cisco<br>Lake Whitefish<br>Round Whitefish<br>Arctic Grayling |
| Esocidae | Northern Pike |
| Cyprinidae<br>Gasterosteidae | Lake Chub<br>Emerald Shiner<br>Spottail Shiner |
| Catostomidae | White Sucker<br>Longnose Sucker |
| Gadidae | Burbot |
| Gasterosteidae | Ninespine Stickleback |
| Percidae | Walleye<br>Yellow Perch |
| Percopsidae | Trout-perch |
| Cottidae | Slimy Sculpin<br>Deepwater Sculpin |

***Midwest Baseline Data***

Northern pike was the most widespread species, in general, and the most widespread large-bodied fish species in lakes in the vicinity of the Midwest site. Lake whitefish and white sucker were also found in the majority of lakes sampled. Ninespine stickleback and lake chub were the most widespread small-bodied fish species captured in the vicinity of the Midwest site.

Fish surveys were conducted in 1979 and 1988 when Mink Arm was part of South McMahon Lake. A total of five fish species were captured in South McMahon Lake between 1979 and 1988, including burbot, lake whitefish, longnose sucker, northern pike, and white sucker. The same species identified in South McMahon Lake were also identified in Mink Arm in 1979 and 1988, with lake whitefish being the most abundant species captured during both survey periods.

Mink Arm became isolated from the remainder of South McMahon Lake in 1988 by the earth dam constructed to allow Mink Arm to be drained. South McMahon Lake was sampled in 2003 and six species were captured, with ninespine stickleback the most abundant species captured. Mink Arm was also sampled in 2003 and seven species were captured, with longnose sucker the most abundant species captured. Mink Arm was surveyed again in 2009 and five species were captured, with northern pike the most abundant species captured.

Fish community surveys were completed in Smith Creek (1979 and 2003) and Boulder Creek (2003). Burbot was the most abundant species captured in Smith Creek and lake chub was the most abundant species captured in Boulder Creek.

Six species of fish (northern pike, lake trout, white sucker, lake whitefish, longnose sucker, and Arctic grayling) were collected for chemical analyses in the vicinity of the Midwest site between 1978 and 2000. Fish tissue arsenic and radionuclide concentrations were below detection limits and were within the northern Saskatchewan regional range of baseline values. Copper, nickel, lead, and zinc concentrations were also within the range of baseline values reported regionally.

***McClean Lake Operation Baseline and Operational Monitoring Data***

Near the McClean Lake Operation, a total of 16 species of fish are known to occur. Lakes that support the greatest variety of fish include Mallen Lake, McClean Lake, Torwalt Lake, and Moffatt Lake. Northern pike is the most widespread species, collected in all lakes sampled. Sue and Sils Lakes were found to be devoid of fish. In general, species composition of lakes in the vicinity of the Midwest site and the McClean Lake Operation were similar, with northern pike and white sucker as the most widespread species.

As part of the McClean Lake EEM Program, small-bodied fish population surveys were conducted in 2002 and 2005. Results from the 2002 lethal survey indicated that small-bodied fish species (slimy sculpin) captured downstream of the effluent discharge point were not significantly different from fish captured in reference lakes based on survival, energy use and energy storage endpoints (age, length, weight, gonad weight, liver weight and fecundity). Results from the 2005 non-lethal slimy sculpin survey indicated that there were differences in length and weight in fish captured downstream of the effluent discharge point relative to fish from reference locations along Collins Creek. The EEM Program for small bodied fish monitoring (2005 to 2008) confirmed differences in measured metrics between the reference and exposure populations. In general, fish (slimy sculpin and burbot) in the exposure population were found to be more abundant and in better condition (i.e., longer and heavier) than those of the reference population. This corresponds to the increased benthic invertebrate abundance mentioned in section 8.5.3.

Fish tissue was analyzed in 2002 and 2005 for the McClean Lake Operation. Waterbodies sampled included Mallen and Henday Lakes (reference), Vulture and Kewen Lakes (primary exposure) and Fox Lake (secondary exposure). During the 2002 operational monitoring period, fish tissue samples from reference and exposure areas contained similar levels of metals and radionuclides. During the 2005 operational monitoring period, higher levels of contaminants were measured in fish tissue collected

in northern pike and white sucker in the primary exposure area (Vulture Lake). The effects to tissue collected in Kewen and Fox Lakes were negligible. Selenium concentrations were elevated in some tissue from Vulture Lake compared to reference areas and the 2002 monitoring results. The results indicate that fish tissue from Vulture Lake is incorporating some effluent constituents, as was predicted in the 1991 and 1995 EIS.

### 8.5.5 Fish Habitat and Spawning Characteristics

The federal *Fisheries Act* defines fish habitat as "spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes".

Fish habitat assessments were completed in lakes in the vicinity of the Midwest site in 1990, 1994 and 2003. Spring and fall fish spawning surveys were also completed to verify locations of habitat utilized for fish spawning. The fish habitat assessments and fish spawning surveys focused on fish species of commercial, subsistence, and recreational importance and considered fish species communities in each waterbody. These species included northern pike, walleye, lake trout, lake whitefish, Arctic grayling, white sucker, and longnose sucker. In 2006, additional habitat assessments were completed at 11 stream crossings along the two proposed transportation corridor options. Supplemental information on fish habitat and habitat utilization in Mink Arm, Too Small Lake, John Pond, South McMahon Lake, and North McMahon Lake was also collected in 2006 and 2007. The objective of these surveys was to validate the habitat assessment previously conducted and assist in forming habitat compensation plans for areas that may be directly impacted by mining activities.

Lakes in the vicinity of the Midwest site can be classified as either large, deep lakes or small, shallow lakes. Henday Lake, Smith Bay and Nicholson Bay are considered large, deep lakes and the remaining lakes are considered small, shallow lakes. The size and depth of lakes influence both the limnology and fish community composition within them (table 8-3).

**Table 8-3** Fish Community and Spawning Habitat at Lakes in the Vicinity of the Midwest Site

| Waterbody | Fish Community | Suitable Spawning Habitat |
|---|---|---|
| Henday Lake | lake whitefish, lake trout, northern pike, white sucker, longnose sucker | lake whitefish, lake trout, northern pike |
| Smith Bay | lake whitefish, lake trout, northern pike, white sucker, longnose sucker, Arctic grayling | lake whitefish, lake trout, northern pike |
| North McMahon Lake | northern pike, lake whitefish, white sucker | northern pike |
| South McMahon Lake | northern pike, white sucker, lake whitefish, longnose | northern pike |

| Waterbody | Fish Community | Suitable Spawning Habitat |
|---|---|---|
| | sucker, burbot | |
| Mink Arm (South McMahon Lake) | northern pike, white sucker, longnose sucker, burbot | northern pike, white sucker, longnose sucker |
| Shallow Lake | northern pike, lake whitefish, white sucker | northern pike, lake whitefish |
| Lake C1 | northern pike, yellow perch | northern pike |
| Lake W1 | northern pike, burbot | northern pike |
| Pig Lake | northern pike | northern pike |
| John Pond | longnose sucker, northern pike | northern pike |
| Deborah Lake | burbot, northern pike, white sucker | none identified |
| Stomach Lake | northern pike, lake whitefish | northern pike, lake whitefish |
| Unnamed Lake | northern pike, lake whitefish | northern pike, lake whitefish |
| Too Small Lake | longnose sucker, ninespine stickleback | northern pike |
| Smith Creek | Arctic grayling, burbot | northern pike, Arctic grayling |
| Boulder Creek | longnose sucker, burbot | northern pike |

Along the proposed north transportation corridor option, there are a total of five watercourse crossings. Only one of the watercourses crossed by the proposed north route provides moderate habitat for large- and small-bodied fish species.

Along the proposed south transportation corridor option, there are a total of six watercourse crossings. Two of the watercourses crossed by the proposed south route provides moderate habitat for large-and small-bodied fish species.

Habitat at the remaining watercourse crossings were classified as having nil or low potential for fish spawning, rearing and foraging. A habitat mapping and classification system was used to determine habitat suitability. The system accounts for a number of habitat variables (i.e. channel width, instream cover, discharge, substrate, depth) within the context of fish life history requirements.

## 8.6 Terrestrial Environment

Terrestrial baseline studies within the local assessment boundary have focussed on characterizing the soil, vegetation, wildlife, and wildlife habitat. Three vegetative species were identified as VECs, including blueberry, Labrador tea, and lichen. A number of wildlife were also identified as VECs, including bald eagle, ptarmigan, mallard, merganser, scaup, caribou, snowshoe hare, moose, wolf, black bear, lynx, muskrat, beaver, and mink (see table 8-1).

The terrestrial environment in the local assessment boundary was initially characterized between 1972 and 1994. More recent data on vegetation community composition, rare plants, wildlife and wildlife habitat were collected in 2003 and 2004. In addition, the McClean Lake Operation has a well-established EMP to monitor potential changes to terrestrial components, including the wetland community, terrestrial vegetation, and soil chemistry.

The local assessment boundary was stratified into ecosite phases based on field investigations conducted from 1978 to 1994 and updated in 2003 and 2004 based on satellite imagery and site-specific information. Terrestrial ecosite phase classification represents the integration of major components of the ecosystems (e.g., air, water, land, biota, and humans) and provides the basis to determine the potential of these habitats to support rare plant species and habitat utilization by wildlife species. A total of 21 ecosite phases were identified in the local assessment boundary (table 8-4).

**Table 8-4** Ecosite Phase Breakdown for the Vegetation Community Classification within the Local Assessment Boundary

| Ecosite Phase | Area (ha) | Percent |
|---|---|---|
| Open Jack Pine Forest | 1,388 | 3.0 |
| Open Black Spruce Forest | 2,476 | 5.3 |
| Recent Burn - Tree Dominated | 9,614 | 20.6 |
| Recent Burn - Shrub Dominated | 7,352 | 15.7 |
| Recent Burn - Lichen / Low Shrub Dominated | 486 | 1.0 |
| Closed Canopy Jack Pine Forest | 5,428 | 11.6 |
| Disturbed Lands - Vegetated | 91 | 0.2 |
| Disturbed Lands - Non-Vegetated | 392 | 0.8 |
| Jack Pine (Black Spruce) with White Birch Forest | 8 | 0.02 |
| Closed Canopy Black Spruce Forest | 3,993 | 8.5 |
| Treed Bog | 1,614 | 3.5 |
| Shrubby Bog | 1,127 | 2.4 |
| Treed Poor Fen | 68 | 0.1 |
| Shrubby Poor Fen | 1,665 | 3.6 |
| Shrubby Rich Fen | 512 | 1.1 |
| Graminoid Rich Fen | 608 | 1.3 |
| Shallow Marsh/Emergent | 327 | 0.7 |

| Ecosite Phase | Area (ha) | Percent |
|---|---|---|
| Treed Riparian | 160 | 0.3 |
| Shrub Riparian | 746 | 1.6 |
| Sedge Riparian | 111 | 0.2 |
| Barren Rock | 71 | 0.2 |
| Lake | 8,470 | 18.1 |
| Total | 46,708 | 100.0 |

Note: Approximately 70% of the local assessment boundary was classified.

### 8.6.1 Species at Risk

A list of rare plant and wildlife species with the potential to occur within the local assessment boundary is provided in tables 8-5 and 8-6. This list was compiled using three sources:

- federal status documents
- provincial species lists for those species requiring special management considerations
- provincial tracking lists for vascular plants and vertebrates

Federal status documents include the SARA [9] and the COSEWIC [10]. Under SARA, over 400 species have been identified by COSEWIC as being at risk in Canada and require special management considerations. Provincially, 15 plants and animals are regulated under the *Wildlife Act*, with an additional 52 species listed on an Interim List for Species at Risk Requiring Special Management Consideration. Species that are ranked either S1 (extremely rare), S2 (rare) or S1S2 (extremely rare to rare) under the *Wildlife Act* or the provincial interim list require special management considerations. Under both SARA and the *Wildlife Act*, plants and animals are protected from being disturbed, collected, harvested, captured, killed, and exported. Special management considerations include appropriate surveys and setbacks on lands where species have been recorded. Provincial tracking lists are provided by the SKCDC. The provincial tracking lists distribute standardized information on the ecological status of species; however they do not require special management consideration.

**Table 8.5** Confirmed Rare Plants in the Local Assessment Boundary

| Scientific Name | Common Name | SKCDC Rank(a) | Preferred Habitat (Harms et al. 1992)(b) | Total in Local Assessment Boundary |
|---|---|---|---|---|
| *Athyrium filix-femina ssp. Angustum* | Northern Lady-fern | S3 | moist sphagnum lake shores | 2 |
| *Carex michauxiana* | Michaux sedge | S1 | wet sedge fens, open and treed bogs | 6 |
| *Carex pauciflora* | Few-flowered sedge | S2 | wet sedge meadows, fens, open and treed bogs | 22 |
| *Carex trisperma* | Three-fruited sedge | S2 | wet black spruce woods, alder thickets, muskegs, open and treed bogs | 38 |
| *Drosera anglica* | Oblong-leaved sundew | S3 | bogs, fens, wet "boggy" shores, seepage areas, usually calcareous | 20 |
| *Huperzia selago var densa* | Mountain or northern club-moss or fir-moss | S1 | moist woods and lakeshore fens | 2 |
| *Juncus stygius ssp americanus* | Moor or American bog rush | S1S2 | bog lake shores and calcareous bog-fens | 14 |
| *Ledum palustre ssp decumbens* | Narrow-leaved Labrador tea | S2S3 | wet black spruce woods and treed bogs | 4 |
| *Lobelia dortmanna* | Water lobelia | S2S3 | aquatic in shallow quiet water | 6 |
| *Loiseleuria procumbens* | Alpine azalea | S1 | dry rock tundra-meadows and open-wooded esker-ridge slopes | 1 |
| *Lycopodium inundatum* | Northern bog clubmoss | S1 | wet bogs, fens and organic lake shores | 2 |
| *Lycopodium sitchense* | Alaskan clubmoss | S2 | drier, sandy, coniferous, mostly pine woods | 21 |
| *Malaxis paludosa* | Bog adder's-mouth orchid | S1 | wet springy black spruce woods and sphagnaceous bogs | 5 |
| *Moehringia macrophylla* | Large-leaved sandwort | S2 | on thin soil n granitic outcrops in semi-open areas | 1 |
| *Pedicularis labradorica* | Labrador lousewort | S2 | open black spruce woods, drier treed bogs, regenerating burns, and lichen-tundra | 2 |
| *Pedicularis macrodonta* | Purple or swamp lousewort | S2 | wet marshy fens and bogs | 1 |
| *Phegopteris connectilis* | Long or narrow beech-fern | S2 | moist wooded streamsides | 5 |
| *Pinguicula villosa* | Hairy butterwort | S2S3 | sphagnum hummocks in treed bogs or muskegs | 2 |

| Scientific Name | Common Name | SKCDC Rank(a) | Preferred Habitat (Harms et al. 1992)(b) | Total in Local Assessment Boundary |
|---|---|---|---|---|
| *Potamogeton epihydrus* | Ribbon-leaf pondweed | S2S3 | emersed aquatics in shallow quiet water of lakes, ponds, slow streams, and wet marshy fens | 11 |
| *Potamogeton pusillus var. tenuissimus* | Berchtold's Pondweed | S2 | submersed aquatics in shallow quiet water of lakes, ponds, slow streams and sloughs | 4 |
| *Scheuchzeria palustris ssp americana* | American scheuchzeria | S3 | wet fens, open and treed bogs | 51 |
| *Sorbus scopulina* | Western mountain-ash | S2 | upper beach borders of shorewoods and wooded bank slopes | 1 |
| *Sparganium fluctuans* | Floating bur-reed | S2 | shallow water aquatics near boggy shores of quiet lakes and streams | 6 |
| *Subularia aquatica var. americana* | Water awlwort | S3 | shallow lake-bottom submerged aquatics | 7 |
| *Taraxacum officinale ssp. Ceratophorum* | Horned Dandelion | S2 | open woods, rocky slopes, thickets, drying meadows and muskegs | 1 |
| *Viola macloskeyi ssp pallens* | Northern or sweet white violet | S1 | wet, marshy fens and bogs | 1 |

S1 extremely rare (5 or fewer occurrences in Saskatchewan, or very few remaining individuals; critically imperiled; may be susceptible to extirpation because of some factor of its biology
S2 rare (6 to 20 occurrences in Saskatchewan or few remaining individuals; imperiled; may be susceptible to extirpation because of some factor of its biology)
S1S2 extremely rare to rare
S3 uncommon ( 21 to 100 occurrences in Saskatchewan; may be rare and local throughout the province or may occur in a restricted provincial range; may be abundant in places; vulnerable; may be susceptible to extirpation by large scale disturbances)
S2S3 rare to uncommon
S4 common (more than 100 occurrences; generally widespread and abundant but may be rare in parts of its range; apparently secure but may be of long-term concern)
S5 very common (more than 100 occurrences; widespread and abundant, but may be rare in parts of its range; demonstrably secure)
Note None are listed provincially or by COSEWIC
**Source** (a) Saskatchewan Conservation Data Centre (2005) – Tracking List [11] (b) Hames *et al.* (1992) [12]

**Table 8.6** Provincially Tracked, Federal Listed and Provincial Listed Species at Risk Known or with Potential to Occur in the Regional Assessment Boundary

| Common Name | Scientific Name | Tracked Provincial Species(a) (SCDC) | Listed Provincial Species(b) (Wildlife Act)(c) | COSEWIC(d) Listed Species (SARA)(d) | Observed or Sign Detected in the Local Assessment Boundary |
|---|---|---|---|---|---|
| BIRDS | | | | | |
| Canada Warbler | Wilsonia canadensis | S5B, S4M, S4N | | Threatened | |
| Common Nighthawk | Chordeiles minor | S4S5B, S4S5M | | Threatened | X |
| Cooper's Hawk | Accipiter cooperii | S4B, S2M, S2N | | Not at Risk | |
| Boreal Owl | Aegolius funereus | S3B, S3N | | Not at Risk | |
| Great Blue Heron | Ardea herodias | S3B | | | |
| Golden Eagle | Aquila chrysaetos | S3B, S4M, S3N | | Not at Risk | |
| Olive-sided Flycatcher | Contopus cooperi | S4 | | Threatened | X |
| Short-eared Owl | Asio flammeus | S3B, S2N | Vulnerable or Special Concern | Special Concern | |
| Turkey Vulture | Cathartes aura | S3B, S2M, S2N | | | |
| Piping Plover | Charadrius melodus circumcinctus | S3B | Threatened and Endangered | Endangered | |
| Semipalmated Plover | Charadrius sempalmatus | S1B, S5M | | | |
| Yellow Rail | Coturnicops noveboracensis | S3B, S2M | Vulnerable or Special Concern | Special Concern | |
| Trumpeter Swan | Cygnus buccinator | S1B | | Not at Risk | |
| Tundra Swan | Cygus columbianus | S5M | | | |
| Black-throated Blue Warbler | Dendroica carulescens | S2B | | | |
| Pileated Woodpecker | Dryocopus pileatus | S4B, S3N | | | |
| Rusty Blackbird | Euphagus carolinus | S4B | | Special Concern | X |
| Peregrine Falcon | Falco peregrinus | S1B | Threatened and Endangered | Threatened | |
| Red-throated Loon | Gavia stellata | S1B | | | |
| Whooping Crane | Grus americana | SXB, S1M | Threatened and Endangered | Endangered | |

| Common Name | Scientific Name | Tracked Provincial Species(a) (SCDC) | Listed Provincial Species(b) (Wildlife Act)(c) | COSEWIC(d) Listed Species (SARA)(d) | Observed or Sign Detected in the Local Assessment Boundary |
|---|---|---|---|---|---|
| Bald Eagle | Haliaeetus leucocephalus | S5B, S4M, S4N | | | X |
| Northern Shrike | Lanius excubitor | S1B, S4N | | | |
| Glaucous Gull | Larus hyperboreus | S2N, S2M | | | |
| Short-billed Dowitcher | Limnodromus griseus | S1B, S4M | | | |
| Connenticut Warbler | Oporornis philadelphia | S2B | | | |
| American White Pelican | Pelecanus erythrorhynchos | S3B | | Not at Risk | |
| Red-necked Phalarope | Phalaropus lobatus | S4B, S3M | | | |
| Pine Grosbeak | Pinicola enucleator | S2B, S4N | | | X |
| Caspian Tern | Sterna caspia | S2B, S2M | Vulnerable or Special Concern | Not at Risk | |
| Forster's Tern | Sterna forsteri | S4B | | Data Deficient | |
| Barred Owl | Strix varia | S3B, S3N | | | |
| Northern Hawk Owl | Surnia ulula | S3B, S5N | | Not at Risk | |
| MAMMALS | | | | | |
| Wolverine | Gulo gulo | S3S4 | Vulnerable or Special Concern | Special Concern | |
| Cougar | Puma concolor | S2S3 | | | |
| Barren-ground Caribou | Rangifer tarandus | S3 | | | X |
| Woodland Caribou | Rangifer tarandus caribou | S3 | Threatened and Endangered | Threatened | |
| AMPHIBIANS | | | | | |
| Northern Leopard Frog | Rana pipiens | S3 | Vulnerable or Special Concern | Special Concern | |

**Species shaded in yellow are those species with distribution ranges that overlap the local assessment boundary; all others have ranges that overlap the regional assessment boundary**

| | |
|---|---|
| S1 | extremely rare (5 or fewer occurrences in Saskatchewan, or very few remaining individuals; critically imperiled; may be susceptible to extirpation because of some factor of its biology) |
| S2 | rare (6 to 20 occurrences in Saskatchewan or few remaining individuals; imperiled; may be susceptible to extirpation because of some factor of its biology) |
| S3 | rare to uncommon ( 21 to 100 occurrences in Saskatchewan; may be rare and local throughout the province or may occur in a restricted provincial range; may be abundant in places; vulnerable; may be susceptible to extirpation by large scale disturbances) |
| S4 | common (more than 100 occurrences; generally widespread and abundant but may be rare in parts of its range; apparently secure but may be of long-term concern) |
| S5 | very common (more than 100 occurrences; widespread and abundant, but may be rare in parts of its range; demonstrably secure) |
| B | for a migratory species, rank applies to the breeding population in the province |
| N | for a migratory species, rank applies to the non-breeding population in the province |
| M | for a migratory species, rank applies to the transient population |

**Source:**

| | |
|---|---|
| (a) | Saskatchewan Conservation Data Centre Tracked Species List for Vertebrates (SCDC 2010) [13] |
| (b) | Saskatchewan Environment Interim List for Species at Risk Requiring Special Management Consideration (2010) [14] |
| (c) | *The Wildlife Act* (1998) [15] |
| (d) | Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2007) (d) where *The Species at Risk Act* (1992) |
| Endangered | a species facing imminent extirpation or extinction |
| Threatened | a species likely to become endangered if limiting factors are not reversed |
| Special Concern | a species that is particularly sensitive to human activities or natural events but is not an endangered or threatened species |
| Not at Risk | a species that has been evaluated and found to be not at risk |
| Data Deficient | the available information is insufficient to resolve a species eligibility fo assessment, or to permit an assessment of the species risk of extinction |

### *Rare Plant Species*

In 2003, a rare plant survey was completed along the proposed corridor alignments and within the proposed Midwest mine site. No COSEWIC listed plant species or provincially listed plant species have ranges overlapping the local assessment boundary and no plant species were identified during the rare plant surveys.

A total of 26 provincially tracked rare plant species were identified within the local assessment boundary (table 8-5). Six species are ranked S1, including Michaux sedge, northern club-moss, alpine azalea, northern bog club-moss, bog adder's-mouth orchid, and northern white violet. One species, American bog rush, is ranked S1S2 and the remaining 19 species are ranked either S2, S2S3 (rare to uncommon), or S3 (uncommon). Of the 26 provincially tracked rare plant species, five aquatic species were identified, including water lobelia, ribbon-leaf pondweed, Berchtold's pondweed, floating bur-reed, and water awlwort. Bogs, fens, wetlands, and riparian areas generally support these rare plant species in the local assessment boundary, with few occurring in open woods. In addition, many of the provincially tracked rare plant species were found to be abundant within the local assessment boundary. As outlined previously, there are no management considerations for these provincially tracked species.

### *Wildlife Species at Risk*

A total of 12 species at risk listed by COSEWIC have the potential to occur within the regional assessment boundary, including Canada warbler, common nighthawk, olive-sided flycatcher, short-eared owl, piping plover, yellow rail, rusty blackbird, peregrine falcon, whopping crane, wolverine, woodland caribou, and the northern leopard frog (table 8-6). Provincially listed species with the potential to occur in the regional assessment boundary include all of the mentioned COSEWIC listed species, with the exception of the rusty blackbird and the addition of the Caspian tern. Of the listed federal and provincial species occurring in the regional assessment boundary, nine have the potential to be found in the local assessment boundary (common nighthawk, olive-sided flycatcher, short-eared owl, yellow rail, rusty blackbird, peregrine falcon, wolverine, woodland caribou, and the northern leopard frog) (table 8-6). Nine provincially-tracked species have the potential to occur within the local assessment boundary, including the boreal owl, golden eagle, pileated woodpecker, bald eagle, short-billed Dowitcher, pine grosbeak, northern hawk owl, and barren-ground caribou (table 8-6).

## 8.6.2 Vegetation and Soils

The local assessment boundary is an estimated 66,800 ha and the ecosite phase classification (satellite imagery) covers approximately 70% of the local assessment boundary (46,700 ha). A total of 21 ecosite phases were identified in the local assessment boundary, with treed habitat types comprising 9 of the 21 mapped ecosite phases. Lakes and deep ponds occupy 18.1% of the local assessment boundary and disturbed areas physically altered by human activity occupy approximately 1%.

The accumulation of metals and radionuclides by plants is important because of the potential food chain transfer to wildlife and humans. As such, vegetation and soil chemistry have been characterized near the Midwest site and are part of the McClean Lake Operation EMP to determine baseline conditions and evaluate effects from

operational activities. Three vegetative species, identified as VECs, were selected for chemical analysis and include lichen, blueberry, and Labrador tea.

***Midwest Baseline Data***

Soil, lichen and plant samples were chemically analyzed in the 1970's, 1980's and mid-1990 as part of the Midwest site sampling program. Eight permanent sample plots were established in 1993/1994 within the vicinity of the Midwest site. Baseline conditions were compared to regional data from other mine developments, McClean Lake reference area, and CCME soil quality guidelines. There are no applicable CCME guidelines for vegetation chemistry.

Concentrations of radionuclides and trace metals for baseline soil and vegetation chemistry in the vicinity of the Midwest site were within the range of concentrations for the regional assessment boundary and below the CCME soil quality guidelines.

Concentrations of radionuclides and trace metals in Labrador tea and blueberry were comparable between the McClean Lake reference area and the Midwest site. Lichen in the Midwest site had higher baseline concentrations of copper, lead, nickel, uranium, and zinc than at the McClean Lake reference area.

***McClean Lake Operation Baseline and Operational Monitoring Data***

The McClean Lake Operation EMP includes permanent sample plots for soil and vegetation chemistry to evaluate potential effects from mining activities. Vegetation and soil were collected from exposure areas (McClean Lake, JEB and Sue site) and the reference area (Mallen Lake). Permanent sample plots were established and sampled in 1993/1994 prior to the development of the McClean Lake Operation in both reference and exposure areas and subsequent monitoring studies were completed in 1998, 2002, and 2005.

During the McClean Lake Operation operational period, soil concentrations of trace metals have remained below CCME soil quality guidelines in both exposure and reference areas. Labrador tea, blueberry, lichen and soil chemistry monitoring data indicate that the majority of metals at the JEB and McClean Lake exposure areas were similar to the values measured at the reference area and background concentrations measured during baseline investigations. These results suggest that mining and milling operations are having a negligible effect on metal concentrations in vegetation and soil in the McClean Lake and JEB exposure areas. In contrast, increased concentrations of radionuclides (uranium, radium-226, and thorium-230) were collected in lichen from the JEB and McClean Lake exposure areas suggesting that dust deposition from mining activities may be having an impact.

The highest concentrations of contaminants in soil, Labrador tea, blueberry, and lichen were measured at permanent sample plots nearest to the Sue pit and the transportation corridor, indicating that Sue mining activities are influencing the chemical profiles of vegetation of soil in the area. As well, increased concentrations of arsenic, lead, uranium, radium-226 and thorium-230 were detected in both soil and vegetation samples, and in Labrador tea, blueberry, and lichen chemistry data collected from the Sue exposure area compared to the reference area. These results suggest that Sue mining activities are influencing the chemical profiles of vegetation through the deposition of dust.

### 8.6.3 Wildlife

Wildlife and wildlife habitat baseline studies were completed within a 500 $km^2$ area within and surrounding the local assessment boundary. Wildlife surveys were completed in 2003/2004 and the information was integrated with the ecosite phase classification to obtain estimates and indices of the abundance of wildlife species within and adjacent to the local assessment boundary. Surveys were completed for furbearers, ungulates, breeding birds, beaver lodges, raptor nests, lichen availability and amphibians. Within the local assessment boundary, small mammal tissues from reference and potential exposure areas were analyzed to determine baseline values of radionuclide and trace metal concentrations.

***Furbearers***

Furbearers have high economic and biological value for northern Saskatchewan residents and are trapped at various times of the year. Furbearers expected to occur in the regional assessment boundary include fisher, marten, mink, otter, beaver, muskrat, lynx, red squirrel, weasel, wolverine, coyote, Arctic fox, snowshoe hare, wolf, and black bear. Within the local assessment boundary, beaver, snowshoe hare, and black bear activity were observed. Wolf activity was also observed near the Midwest site, but the activity level was low. Species observed during winter track count surveys in 2003/2004 included weasel, marten, red fox, mink, snowshoe hare, and red squirrel. Incidental observations of river otter and lynx were also recorded. Wolverine is the only federally and provincially listed furbearer with the potential to occur within the local assessment boundary (table 8-6). During baseline field surveys, no wolverine animals or signs were observed within the local assessment boundary but were seen within the region. Due to the large home range of individuals, they are likely to be present, but their numbers in the local assessment boundary would be low.

***Ungulates***

Ungulates include moose, caribou (woodland caribou and barren-ground caribou), elk, bison, and deer. Barren-ground caribou are not a federally-listed species but the species is provincially tracked and ranked S3 (rare to uncommon). Woodland caribou are listed under the SARA, designated as "threatened" by COSEWIC, and are listed provincially under the *Wildlife Act*.

The barren-ground caribou's winter migration was known to extend into the Midwest Project area in the 1980s, with an estimated density of 0.49 caribou/$km^2$ observed during aerial surveys. There were no reports of barren-ground caribou sightings within or near the Midwest site during aerial surveys for ungulates or during other wildlife surveys completed during 1981 and 1995. No woodland caribou were observed during aerial surveys within the local assessment boundary of the Midwest Project. Caribou tracks were observed near Unnamed Lake and within the vicinity of the McClean Lake Operation during winter track baseline surveys completed in 1994, while a group of caribou pellets and an old caribou skull (both observations from unknown caribou species) were found within the vicinity of the Midwest site in 2003.

Moose were observed within the local assessment boundary, but the density was lower than the average densities reported for more southern parts of Saskatchewan, likely

because of the lower availability of forage and cover, and colder temperatures. Pellet groups recorded in 2003 indicate a widespread distribution of moose near the Midwest site, even with industrial activity occurring in the area.

### *Birds*

Within the regional assessment boundary, nine COSEWIC listed species and six provincially listed species were identified to potentially occur within the regional assessment boundary. In addition, 22 provincially tracked bird species could potentially occur within the regional assessment boundary. Six of the species listed by COSEWIC have ranges that overlap the local assessment boundary, including the short-eared owl, common nighthawk, yellow rail, and the rusty blackbird. These species are listed as "species of special concern". The peregrine falcon and olive-sided flycatcher are listed by COSEWIC as "threatened". The short-eared owl, yellow rail, and peregrine falcon are also listed as provincial species requiring special management considerations. Of the provincially tracked bird species, 14 have ranges overlapping the local assessment boundary (table 8-6).

Surveys did not identify short-eared owl and yellow rail in the local assessment boundary. Common nighthawk, rusty blackbird, pine grosbeak and olive-sided flycatcher have been observed in the local assessment boundary. The peregrine falcon commonly occupies cliffs for nesting and no observations were recorded during surveys based on the lack of availability of cliffs in the local assessment boundary. Bald eagles and ospreys were the most common raptor species observed in the local assessment boundary.

A total of 28 water bird species were identified in the regional assessment boundary. Common loons, scaup, merganser and Canada geese were the most common species in the region. A low number of broods were observed in the local assessment boundary, as the local assessment boundary is likely used by waterfowl primarily as a stop-over rather than an important breeding habitat. No federally or provincially listed water bird species were found to have the potential to overlap the regional and local assessment boundary. The tundra swan is the only provincially tracked water bird species with a distribution range that overlaps the local assessment boundary.

### *Amphibians and Reptiles*

The northern leopard frog is the only species listed by COSEWIC that is known to potentially occur within the regional assessment boundary. There were no reported sightings of northern leopard frogs during the surveys completed within the vicinity of the Midwest site, and it is unlikely that northern leopard frogs would be encountered. The only amphibians detected within the local assessment boundary include the boreal chorus and wood frog.

### *Small Mammals*

The most abundant small mammal species within the local assessment boundary were the red-backed vole and the meadow vole. Small mammals provide an important prey base for several species of raptors and furbearers. In order obtain baseline values of radium-226, nickel, and arsenic, red-backed voles were captured near the Midwest site in 1979. The mean concentrations of metals and radionuclides were similar in red-backed voles captured in the potential exposure area (JEB) and the reference area (Mallen Lake).

Concentrations of arsenic measured in red-backed voles from the McClean Lake Operation were similar to arsenic concentrations measured near the Midwest site.

### 8.6.4 Wildlife Habitat

Caribou primarily feed on terrestrial and aboreal lichens during winter. The abundance of lichens within a given habitat type has an influence on caribou habitat use and distribution. A total of 67% of the local assessment boundary is considered to be high potential caribou foraging habitat. Moose prefer a diverse association of understory shrub species near waterbodies. A total of 11% of the local assessment boundary is considered suitable habitat for moose in the spring/summer season and a total of 42% of the local assessment boundary is considered suitable habitat for moose in the winter.

## 8.7 Human Environment

### 8.7.1 Occupational Health and Safety

The McClean Lake Operation has a comprehensive occupational health and safety program (OH&S) aimed at accident prevention and risk management. The OH&S considers hazards associated with open pit mining, milling of uranium ores and supporting activities. The Midwest Project will be operated as part of the McClean Lake Operation's OH&S Program, with no changes anticipated for activities related to mining the Midwest open pit and processing the ore.

### 8.7.2 Radiation Protection

The protection of workers from potential sources of radioactivity is necessary to provide a safe and healthy workplace environment. Workers at risk are those routinely exposed to potential sources or radioactivity, and include mine workers and mill workers.

A comprehensive radiation protection program is in place for the McClean Lake Operation, which is designed to meet the regulatory requirements under the NSCA and associated regulations as well as the internal requirements of AREVA. The radiation protection program is amalgamated into the site-wide IQMS. No changes to the existing radiation protection program are anticipated for implementing the Midwest Project.

Radiation protection practices for mining, open pit operations and in the JEB Mill consist of a combination of design and equipment features, operational practices and ongoing review and follow-up of results.

AREVA undertook an assessment of the JEB Mill radiation protection performance in 1999, during its first few months of operation. The results indicate that radiological levels in the general work environment of key mill areas were below the workplace nominal exposure rate design objectives. The actual worker dose exposure and dose estimates were found to be below the dose predictions. The average annual worker dose was 1.2 mSv, half of the predicted value of 2.9 mSv.

### 8.7.3 Human Health Risk Assessment

A human health risk assessment (HHRA) was carried out within the framework of an integrated ecological risk assessment. The HHRA involved assessing various pathways by which plants, animals and humans may be exposed to emissions from the McClean

Lake Operation and the Midwest Project, determining exposure and dose levels and evaluating human health risk associated with the estimated potential exposure and intake levels. Two primary sources of emissions (air and water) were identified that have the potential to affect human health.

Twelve human receptors were identified for the Midwest Project as people working and/or living nearby (table 8-7). Most of the selected receptors are considered members of the public. The JEB camp worker and Rabbit Lake mine site worker are considered on-site employees but are not classified as nuclear energy workers (NEWS). The pathways of exposure considered in the HHRA involved soil ingestion, water ingestion, consumption of wild game, consumption of fish, consumption of berries and consumption of backyard garden vegetables. Inhalation of dust, radon and groundshine were considered for the radionuclide dose calculations. The HHRA also considered the period of occupancy at the assessment location, dietary characteristics, sources of local food and drinking water, and air and soil intake quantities for each of the 12 receptors.

Dietary characteristics for each of the human receptors differed with respect to how much local food is consumed. The primary diet for Wollaston Lake residents and trappers was assumed to consist of local food; whereas the primary diet for workers (Rabbit Lake, Points North, JEB camp) was market food. Wollaston Lake residents also consumed higher quantities of meat/poultry (three times) and fish (five times) than the average Canadian.

**Table 8-7** List of Human Receptors and Period of Occupancy

| Human Receptor | Description/Location | Fraction of Year Spent at Assessment Location |
|---|---|---|
| 1a, 1c, 1t | Adult (1a), child (1c) or toddler (1t) Wollaston Lake resident located on Wollaston Lake, living/working in town | 100% (year-round) |
| 2a, 2c | Adult (2a) or child (2c) Wollaston Lake resident, with trapline along Collins Creek | 100% (3 months trapping and 9 months at Wollaston Lake) |
| 3a, 3c | Adult (3a) or child (3c) Wollaston Lake Lodge operator located on Hidden Bay, Wollaston Lake | 25% (summer months only) |
| 4 | Rabbit Lake Operation camp worker located at the Rabbit Lake site (i.e., not nuclear energy worker) | 50% (on a rotational basis) |
| 5 | McClean Lake Operation JEB camp worker (i.e., not nuclear energy worker) | 50% (on a rotational basis) |
| 6 | Points North worker located on Glove Lake | 50% (on a rotational basis) |
| 7a, 7c | Adult (7a) or child (7c) Hatchet Lake Lodge operator located at Hatchet Lake | 25% (summer months only) |

### 8.7.4 Transportation

An all-weather gravel road, Provincial Road 905, provides access to the McClean Lake Operation and Midwest Project sites. Land-based trucking is the mode of transportation used to deliver supplies to the McClean Lake Operation. Traffic related to the McClean Lake Operation averages about three trucks per day, representing approximately 4% of

the total traffic on Provincial Road 905. Future trucking requirements during the operational period of the Midwest Project along Provincial Road 905 are estimated to remain at about three to six trucks per day, which is not expected to result in notable degradation of road safety.

The proposed transportation corridor to be used as a dedicated all-weather haul road between the Midwest site and the JEB site will address safety issues and concerns with using Provincial Road 905 to haul ore. Access to the proposed transportation corridor will be located beyond the site security gates at both the Midwest and McClean Lake sites and access by members of the public will require prior permission.

## 8.8 Socio-Economic Environment

### 8.8.1 Population and Demographic Characteristic

The seven communities that are included in the Athabasca Basin are the First Nation communities of Fond du Lac, Black Lake, and Hatchet Lake (located at Wollaston Lake), the Northern Settlements of Camsell Portage, Uranium City and Wollaston Lake and the Northern Hamlet of Stony Rapids. The Athabasca Basin covers an area of approximately 100,000 $km^2$ and has a population between 2,792 and 3,539 residents. Highway 905 provides the only all-season access into the Athabasca Basin.

The uranium industry has an integral role in the economy of the Athabasca Basin, as five uranium mines are located within the region. From 1999 to 2005, between 114 and 340 Athabasca Basin residents were employed at uranium mines in northern Saskatchewan. As of 2009, there were 260 people employed at the McClean Lake Operation. In accordance with the Human Resource Development Agreement, McClean Lake Operation is striving towards 67% northern employment, as was recommended by the 1997 Joint Panel. Resource harvesting (trapping, fishing, and guiding) also provides seasonal income for many of the region's residents.

### 8.8.2 Heritage Resources

Heritage Resource Impact Assessments (HRIA) have been completed in the local assessment boundary. Each HRIA was completed under Archaeological Resource Investigation Permits issued by the Saskatchewan Heritage Resource Branch, Department of Culture, Youth and Recreation. Archaeological investigations in the region were completed in advance of projects related to roads, mining, and power transmission lines. In total, ten HRIAs have been completed in the local assessment boundary. Thirty-five heritage resources have been recorded during these assessments, but none of the sites are in known conflict with the proposed Midwest Project.

An HRIA was completed on the two proposed transportation corridor options and the western margin of Two Small Lake as part of the Midwest Project. The report indicated that no heritage resources were identified and no additional archaeological work was recommended. A subsequent HRIA was conducted in 2008 on the proposed Midwest Project. This assessment built on previous baseline studies conducted for the Midwest Project in 1979. The heritage study area examined included the shoreline of North McMahon Lake and South McMahon Lake and portions of Shallow Lake. No new heritage resources were identified and only one of eight previously recorded heritage

resources was relocated. A subsequent shovel testing program of the site areas revealed that the location of the Midwest Project was of limited archaeological value. It was concluded that AREVA likely meets the requirements for regulatory approval that would be needed to proceed with the proposed Project. The Heritage Resources Branch, Department of Culture, Youth and Recreation formally concurred with AREVA's recommendations.

### 8.8.3 Traditional Land Use

Environmental knowledge exists among the Elders and resource harvesters of local First Nations and this provides relevant information on the ecological components of the existing environment. Through oral history and living memory, knowledge of traditional land use can be used to facilitate the identification of potential project-land use interactions and supplement archaeological evidence. Traditional land use research was used to assess the interactions of the Midwest Project with traditional land uses. This research was undertaken as part of an *Agreement Respecting the Land and Renewable Resource Use Planning and Management in Northern Saskatchewan – Lake Athabasca Region* between the Government of Saskatchewan and Athabasca First Nation groups and communities. The Prince Albert Grand Council (PAGC) is the custodian of the traditional land use research.

To assess the potential interactions of the Midwest Project with traditional land use, a request was made of the PAGC to map traditional land use themes within the Midwest Project local assessment boundary. The PAGC identified 47 different traditional land use themes, including spiritual places, subsistence and commercial water use, overnight sites, plant and earth materials, large and other animal kill sites, and trapping area boundaries within the Midwest Project local assessment boundary. No sacred sites, birth or death sites, burial sites, or locations of medicinal plant use are located within the Midwest Project local assessment boundary. Few subsistence and commercial water use areas are present within the local assessment boundary. Harvesting of large and small animals is most often associated with the larger lakes (Wollaston Lake, Hatchet Lake, Waterbury Lake, and Henday Lake) at the periphery of the local assessment boundary. Barren-ground caribou consumed are almost exclusively harvested outside of the regional assessment boundary and are brought back to the community. Trapping density within the local assessment boundary has historically been low, with less than 5 trapping areas within the local boundary. Only two traditional users have been identified for both the Midwest site and the McClean Lake Operation and Trapper Compensation Agreements are in place. Nine overnight sites, one area used for special woods, and two areas used for wild berries are within or adjacent to the local assessment boundary but none of the areas are in close proximity to the proposed Midwest Project. The evaluation of traditional land use activities, relative to the Midwest Project, found that such activities have been historically confined to the larger lakes located at the periphery of the Midwest Project local assessment boundary. As such, the Midwest Project will have limited interaction with traditional land use.

### 8.8.4 Renewable and Non-Renewable Resource Use

In addition to wage employment, resource harvesting, primarily trapping, fishing and guiding, provides important seasonal income for many of the region's residents. The area has a number of fishing and outfitting camps for tourists. Income from resource harvesting has remained fairly stable over the past two decades at about $2000.00 per resource harvester. In the last four years, improved fur prices have meant that trapping earnings have improved by more than 40% for the 50 to 70 trappers operating in the Athabasca Region.

In 2002, there were 13 bear outfitters and 10 moose outfitters operating in Wildlife Management Zone 76, which includes the Athabasca Region that offer sport fishing services; seven of these also provide outfitting services.

### 8.8.5 Navigation

AREVA filed a NWPA Application for Proposed Works Associated with the Midwest Project with Transport Canada to facilitate TC's review of the effects of the Midwest Project on the public's right to navigate. The aspects of the Midwest Project included in the application are:

- the existing Mink Arm dam
- upgrades to the Mink Arm dam
- construction of a new secondary retention dam at Mink Arm
- dewatering of Mink Arm
- crossing N4 along the proposed transportation corridor
- crossing N5 along the proposed transportation corridor

TC communicated to AREVA that, as no record of approval for the existing Mink Arm dam could be found, AREVA would have to provide evidence that the dam was approved under the NWPA, built or owned by the Crown, or built under an Order in Council, otherwise the dam would be considered an unlawful work under the NWPA. Evidence of an EA approval (1988) and approval to construct issued by the Province of Saskatchewan (1988) could be located, but not one from an agency of the federal government enforcing the NWPA. As such, AREVA's NWPA application to TC included information relating to the existing Mink Arm dam, as well as the proposed upgrades.

TC's NWPA Request for Project Review identified two stream crossings along the north route, the preferred route, as navigable: Crossings N4 and N5. To comply with TC requirements, the proposed configuration for Crossing N4 will be a culvert and the proposed configuration for Crossing N5 will be a clear span bridge.

# 9 ENVIRONMENTAL EFFECTS ASSESSMENT

An environmental effect is defined as a measurable change resulting from an interaction between the Midwest Project and the environment. This could include a change that the Midwest Project may cause in the environment or a change that the environment may cause to the Project. Effects for the Midwest Project were considered during construction, normal operations, malfunctions and accidents, and during and subsequent to decommissioning and the effects assessment also considered cumulative effects.

## 9.1 Assessment of the Effects of the Project on the Environment

The assessment of likely effects of the Midwest Project on the environment was carried out in a stepwise manner as follows:

- identifying Valued Ecosystem Components (see section 8.1)
- establishing study boundaries (see section 6.0)
- identifying constituents of concern (table 9-1)
- identifying potential interactions between the Project and the environment (table 9-2)
- identifying potential adverse effects on the environment (table 9-3)
- identifying mitigation measures for adverse effects (section 9.2)
- determining residual adverse effects, if any (section 9.2)
- determining effects that would remain after mitigation, should residual adverse effects be identified (section 9.2)
- assessing the significance of any residual adverse effects that cannot be mitigated (section 9.2)
- providing conclusions of the federal RAs and provincial SMOE on the significance of residual effects (section 9.2)

### 9.1.1 Identification of Constituents of Concern

There are a number of COCs identified for the Midwest Project (table 9-1), which are based on past assessments of the Midwest and McClean Lake Operation.

**Table 9-1** Selection of Constituents of Concern for the Midwest Project

| Chemistry | Constituents |
|---|---|
| **General Chemistry** | Ammonia<br>Chloride<br>Sulphate<br>Total Dissolved Solids |
| **Non-Radionuclides** | Arsenic<br>Cadmium<br>Cobalt<br>Copper<br>Lead<br>Molybdenum<br>Nickel<br>Selenium<br>Uranium<br>Vanadium |
| **Radionuclides** | Radium-226<br>Lead-210<br>Polonium-210<br>Thorium-230<br>Radon-222 |

The assessment evaluated the potential effects of COCs (radionuclides and non-radionuclides) on the following terrestrial and aquatic VECs;

- aquatic biota, including phytoplankton, zooplankton, macrophytes and predatory and bottom-feeding fish, based on exposure to predicted water concentrations, and benthic invertebrates, based on exposure to predicted sediment concentrations
- terrestrial biota and waterfowl, including bear, mink, beaver, lynx, caribou, eagle, hare, mallard, merganser, moose, muskrat, scaup, ptarmigan, and wolf, based on predicted exposure to concentrations in water, food sources, sediment, and soil
- direct exposure to vegetation VECs (lichen, blueberry, and Labrador tea) were not evaluated since air emissions from the Project are very low. However, indirect exposure to vegetation VECs was evaluated, since they are a food source for many of the terrestrial VECs

The numerical criteria for the COCs were established from a number of benchmarks that were used to evaluate the potential effects of the Midwest Project on the environment. These criteria range from generic national and provincial guidelines to site-specific toxicity benchmarks. An outline of the evaluation criteria used in the assessment is provided in Appendix B.

### 9.1.2 Identification of Project-Environment Interactions

A project-environment interaction matrix is provided which illustrates how potential effects were first identified (table 9-2). The Midwest Project activities were identified for the construction, operation, and decommission Project components at the Midwest site and the McClean Lake Operation, including accidents and malfunctions.

All open and closed circles represent potential interactions with the biophysical and socio-economic environments associated with the Midwest Project. The open circles identify potential Project interactions that would not constitute a likely residual adverse effect. The closed circles identify potential Project interactions with likely residual adverse effects, for which mitigation measures are not available or for which an effect could remain following the implementation of mitigation measures. As the CEA Act is only concerned with adverse environmental effects, analysis was not conducted for effects deemed positive (e.g. provision of employment in the region).

## Table 9-2 Potential Residual Effects from the Midwest Project

**Table 9-2: Potential Residual Effects from the Midwest Project**

| Project Components | Environmental Components | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Human Environment | | | | | Aquatic Environment | | | | | | | | | Atmospheric Environment | | | Geologic / Hydrogeologic Environment | | | | Terrestrial Environment | | | | | Socio-Economic Environment | | | | | | |
| | | | | | | Physical | | Biological | | | | | | | | | | | | | | | | | | | Land Resources | | | Community and Economic Conditions | | | |
| | Radiation Doses to General Public | Radiation Doses to Workers | Non-Radioactive Chemical Exposure to Public | Non-Radioactive Chemical Exposure to Workers | Physical Hazards | Stream Flow / Lake Level | Drainage Alteration | Aquatic Biota (physical, chemical) | Aquatic Habitat Quantity | Aquatic Habitat Quality | Radiation in Surface Water | Radiation in Sediment | Surface Water Quality (Non-Radioactive) | Sediment Quality (Non Radioactive) | Radioactivity in Atmospheric Environment | Air Quality (Non-Radioactive) | Noise Quality | Soil Quantity and Quality (Chemical, Physical) | Long-term Transport of Radioactive COCs to Surface Waters | Long-term Transport of Non-Radioactive COCs to Surface Waters | Groundwater Levels | Radiation Exposure to Biota and Wildlife | Non-Radiation Exposure to Biota and Wildlife | Physical Hazards (e.g., attraction to site, human-wildlife interactions) | Wildlife Habitat Quantity | Wildlife Habitat Quality | Land Use (Traditional and Non-Traditional) | Transportation Network and Elements | Landscape and Visual Setting | Population and Economic Base | Community Infrastructure and Services | Residents and Communities | Renewable /Non-renewable Resources |
| **CONSTRUCTION OF MIDWEST PROJECT** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Explosives usage | | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ● | ● | ○ | | | | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | |
| Mink Arm Dewatering (including dam upgrade) | | | | | ○ | ● | ● | ● | ● | ● | | | ● | ● | | ○ | ● | ● | | | ● | | | ○ | ● | ● | ● | ○ | ● | | | | ● |
| Midwest Pit Development (land clearing, dust deposition) | | | ○ | ○ | ○ | ● | ● | | ○ | ● | | | ● | ● | | ● | ● | ● | | | ● | | ○ | ○ | ● | ● | ● | ○ | ● | ○ | | ● | ● |
| Site Preparation and Equipment Operation (clean waste stockpiles, special waste rock stockpile, ore stockpile, and site surface infrastructure and utilities) | | | | | ○ | ● | ● | ● | ○ | ● | | | ● | ● | | ● | ● | ● | | | | | ○ | ○ | ● | ● | ● | ○ | ● | ● | | | |
| Waste Water Management and Treatment Facility, and Associated Discharge Pipeline | | | | ○ | ○ | ● | ● | ● | ○ | ● | | | ● | ● | | ● | ● | ● | | | | | ○ | ○ | ● | ● | ● | ○ | ● | | | | |
| Haulage Road Construction and Stream Crossings | | | | | ○ | ○ | ○ | ○ | ● | ● | | | ● | ● | | ● | ● | ● | | | | | ○ | ○ | ● | ● | ● | ● | ● | ● | | | |
| Construction Material Transport | | | | | ○ | | | ○ | | ● | | | ● | ● | | ● | ● | ● | | | | | ○ | ○ | | ● | ○ | ● | | ● | | | |
| **OPERATION OF MIDWEST PROJECT** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Explosives usage | | ○ | | ○ | ○ | | | ○ | | ○ | ○ | ○ | ○ | ○ | ○ | ● | ● | ○ | | | | ○ | ○ | ○ | ○ | ● | | | | | | | |
| Material excavation and haulage (i.e., dust deposition) | ● | ● | ● | ● | ○ | ● | ● | ○ | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ○ | ● | ● | ● | | ● | ● | | ● | ● |
| Clean Waste Stockpiles (includes industrial landfill) | | | | | ○ | ● | ● | ○ | | ○ | | | ○ | ○ | | ● | ● | ○ | | ○ | | | | ○ | ● | ● | ● | | ● | | | | |
| Special Waste Rock Stockpile | | ● | | ● | ○ | ● | ● | ○ | | ○ | ○ | ○ | ○ | ○ | ○ | ● | ○ | ○ | ● | ● | | ● | ● | ○ | ● | ● | ● | | ● | | | | |
| Ore Stockpile | | ● | | ● | ○ | ● | ● | ○ | | ○ | ○ | ○ | ○ | ○ | ○ | ● | ○ | ○ | ○ | ○ | | ● | ● | ○ | ● | ● | ● | | ● | | | | |
| Waste Water Management and Treatment Facility, and Associated Discharge Pipeline | ○ | ○ | ○ | ○ | ○ | ● | ● | ● | ○ | ● | ● | ● | ● | ● | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | ● | ● | ○ | | ○ | | | | |
| Site Surface Infrastructure, Utilities, and Equipment (e.g., office, shops, warehouses, explosives shack, power generation, potable water supply, hazardous materials storage) | | ○ | | ○ | ○ | ● | ● | ○ | | ● | | | ● | ● | | ● | ● | ● | | | | | ○ | ○ | ● | ● | ● | | ● | ● | | ○ | |
| Road and Transportation | ○ | ● | ○ | ● | ○ | | | ○ | ○ | ● | ○ | ○ | ● | ● | ○ | ○ | ● | ● | | | | ○ | ○ | ○ | ● | ● | ● | ○ | ● | ● | | | |
| **DECOMMISSIONING OF THE MIDWEST PROJECT** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Midwest Pit Closure (partially backfilled, capped, and flooded) | | ○ | | ○ | ○ | ● | ● | ○ | | ● | ● | | ● | ● | | ● | ● | ● | | | ● | | ○ | ○ | ● | ● | ● | | ● | ● | | | |
| Recontouring of Stockpiles | | | | | ○ | | ● | | | ● | | | ● | ● | | ● | ● | ○ | | ● | | | ○ | ○ | ● | ● | ● | | ● | ● | | | |
| Removal of Site Surface Infrastructure and Reclamation | | | | | ○ | ● | ● | ○ | | ● | | | ● | ● | | ● | ● | ● | | | | | ○ | ○ | ● | ● | ● | ○ | ● | ● | | | |
| Removal of Roads and Reclamation | | | | | ○ | ○ | ○ | ○ | ○ | ● | | | ● | ● | | ● | ● | ● | | | | | ○ | ○ | ● | ● | ● | | ● | ● | | | |

**Table 9-2-B** Potential Residual Effects from the Midwest Project

| Project Components | Environmental Components | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Human Environment | | | | | Aquatic Environment | | | | | | | | | Atmospheric Environment | | | Geologic / Hydrogeologic Environment | | | | Terrestrial Environment | | | | | Socio-Economic Environment | | | | | | | | | |
| | | | | | | Physical | | Biological | | | | | | | | | | | | | | | | | | | | Land Resources | | | Community and Economic Conditions | | | | | |
| | Radiation Doses to General Public | Radiation Doses to Workers | Non-Radioactive Chemical Exposure to Public | Non-Radioactive Chemical Exposure to Workers | Physical Hazards | Stream Flow / Lake Level | Drainage Alteration | Aquatic Biota (physical, chemical) | Aquatic Habitat Quantity | Aquatic Habitat Quality | Radiation in Surface Water | Radiation in Sediment | Surface Water Quality (Non-Radioactive) | Sediment Quality (Non Radioactive) | Radioactivity in Atmospheric Environment | Air Quality (Non-Radioactive) | Noise Quality | Soil Quantity and Quality (Chemical, Physical) | Long-term Transport of Radioactive COCs to Surface Waters | Long-term Transport of Non-Radioactive COCs to Surface Waters | Groundwater Levels | Radiation Exposure to Biota and Wildlife | Non-Radiation Exposure to Biota and Wildlife | Physical Hazards (e.g., attraction to site, human-wildlife interactions) | Wildlife Habitat Quantity | Wildlife Habitat Quality | Land Use (Traditional and Non-Traditional) | Transportation Network and Elements | Landscape and Visual Setting | Population and Economic Base | Community Infrastructure and Services | Residents and Communities | Renewable /Non-renewable Resources |
| **McCLEAN LAKE OPERATION** [a] | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MCL Uranium Milling Facility (JEB Mill and Associated Circuits, including modifications) | ○ | ● | ○ | ● | ○ | ○ | | ● | ○ | ● | ● | ● | ● | ● | ● | ● | ● | ● | | | | ● | ● | | ● | ● | ● | | ● | ● | | ● | | ○ |
| MCLTailings Management Facility (JEB TMF - including pipelines) | ● | ● | ● | ● | ○ | | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ | ○ | ● | ● | ● | ● | ● | ○ | ○ | ● | ● | | ● | | | | | |
| MCL Waste Water Management (SUE WTP, S/V TEMS) | ● | ● | ● | ● | ○ | ● | | ● | ● | ● | ● | ● | ● | ● | | ● | ● | ○ | | | ● | ● | ● | | ○ | ○ | ● | | ● | | | | | ○ |
| MCL Ore Storage and Transfer Pad (SUE) | ○ | ● | ○ | ● | ○ | | | ○ | | ○ | ○ | ○ | ○ | ○ | ● | ● | ● | ○ | ○ | ○ | | ○ | ○ | | ○ | ● | ● | | ● | | | | | |
| MCL Overburden Stockpile | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MCL Clean Waste Stockpile | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MCL Special Waste Rock Stockpile | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MCL Industrial Waste | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MCL Contaminated Waste | | ● | | ○ | ○ | | | | | | | | | ● | ● | ● | | | | | | ○ | ○ | ○ | | ○ | ○ | | ○ | | | | | |
| MCL Other Wastes (sewage, domestic waste) | | | | ○ | ○ | ○ | | ○ | | ● | | | ● | ● | | ● | ● | ○ | | | | | ● | ○ | | ○ | ● | | ○ | | | | | |
| MCL Infrastructure and Equipment (fuel storage, camp, power lines) | | | ○ | ○ | ○ | | | ○ | ○ | ○ | | | ○ | ○ | | ● | ● | ○ | | | | | ○ | ○ | ○ | ● | ● | | ● | ● | | | | |
| Roads and Transportation | ○ | ● | ○ | ● | ○ | | | ○ | ○ | ● | ○ | ○ | ● | ● | ○ | ● | ● | ● | | | | ○ | ● | ○ | ○ | ● | ● | ○ | ● | | | ○ | | |
| **DECOMMISSIONING OF THE McCLEAN LAKE OPERATION** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MCL Closure of the Tailings Management Facility (backfilling and capping) | | ○ | | ○ | ○ | | ● | | | ○ | | | ● | ● | | ● | ● | ● | ● | ● | ● | | ○ | ○ | ● | ● | ● | | ● | ● | | | | |
| MCL Decommissioning of the S/V TEMS | | | | | ○ | ● | ● | ● | ● | ● | | | ● | ● | | ● | ● | ○ | | | | | ○ | ○ | ○ | ● | ● | | ○ | ● | | | | ○ |
| MCL Recontouring of Stockpiles | | ○ | | ○ | ○ | | ● | | | ● | | | ● | ● | | ● | ● | ○ | | ○ | | | ○ | ○ | ● | ● | ● | | ● | ● | | | | |
| MCL Removal of Milling Facility, Surface Infrastructure and Reclamation | | | | | ○ | ● | ● | ○ | ○ | ● | | | ● | ● | | ● | ● | ● | | | | | ○ | ○ | ● | ● | ● | | ● | ● | | | | |
| MCL Removal of Roads and Reclamation | | | | | ○ | ○ | ○ | ○ | ○ | ● | | | ● | ● | | ● | ● | ● | | | | | ○ | ○ | ● | ● | ● | | ● | ● | | | | |
| MCL Removal of Other Wastes (industrial, contaminated, domestic) | | | | ○ | ○ | ○ | ○ | ○ | | ○ | | | ○ | ○ | | ● | ● | ● | | | | | ○ | ○ | ● | ● | ● | | ● | ● | | | | |

a incremental interaction to the McClean Lake Operation from the construction and operation of the Midwest Project

MCL McClean Lake Operation

○ No measurable change or negligible residual effect

● Residual Effect (incremental effect to the Midwest Project and McClean Lake Operation from construction, operation, and decommissioning activities

### 9.1.3 Prediction of Effects

Predicted construction, operational, decommissioning and long-term effects were determined through an integrated assessment framework consisting of dispersion and pathways modelling and an ecological risk assessment (ERA).

The assessment of effects from the Midwest Project on water and sediment quality was undertaken through dispersion models and based on previous EAs (1991, 1995 and 2004 Sue E EIS). The 2004 Sue E EIS was used, as it encompassed the fully expanded JEB Mill assessed in the 1995 EIS for the development of the Cigar Lake mine and the Midwest Project. The assessment of effects from the Project on air quality was undertaken through air dispersion modelling.

An ERA was completed to evaluate the potential for residual effects on aquatic and terrestrial VECs as a result of exposure to COCs, both radiological and non-radiological, from a variety of potential exposure pathways. The ERA was completed to provide additional understanding of potential environmental effects beyond that provided by comparisons of predicted effects to generic guidelines and objectives.

A screening index (SI) was used to evaluate and compare predicted VEC exposure to a toxicity benchmark to determine the potential for an effect. The SI for aquatic and terrestrial VECs was calculated by dividing the predicted COC received by a receptor by the toxicity benchmark or reference dose rate (for radionuclides). An SI value greater than 1.0 was indicative that the benchmark for an aquatic or terrestrial VEC was exceeded by that predicted concentration (see Appendix B).

### 9.1.4 Consideration of Mitigation Measures for Potential Adverse Effects

Each likely adverse effect was considered to identify possible means of mitigation to eliminate, reduce or control potential effects due to construction, normal operations, decommissioning activities or from malfunctions and accidents.

Table 9-3 summarizes the potential effects of the Midwest Project on the environment. The table outlines the commitments, mitigation practices and best management practices to reduce, eliminate or control any potential effect. These mitigation measures are outlined for those components of the Midwest Project that will result in changes at McClean Lake Operation (e.g. expansion of the JEB Mill); however the mitigation measures described for each environmental component focused on Midwest Project-specific mitigation practices, rather than mitigation associated with the existing facilities at McClean Lake Operation for which EAs have been completed and approved.

### 9.1.5 Assessing the Likely Residual Adverse Effects

A residual effect is one which remains after mitigation has been put into place and would be measurable or observable on the selected VEC. Each potential interaction was evaluated to determine if it would result in a residual adverse effect, after implementation of available mitigation measures.

### 9.1.6 Assessing the Significance of Residual Adverse Effects

Only those residual effects considered adverse were assessed for significance (see closed circles on table 9-2). Assessment of the significance of the residual adverse environmental effects of the Midwest Project involved consideration and evaluation of specific characteristics or attributes of the effects. Attributes of the effects examined included:

- magnitude: the scale or size of the effect
- geographic extent: the area over which the effects occur
- duration: the time frame of the effect
- reversibility: the degree to which the effect can be reversed
- frequency: the rate at which the effect recurs
- likelihood: the probability of an effect occurring

Table 9-4 provides definitions of the criteria used in the determination of significance of adverse residual effects of the Midwest Project. Significance was used to identify projected residual effects that are of sufficient magnitude, duration and/or geographic extent that they could lead to fundamental changes to VECs. Based on this definition, environmental significance was identified as:

- predicted effects that may be detectable at the population level, and are likely to be irreversible were considered significant.
- predicted effects that may be detectable at the individual or population level, but the effects are likely to be reversible at the population level were considered not significant.

**Table 9-3** Summary of Potential Effects on the Environment and Commitments, Mitigation Measures, and Best Management Practices for the Midwest Project

| Environmental Component | Project Component/Activity | Project-Environment Interactions | Potential Environmental Effects | Commitments, Mitigation Practices and Best Management Practices |
|---|---|---|---|---|
| Atmospheric Environment | ▪ site preparation of surface footprint for construction of the Midwest pit, mine facilities, transportation corridor and pipeline<br>▪ vehicle and heavy equipment operation<br>▪ explosives use for blasting<br>▪ general mining operations<br>▪ ore haulage | ▪ emissions of diesel exhaust from vehicle and heavy equipment operation during construction, operation, and closure<br>▪ dust generation from ground disturbance during construction, operation and closure<br>▪ dust generation from mining and vehicle traffic during construction, operation, and closure<br>▪ wind generated dust from exposed soil during construction and operation<br>▪ dust emissions from waste rock and ore stockpiles during construction and operation<br>▪ noise from vehicle traffic and heavy equipment during construction, operation, and closure<br>▪ noise from blasting and general mining operations during construction and operation | ▪ air emissions and dust deposition can alter air quality<br>▪ increase in ambient noise levels | ▪ the Integrated Quality Management System (IQMS) implemented at the McClean Lake Operation will be adapted for the Midwest Project<br>▪ transportation corridors will be properly maintained and watered when conditions dictate to ensure safe hauling conditions<br>▪ drivers will be trained on road safety and speed limits will be posted and enforced<br>▪ controlled blasting techniques and monitoring to ensure pit wall stability<br>▪ JEB Mill ventilation system is designed to replace exhausted air and control long-lived radioactive dust and radon gas<br>▪ wet scrubbers on various emission stacks receive regular maintenance to ensure efficient operation with minimum air emissions, thereby minimizing subsequent aerial deposition<br>▪ use appropriate dust suppression measures to control dust emissions<br>▪ monitor sulphur dioxide emissions through in-stack detector at JEB Mill<br>▪ control emissions from plant areas through scrubber systems and bag houses at JEB Mill<br>▪ limit the amount of noise from the site with the use of appropriate exhaust mufflers, where appropriate (i.e. fit diesel generator units with high-performance engine exhaust silencers)<br>▪ limit equipment noise sources by locating them inside buildings, where possible |
| Geological/ Hydrogeological Environment | ▪ mine surface footprint, transportation corridor, and pipeline;<br>▪ general construction, operation, and closure works<br>▪ tailings management facility (TMF)<br>▪ spills outside of containment | ▪ dewatering of Mink Arm and discharge into South McMahon Lake<br>▪ seepage from the ore stockpile<br>▪ seepage from the TMF<br>▪ seepage to groundwater | ▪ loss or alteration of surface water flows and level of local water body may affect groundwater flows<br>▪ seepage from the ore stockpile can cause effects to groundwater quality<br>▪ seepage from the TMF can cause effects to groundwater quality | ▪ the IQMS implemented at the McClean Lake Operation will be adapted to the Midwest Project<br>▪ waste rock from the pit development will be sampled and monitored to ensure the materials are properly segregated<br>▪ the ore stockpile will be surrounded by a perimeter ditch designed to collect runoff water, and lined with an impervious liner<br>▪ control rate of solute transport from decommissioned facility through tailings preparation and placement<br>▪ hydrodynamic containment will be used to prevent the release of contaminants during operation<br>▪ dewatering wells have been installed to intercept groundwater prior to interaction with tailings pore water<br>▪ all dewatering well piping will be heat traced and insulated<br>▪ use of in-pit tailings to provide better isolation and security<br>▪ use of reagents to tailings to reduce long-term source contaminant concentrations<br>▪ central placement of tailings to minimize groundwater flow through the tailings should tailings segregation occur<br>▪ ongoing monitoring and sampling to ensure background levels are achieved |
| Aquatic Environment | ▪ dewatering of Mink Arm<br>▪ vehicle and heavy equipment operation<br>▪ explosives use for blasting<br>▪ general construction, operation, and closure works<br>▪ S/V TEMS<br>▪ TMF | ▪ dewatering of Mink Arm and discharge into South McMahon Lake<br>▪ construction of mine surface footprint, transportation and utility corridor, stream crossings<br>▪ change in ambient air quality from air emissions during construction, operation, and closure<br>▪ increase in dust deposition during construction, | ▪ loss or alteration of surface water flows, drainage patterns, and level of local water bodies<br>▪ erosion and sedimentation of streams and stream channel alteration, resulting in the HADD of fish habitat<br>▪ impediments to fish passage from construction activities or from improperly designed or installed stream crossing structures<br>▪ increased risk of injury/mortality of fish from the removal and | ▪ the IQMS implemented at the McClean Lake Operation will be adapted to accommodate the Midwest Project<br>▪ a fish habitat compensation plan will be implemented to offset the loss of Mink Arm. The plan includes BMPs to minimize impacts at stream crossings and ensure fish passage where required<br>▪ the surface water elevation of Too Small, Shallow, and South McMahon Lakes will be monitored. If necessary, lake volume will be augmented through the addition of clean RO permeate<br>▪ baseline nutrient monitoring of Too Small, Shallow and South McMahon Lakes will be undertaken, with further contingency mitigation measures implemented as required by DFO<br>▪ the existing dam will be upgraded to control seepage and to maintain adequate protection from over-topping in the event of a probable maximum precipitation flooding event<br>▪ the use of the existing Mink Arm dam will minimize fish habitat loss in Mink Arm<br>▪ a fish removal and transfer program will be undertaken to capture and transfer fish from Mink Arm to South McMahon Lake prior to dewatering activities<br>▪ electrofishing will be used to the extent possible to reduce fish capture stress |

| Environmental Component | Project Component/Activity | Project-Environment Interactions | Potential Environmental Effects | Commitments, Mitigation Practices and Best Management Practices |
|---|---|---|---|---|
| | | operation, and closure<br>▪ surface water runoff<br>▪ spills during construction, operation, and closure<br>▪ effluent discharge from the S/V TEMS<br>▪ seepage from the TMF and waste rocks | transfer prior to Mink Arm dewatering activities<br>▪ changes to the chemical properties of surface water and sediment from air emissions<br>▪ changes to the chemical properties of surface water and sediment from air emissions and dust deposition may change the quality of fish habitat<br>▪ changes to the chemical properties of surface water and sediment from air emissions and dust deposition may affect fish health and population size<br>▪ changes to the chemical properties of surface water and sediment may affect fish habitat from the discharge of treated effluent<br>▪ changes to the chemical properties of surface water and sediment and effects to fish health, which may affect fish population size, from the discharge of treated effluent<br>▪ surface water runoff and associated soil erosion may affect drainage flows, surface water levels, and surface water quality, which can affect fish habitat<br>▪ spills on-site or along the transportation corridor may cause changes to surface water quality and fish habitat<br>▪ spills on-site can increase risk of mortality to fish, which may affect fish population size<br>▪ seepage from the TMF and waste rocks may affect to surface water quality and potential changes to fish habitat | ▪ the intake will be designed to prevent fish entrapment and entrainment of suspended particulate in the diverted water<br>▪ the rate of discharge to South McMahon Lake will be constrained by the 1 in 10 year flood capacity of Midwest Creek<br>▪ the discharge pipeline will be terminated sufficiently far from the shoreline to minimize the potential for the disruption of fish habitat and scour lakebed sediments<br>▪ the discharge pipeline is equipped with a flow diffuser to enhance the dispersion of treated effluent in the east basin of McClean Lake<br>▪ the pipeline will follow the transportation corridor, thus reducing the amount of habitat disturbed<br>▪ the discharge pipe will be located away from the littoral fish habitat<br>▪ the vertical alignment will be optimized to minimize haulage across streams<br>▪ transportation corridor surfaces will be graded on a regular basis to ensure runoff is directed towards the drainage ditches<br>▪ transportation corridors will be maintained and watered when conditions dictate to ensure safe hauling conditions<br>▪ the road design includes provisions for containment ponds at the low points along the route and an earth pad for booster pump station<br>▪ approach culverts will be required at intersections to allow ditch drainage across the approach<br>▪ stream crossings will be designed to meet DFO fish passage requirements as required by DFO<br>▪ any works in navigable waterways for the purpose of the fish habitat compensation land will have to be approved under the NWPA<br>▪ large sized culverts will be installed to reduce the potential for build up of debris that may obstruct flow at the inlet<br>▪ culverts will be required at locations to maintain natural drainage patterns<br>▪ construction activities near stream crossings will be avoided during spring and fall fish spawning or migration periods<br>▪ in-stream work, where possible, will be scheduled during a low flow period to minimize erosion<br>▪ erosion and sediment control measures will be applied to prevent discharge of sediments into fish bearing streams<br>▪ erosion control mats will be installed at the stream crossings to protect the slopes from erosion until vegetation is established<br>▪ rip rap will be placed at locations that may experience high flow velocities (e.g., culvert outlets)<br>▪ conventional treatment of the RO brine solution will result in a reduction in loadings of COCs to the environment<br>▪ wet scrubbers on various air emission stacks receive regular maintenance to ensure efficient operation with minimum air emissions, thereby minimizing subsequent aerial deposition of contaminants of potential concern into nearby waterbodies<br>▪ the Midwest site will be constructed to collect and contain contaminated and potentially contaminated waters and all water will be directed to the Midwest WTP, to eliminate or reduce potential effects to the aquatic environment from surface runoff and seepage<br>▪ hydrodynamic containment will be used to prevent the release of contaminants during operation<br>▪ the uranium production unit processes are housed within tertiary containment structures and internal spills have essentially no potential to harm the environment;<br>▪ water can be stored within the S/V TEMS reservoir during periods of low flow through the watershed to ensure adequate mixing of effluent in natural creek flows<br>▪ fishing is only allowed on designated lakes within the McClean Lake Operation area with certain restrictions (i.e., only one boat is allowed on each lake at a time, barb-less hooks must be used, and only one fish can be kept per person per week)<br>▪ all personnel fishing in the area of the Operation must hold a valid fishing license, except where exempted by law. |
| Terrestrial Environment | ▪ mine surface footprint, transportation corridor, and pipeline;<br>▪ vehicle and heavy equipment operation<br>▪ explosives use for blasting<br>▪ general construction, operation, and closure works | ▪ site clearing during construction<br>▪ physical presence of the mine surface footprint, transportation corridor, and pipeline during construction, operation, and closure<br>▪ surface water runoff<br>▪ change in ambient air quality from air emissions during construction, operation, and closure<br>▪ increase in dust deposition | ▪ site clearing, contouring and excavation can increase erosion to soils<br>▪ direct loss of soil and vegetation<br>▪ direct loss and fragmentation of wildlife habitat<br>▪ alteration of drainage patterns and surface water levels and potential effects to soil, riparian vegetation, and wildlife habitat<br>▪ surface water runoff can cause soil erosion, and changes to vegetation and wildlife habitat quality | ▪ the IQMS implemented at the McClean Lake Operation will be adapted to accommodate the Midwest Project<br>▪ the existing dam will be upgraded to control seepage and to maintain adequate protection from over-topping in the event of a probable maximum precipitation flooding event<br>▪ the rate of discharge to South McMahon Lake will be constrained by the bank flow streamflow capacity of Midwest Creek<br>▪ the pipeline will follow the transportation corridor, thus reducing the amount of habitat disturbed<br>▪ the vertical alignment will be optimized to minimize haulage across streams<br>▪ transportation corridor surfaces will be graded on a regular basis to ensure runoff is directed towards the drainage ditches<br>▪ the road design includes provisions for containment ponds at low points along the route and an earth pad for the booster pump station<br>▪ transportation corridors will be maintained and watered when conditions dictate to ensure safe hauling conditions<br>▪ existing on-site roads will be used as much as possible<br>▪ drivers will be trained on road safety and speed limits will be posted and enforced<br>▪ unauthorized trails and transport corridors leading to the proposed transportation corridor will be restricted using a variety of physical barriers suitable to the situation such as a rock pile or berms<br>▪ erosion control mats will be installed at the stream crossings to protect the slopes from erosion until vegetation is established |

| Environmental Component | Project Component/Activity | Project-Environment Interactions | Potential Environmental Effects | Commitments, Mitigation Practices and Best Management Practices |
|---|---|---|---|---|
| | | during construction, operation, and closure<br>▪ increase in noise level and human activity during construction, operation, and closure<br>▪ spills during construction, operation, and closure<br>▪ increase in vehicle traffic during construction, operation, and closure<br>▪ attraction to the site may increase human-wildlife interactions and increase predator numbers<br>▪ | ▪ sensory disturbance to wildlife (e.g., noise, lights, smells, human presence) and altered behaviour and movement<br>▪ air emissions can affect the quality of soil, vegetation, and wildlife habitat<br>▪ dust deposition may cover vegetation and lead to physical damage<br>▪ dust deposition can affect the quality of soil, vegetation, and wildlife habitat<br>▪ spills on-site or along the transportation corridor may cause changes to the chemical properties of water, soil, and vegetation<br>▪ spills on-site can increase risk of mortality to individual animals which can affect wildlife population size<br>▪ collisions with vehicles may cause injury/mortality to individual animals, which can affect wildlife population size<br>▪ human-wildlife interactions can increase risk of mortality to individual animals, which can affect wildlife population size | ▪ a minimum required distance will be maintained from the location of known raptor nesting areas during sensitive periods<br>▪ construction activities for the Midwest Project will be completed outside of the breeding and migratory period for bird species (i.e. April 15 to July 31)<br>▪ if construction activities extend into the breeding and migratory period, clearing of vegetation will be done prior to spring thaw to avoid disruption of breeding activities<br>▪ for construction activities within the breeding period, a monitoring program will be developed and implemented prior to and during the construction period, which may include a pre-construction bird survey for migrants and nesting species to document the use of habitat within the Midwest Project site study area<br>▪ nest searches will be completed prior to and during the construction period and if found, AREVA will contact the Canadian Wildlife Service for any appropriate mitigation measures<br>▪ minimum setback distances, as confirmed by EC, will be implemented from active nests for song birds (30 m), waterfowl and waterbirds (100 m), short-eared owl and yellow rail (200 m), and SARA listed Rusty blackbird, olive sided flycatcher, and common nighthawk (100 m)<br>▪ organic material removed during the initial stripping activity will be stockpiled separately for use in future reclamation activities<br>▪ the Midwest site will be constructed to collect and contain contaminated and potentially contaminated waters and all water will be directed to the Midwest WTP, to eliminate or reduce potential effects to the terrestrial environment from surface runoff and seepage<br>▪ controlled blasting techniques and monitoring to ensure stability of pit walls<br>▪ waste rock from the pit development will be sampled and monitored, to ensure the materials are properly segregated<br>▪ the Midwest dewatering well and Midwest to McClean effluent pipelines are of high density polyethylene (HDPE) material and heat traced insulated<br>▪ fuel and used oil will be stored in tanks with secondary containment<br>▪ secondary containment and alarms are provided for all hazardous material storage<br>▪ hazardous wastes are shipped off-site for proper disposal<br>▪ the uranium production unit processes are housed within containment structures and internal spills have essentially no potential to harm the environment<br>▪ wet scrubbers on various air emission stacks receive regular maintenance to ensure efficient operation with minimum air emissions, thereby minimizing subsequent aerial deposition of contaminants of potential concern to terrestrial vegetation and soil<br>▪ conventional treatment of the RO brine solution will result in a reduction in loadings of COCs to the environment<br>▪ water can be stored within the S/V TEMS reservoir during periods of low flow through the watershed to ensure adequate mixing of effluent in natural creek flows;<br>▪ hydrodynamic containment will be used to prevent the release of contaminants during operation;<br>▪ special rock waste will be disposed of underwater in the mined-out pit at the end of pit development;<br>▪ food wastes are incinerated; and<br>▪ personnel must not harass wildlife in any manner, feed wildlife, or in any way encourage the presence of wildlife in area near residences or work places. |
| Human Environment | ▪ mine surface footprint, transportation corridor, and pipeline;<br>▪ vehicle and heavy equipment operation<br>▪ explosives use for blasting<br>▪ general construction, operation, and closure works | ▪ alteration of landscape<br>▪ disturbance or loss of heritage resources<br>▪ workforce and procurement requirements of the Project<br>▪ increase in traffic<br>▪ decrease in surface water levels and quality<br>▪ air emissions from power generation, vehicles, machinery<br>▪ sensory disturbance (e.g., odours, lights) | ▪ visual impact of Project facilities<br>▪ reduction in number of undisturbed sites of cultural importance<br>▪ increase in employment and business opportunities<br>▪ increase in education and training<br>▪ increase in labour income<br>▪ increase in economic activity in nearby communities/region<br>▪ nuisance to human populations due to increase in noise or dust emissions<br>▪ reduced road safety<br>▪ deterioration of road surface<br>▪ effects of changes to air, water, soil, vegetation quality and aquatic and terrestrial VEC exposure on human health<br>▪ changes in air quality, with possible effects on human health | ▪ the IQMS implemented at the McClean Lake Operation will be adapted to the Midwest Project<br>▪ the Midwest Project will be incorporated into the McClean Lake Operation Occupational Health and Safety Program<br>▪ the proposed transportation corridor will divert traffic between the Midwest site and McClean Lake Operation and reduce the traffic along portions of Provincial Road 905<br>▪ the transportation corridors will be properly maintained and watered when conditions dictate to ensure safe hauling conditions<br>▪ drivers will be trained on road safety and speed limits will be posted and enforced<br>▪ transportation corridor surfaces will be graded on a regular basis to ensure runoff is directed towards the drainage ditches<br>▪ the pipeline will follow the transportation corridor, thus reducing the amount of habitat disturbed<br>▪ the Midwest site will be constructed to collect and contain contaminated or potentially contaminated waters and all water will be directed to the Midwest WTP, to eliminate or reduce potential effects to the human environment from surface runoff and seepage<br>▪ existing on-site roads will be used as much as possible<br>▪ barriers appropriate to the situation will be constructed to limit access by non-authorized vehicles at the intersection of non-operational trails and access points along the transportation corridor<br>▪ a layered approach to stockpile construction will be followed to increase the overall stockpile stability<br>▪ catchments will act as a slope break and minimize erosion caused by surface runoff<br>▪ the access ramp will allow the safe passage of two mining trucks without the need for turnouts<br>▪ roadside pull-outs on the transportation corridors will be used to enhance road safety when vehicles are passing<br>▪ vertical curves will be designed to provide adequate stopping distances throughout the length of the vertical curve<br>▪ water flows can be readily isolated to prevent radon exposure to workers<br>▪ open pit mining allows natural ventilation and increased distances between workers and ore<br>▪ controlled blasting techniques and monitoring to ensure slope stability of pit walls |

| Environmental Component | Project Component/Activity | Project-Environment Interactions | Potential Environmental Effects | Commitments, Mitigation Practices and Best Management Practices |
|---|---|---|---|---|
| | | | and/or visual aesthetics | ▪ waste rock from the pit development will be sampled and monitored, to ensure the materials are properly separated<br>▪ conventional treatment of the RO solution will result in a reduction in loadings of constituents of concern to the environment<br>▪ the uranium production unit processes are housed within tertiary containment structures and internal spills have essentially no potential to harm the environment<br>▪ wet scrubbers on air emission stacks receive regular maintenance to ensure efficient operation with minimum air emissions<br>▪ water can be stored within the S/V TEMS reservoir during periods of low flow through the watershed to ensure adequate mixing of effluent in natural creek flows<br>▪ hydrodynamic containment will be used to prevent the release of contaminants during operation |
| Human Environment (cont'd) | | | | ▪ addition of reagents to tailings reduces long-term source contaminant concentrations<br>▪ special rock waste will be disposed of underwater in the mined-out pit at the end of pit development<br>▪ fishing by personnel working at the McClean Lake Operation and/or Midwest site is only allowed on designated lakes within the McClean Lake Operation with certain restrictions (i.e. only one boat is allowed on each lake at a time, barb-less hooks must be used, and only one of each species can be kept per person per week)<br>▪ all personnel of the Midwest Project and/or McClean Lake Operation must hold a valid fishing licence, except where exempted by law<br>▪ personnel must not harass wildlife in any manner, feed wildlife, or in any way encourage the presence of wildlife in area near residences or work places |
| Malfunctions and Accidents | ▪ hazardous waste spillage<br>▪ stack scrubber failure<br>▪ acid plant malfunction<br>▪ ore spillage<br>▪ release of off-specification effluent<br>▪ release of contaminants from ore stockpiles<br>▪ power outage<br>▪ extended interruption<br>▪ fire in process plant<br>▪ failure of Sink Reservoir<br>▪ malfunction of S/V TEMS<br>▪ spills from external pipelines<br>▪ pit slope failure<br>▪ erosion along haulage road<br>▪ erosion from dewatering<br>▪ culvert blockage from debris<br>▪ leakage from exterior ponds<br>▪ flooding from intense precipitation | ▪ direct and indirect effects | ▪ direct and indirect effects from accidents and malfunctions may result in changes (e.g., physical or chemical) to the biophysical environment | ▪ routine monitoring and inspections<br>▪ adequate preventative maintenance<br>▪ limit maximum haul load<br>▪ the Midwest site will be constructed to collect and contain contaminated or potentially contaminated waters and all water will be directed to the Midwest WTP to eliminate or reduce potential effects from surface runoff and seepage<br>▪ emergency power supply<br>▪ concrete berms are placed around all storage vessels<br>▪ the mill design features such as floor grading and sump collection provide protection from spills into the environment<br>▪ spill response plans are in place<br>▪ exterior piping will be heat traced and insulated to prevent freezing<br>▪ dewatering wells will be equipped with monitoring instrumentation/equipment<br>▪ in the event of an intense precipitation event overflow from site catchments will report to the pit<br>▪ effluent lines are monitored on a regular basis<br>▪ routine liner inspections and maintenance<br>▪ groundwater monitoring stations are used to detect deterioration of groundwater quality<br>▪ monitoring of receiving water chemistry and limiting discharges from S/V TEMS<br>▪ dual containment for exterior pipelines carrying contaminated water<br>▪ secondary containment for hazardous substance and waste dangerous goods storage tanks<br>▪ hazardous substance and waste dangerous goods storage facilities are equipped with high level alarms to prevent over filling<br>▪ mine facility ponds will be constructed with dual containment and leak detection<br>▪ fire protection systems<br>▪ large sized culverts will be installed to reduce potential for build up of debris that may obstruct flow at the inlet<br>▪ regular monitoring for indications of physical degradation of the natural stream course<br>▪ there will be a number of drain points at low points along the pipeline, complete with berm style containment areas to drain the line in the event of an extended interruption<br>▪ containment ponds will be located at regular intervals along the transportation corridor to provide temporary containment of water for the purpose of preventing excess erosion<br>▪ water can be stored within the S/V TEMS reservoir during periods of low flow through the watershed to ensure adequate mixing of effluent in natural creek flows |

**Table 9-4** Definitions of Criteria Used in the Determination of Significance

| Magnitude | Geographic Extent | Duration | Reversibility | Frequency | Likelihood | Context | |
|---|---|---|---|---|---|---|---|
| | | | | | | Ecological Considerations | Socio-Economic and Human Environment |
| **Negligible:**<br>No detectable or measurable change from existing environment values<br>**Low:**<br>Effect is within the range of natural variance or existing environment values; is less than reference criteria or guidance values; less than 10% of the particular habitat is lost within the local assessment boundary<br>**Moderate:**<br>Effect is at or slightly above the limits of natural variation or existing environment values; is at or slightly above reference criteria, or guideline values; 10 to 20% of the particular habitat is lost within the local assessment boundary<br>**High:**<br>Effect exceeds the upper or lower limit of natural variation or existing environment values; exceeds reference criteria, or guideline values; greater than 20% of the particular habitat is lost within the local assessment boundary | **Site:**<br>Effect is limited in spatial extent and is localized within the site assessment boundary<br>**Local:**<br>Effect is beyond the site assessment boundary but within the local assessment boundary<br>**Regional:**<br>Effect extends beyond the local assessment boundary | **Short-term:**<br>Effect occurs over a period of days to weeks<br>**Medium-term:**<br>Effect occurs during construction, operation, decommissioning, and/or the near-term post decommissioning period (tens of years)<br>**Long-term:**<br>Effects manifest in post decommissioning period (within thousands of years) | **Reversible:**<br>Effect is transient for duration outlined, beyond which, with or without reclamation, conditions will approach baseline<br>**Irreversible:**<br>Effect, with respect to habitat loss or chemical perturbation, will persist and a return to baseline-like conditions is not anticipated, even with reclamation | **Isolated:**<br>Occurs on one occasion<br>Periodic: occurs intermittently on more than one occasion<br>**Continuous:**<br>Continuous occurrence | **Unlikely:**<br>Effect is unlikely to occur based on outcome of risk assessment or planned infrastructure development<br>**Likely:**<br>Effect is reasonably expected to occur based on outcome of risk assessment or planned infrastructure development<br>**Highly Likely:**<br>Effect is highly likely to occur based on outcome of risk assessment or planned infrastructure development | **Negligible:**<br>Effect is not anticipated to result in changes in ecosystem structure or function<br>**Level I:**<br>Effect not anticipated to result in changes in ecosystem structure but individuals within populations maybe affected<br>**Level II:**<br>Effect anticipated to result in changes to both ecosystem structure and function; or where habitat disruption occurs, an altered or alternative ecosystem may develop with reclamation<br>**Level III:**<br>Effect anticipated to rare or endangered species | **Negligible:**<br>No implications to human health, well being or quality of life, including traditional, economic, recreational or archaeological resources<br>**Level I:**<br>No implications to human health, well being or quality of life, including economic, recreational or archaeological resources, but some types of restriction on land use, and/or change in aesthetics; potential effects on individuals within populations of traditional resources<br>**Level II:**<br>Implications to human health, well being or quality of life, including economic, recreational and/or archaeological resources; potential population level effects on traditional resources |

# 9.2 Potential Effects of the Project on the Environment

## 9.2.1 Atmospheric Environment

### *9.2.1.1 Air Quality*

Potential Effects

Air emissions ($SO_2$, $NO_2$, TSP, radon, dust, metals, and greenhouse gases) can affect air quality and have the potential to result in residual effects on receptors within the environment (e.g. aquatic habitat quality, surface water and sediment quality, soil quality, vegetation quality, and wildlife habitat quality). There is also a potential risk to human health through plant and animal exposure to air emissions from Project activities (see section 9.2.6). Potential effects from the Midwest Project activities on air quality are associated with the construction, operation, and decommissioning phases of the Project.

Prediction

The assessment of Midwest Project interactions with air quality were evaluated using air dispersion modelling. The highest concentrations of TSP, $NO_2$ and $SO_2$ are predicted to be at the active working areas of mining operations, including the Midwest site, JEB Mill and acid plant, and Sue site, where vehicle emissions play a dominant role.

Concentrations are predicted to decrease rapidly with distance from these areas and are predicted to be well below the reference levels. Air quality is predicted to remain within federal and provincial air quality guidelines.

***$NO_2$ and $SO_2$ Concentrations***

Predicted $NO_2$ and $SO_2$ concentrations at the JEB permanent camp and the Points North Landing, the closest receptors associated with the Midwest Project beyond the surface lease boundary were compared to federal and provincial air quality standards (Appendix B). The maximum incremental short-term (1-hour and 24-hour) and mean annual concentrations are predicted to be below the federal and provincial air quality standards.

Predicted $NO_2$ and $SO_2$ levels from the haulage of ore from the Midwest site to the JEB Mill are also predicted to be below federal and provincial air quality standards.

### *Radon, Dust and Metal Concentrations*

Annual radon-222 concentrations will be highest near the Midwest pit, at approximately 20 $Bq/m^3$, less than the concentration that would typically result in an annual effective dose of 1 mSv (specified in the CNSC *Radiation Protection Regulations* as 60 $Bq/m^3$). Predicted annual average concentrations of uranium, arsenic, nickel, copper, molybdenum, selenium, cobalt, lead, and zinc are all predicted to be well below acceptable provincial and federal limits at all receptor locations beyond the surface lease boundary.

Although air quality effects are expected to remain within federal and provincial requirements, the effects of dispersion of airborne metals, radionuclides and dust were evaluated for potential effects on terrestrial and aquatic VECs, including humans, in the sections below.

### *TSP Concentrations*

Haulage of ore from the Midwest site to the JEB Mill is predicted to result in the occasional exceedance of the 24-hour air quality standard for TSP. However, the TSP will be localized and is predicted to decrease below the 24-hour standard within 250 m from the road. The mean annual TSP emission estimates are predicted to be within acceptable provincial limits. Effects of vehicle traffic along the transportation corridor on $SO_2$ and $NO_x$ levels in the study area are predicted to be negligible.

### *Greenhouse Gas Emissions*

There will be an incremental effect of the Midwest Project on greenhouse gas emissions. Direct mining activities from the Midwest Project are estimated to contribute 17,470 tonnes of $CO_2$ equivalent or 0.08% of the Saskatchewan (2006) provincial GHG emissions estimate of 22,522,481 tonnes of $CO_2$ equivalent. With the McClean Lake Operation, camp facilities and the JEB Mill included, the total $CO_2$ equivalent will increase to approximately 42,855 tonnes or 0.19% of Saskatchewan's estimated emissions in 2006.

Mitigation Measures

Specific mitigation measures to reduce dust deposition and air emissions include:

- dust generation will be minimized by maintaining and watering roads
- use of controlled blasting techniques
- use of dust suppression measures
- dust and radon monitoring will be undertaken during mining to ensure workers and nearby residents are not exposed to undue high levels of radon
- drivers will be trained with respect to road safety and speed limits will be posted and enforced to minimize dust

A list of AREVA's commitments, mitigation practices, and best management practices to minimize the effects on the atmospheric environment are further described in table 9-3.

Residual Effects and Significance

Although air quality effects are expected to remain within federal and provincial requirements, changes to air quality from air emissions and dust deposition during construction, operation, and decommissioning was considered a potential residual effect.

Residual adverse effects to air quality are expected to be low in magnitude, local in geographic extent and limited to within the local assessment boundary. The duration of the effect will be medium-term, occurring on a continuous basis during the construction, operation, and decommissioning periods. With cessation of activities, air quality will return to baseline-like conditions; therefore, the effects are considered reversible. The effects will have negligible ecological, socio-economic and human health implications and will not result in changes in the structure and function of ecosystems, nor will they have an effect on individuals within populations. As such, adverse residual effects to air quality from the Midwest Project are considered to be not significant.

Although air quality effects from the Midwest Project are considered not significant, the contribution of airborne loadings of metals, radionuclides, and radon on terrestrial and aquatic VECs is discussed below.

Conclusions

In reaching a conclusion on the significance of the potential environmental effects on air quality, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the Midwest Project is not likely to cause significant adverse environmental effects to the atmospheric environment.

#### *9.2.1.2 Noise*

Potential Effects

Emissions from construction and maintenance vehicles at both the Midwest site and on the transportation corridor have the potential to affect noise levels during the construction, operation and decommissioning phases of the Midwest Project. There is also a potential risk to human health through increased noise levels from Project activities.

Prediction

Noise levels are predicted to be elevated during blasting, hauling and general mining operations.

Mitigation Measures

Specific mitigation measures to reduce noise emissions include:

- use of appropriate exhaust mufflers
- controlled blasting techniques

- equipment noise sources will be limited by locating them inside buildings, where practical
- continue to implement the hearing conservation program as part of the Occupational Health and Safety Program to minimize the effects of noise on workers

A list of AREVA's commitments, mitigation practices, and best management practices to minimize the effects on the atmospheric environment are further described in table 9-3.

Residual Effects and Significance

Increases in ambient noise levels as a result of the Midwest Project can lead to indirect effects to VECs, particularly wildlife movement and behaviour and the traditional use of these species. The effect is considered low in magnitude and limited to the local assessment boundary. The effect is reversible, as noise levels are anticipated to return to baseline conditions after decommissioning activities cease. Sensory disturbance from noise may influence individual wildlife but population influences are not anticipated.

Although noise emissions from the Midwest Project are considered not significant, the contribution of noise on wildlife movement and behaviour is discussed below.

Conclusions

In reaching a conclusion on the significance of the potential environmental effects on noise, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the Midwest Project is not likely to cause significant adverse environmental effects to the atmospheric environment.

## 9.2.2 Geological/Hydrogeological Environment

### *9.2.2.1 Groundwater Quality*

Potential Effects

Groundwater quality (e.g. radiological and chemical releases) may be affected by the development of the mine pit, the excavation and haulage of ore, the storage of ore, and the stockpiling of special waste rock.

Prediction

Post-operational effects are predicted with the release of COCs from the stockpiles (ore and special waste) to the surrounding groundwater and the transport of COCs to surface waters by groundwater flows.

Mitigation Measures

Specific mitigation measures to reduce the long-term transport of COCs in groundwater include:

- sampling and monitoring of waste rock will be conducted to ensure proper classification and separation of materials
- infrastructure will be designed to collect runoff and prevent release of contaminants

A list of AREVA's commitments, mitigation practices, and best management practices to reduce effects on the geological and hydrogeological environment are further described in table 9-3.

Residual Effects and Significance

Residual effects are anticipated from the disposal of Midwest waste rock and special waste rock and the long-term transport of COCs in groundwater to surface waters. It is anticipated that these long-term residual effects will persist into the post-decommissioning period. The effect is limited to the local assessment boundary. Changes to groundwater quality from the long term transport of COCs from the submerged waste rock in the Midwest pit are anticipated to occur in a deep zone in the sandstone near the unconformable contact with the basement rock. Due to its depth and the existence of other alternative sources of water from surface water bodies and shallower aquifers, the potential use of the affected hydrogeological unit as a future water source would be small and adverse effects on surface water quality is anticipated to be reversible in the long-term. Changes to surface water quality from the long-term transport of COCs are anticipated to be below SSWQO and will not alter ecosystem structure or function. The effects from changes in groundwater quality are expected to have a negligible effect on human health, well being and traditional resources. The residual adverse effects from the Midwest Project on the long-term transport of COCs are considered not significant.

Conclusions

In reaching a conclusion on the significance of the potential environmental effects on groundwater quality from the long-term transport of COCs, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the Midwest Project is not likely to cause significant adverse environmental effects to the geological/hydrogeological environment.

#### *9.2.2.2 Groundwater Levels and Drawdown of Lake Levels*

Potential Effects

Total groundwater inflow to the proposed open pit will be approximately 25,000 $m^3/d$ and will require significant dewatering efforts. Open pit dewatering will result in the development of a sink in the groundwater regime, which will induce water movement from nearby surface waterbodies. The Midwest pit will be actively dewatered for five years.

Prediction

Mine dewatering activities are predicted to result in depressed groundwater levels in the immediate vicinity of the Midwest pit during the active mining period when dewatering activities are taking place, resulting in groundwater movement towards the pit. The radius of influence is predicted to extend approximately 3 to 4 km.

For the Midwest Project, the three potentially most impacted lakes are: Too Small Lake, Shallow Lake and South McMahon Lake. The maximum predicted impact is to Too Small Lake where the lake is predicted to be fully drained after four years of pit dewatering. For Shallow Lake and South McMahon Lake, the predicted drawdown range is from approximately 0.60 m to 1.60 m, respectively, and these lakes are not predicted to be fully drained. These predictions are considered conservative.

Fluctuations in lake levels have the potential to harmfully alter or reduce the amount of available fish habitat and also have the potential to indirectly impact navigation.

Mitigation Measures

Specific mitigation measures to reduce impacts resulting from changes to groundwater flow and mitigate the potential for fish habitat alteration and impacts to navigation include:

- water surface elevation of Too Small, Shallow and South McMahon Lakes will be measured monthly during the open water season
- potentially affected lakes are currently equipped with staff gauges and these will be monitored for the purpose of monitoring water levels changes
- if lake level fluctuations are occurring in a manner inconsistent with reference lake levels and beyond the range of natural variation (0.4 m), clean RO permeate will be diverted from the water treatment process, if required. RO permeate will be diverted to the affected lakes through a temporary pipeline, which will be designed so as to not impact navigation
- prior to discharge of treated effluent into local lakes, should their water levels decline due to mining activity, a discharge point will be declared under the MMER and the effluent and receiving waters will be subject to the requirements of the MMER
- water quality in lakes affected by dewatering activities and RO additions will be regularly monitored. At the time of licensing, a baseline nutrient monitoring program will be initiated for total phosphorous and nitrogen in Too Small, Shallow and South McMahon Lakes. If phosphorous concentrations cannot be accurately measured, chlorophyll A levels will be measured instead of phosphorous
- nutrient baseline data and monitoring results will be reported to DFO. Based on the review of this data, DFO will determine if further mitigation measures are necessary and recommend a mitigation strategy. AREVA, in consultation with DFO, will implement the recommended strategy as required
- piezometers will be installed around the Midwest pit and waste rock stockpiles to monitor groundwater flow during mining

A list of AREVA's commitments, mitigation practices, and best management practices to reduce effects on the geological and hydrogeological environment are further described in table 9-3.

Residual Effects and Significance

Effects of mine dewatering activities on groundwater levels are predicted to be of high magnitude resulting in depressed groundwater levels beyond the upper limits of natural variation but localized within the local assessment boundary. The potential effects are anticipated to last throughout the active mining period, following which dewatering will cease and the groundwater system will recover to natural conditions, thus the effects are considered reversible. Mine dewatering activities will result in depressed groundwater levels in the immediate vicinity of the Midwest pit for a short period of time; however, changes are not anticipated to affect surface water quantity in the local assessment boundary. Changes in groundwater flow are expected to have a negligible effect on socio-economic and human environment considerations (human health, quality of life, traditional resources). The residual adverse effects from the Midwest Project on changes to groundwater levels are considered not significant.

Changes in lake levels due to dewatering have the potential to alter fish habitat, cause sediment oxidation and contaminant mobilization, and indirectly impact navigation. Lakes levels will be monitored during the Midwest pit development and should the influence of dewatering on local lake levels become apparent, an operational contingency has been developed whereby high quality RO permeate will be discharged to local lakes (Too Small, Shallow and/or South McMahon Lakes), if required. Changes in local lake levels from mine dewatering activities are predicted to be low in magnitude and limited to the local assessment boundary, as mitigation practices and contingency measures are available at the Midwest site to offset the effects of dewatering and maintain local lake levels within the range of natural variation. The effect to local lake levels will be throughout the active mining period. When dewatering activities cease, the potential influence of dewatering on local lake levels and the potential impacts to fish habitat, sediments and contaminants, and navigation will be removed, therefore, the effect is considered reversible. As monitoring will be conducted and contingencies implemented if required, the residual adverse effects from the Midwest Project from changes to lake levels are considered not significant.

Conclusions

In reaching a conclusion on the significance of the potential environmental effects on groundwater and lake levels, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the Midwest Project is not likely to cause significant adverse environmental effects to the geological/hydrogeological environment.

#### *9.2.2.3 Loss of Drainage Areas*

Potential Effects

The dewatering of Mink Arm will result in a permanent reduction of the effective drainage of the Smith Creek watershed, which includes Midwest Creek. As a result, runoff, streamflow and water levels within the watershed could be reduced, which could negatively affect fish habitat.

Prediction

The dewatering of Mink Arm will result in a permanent reduction of approximately 25% of the effective drainage of Midwest Creek and a reduction of approximately 0.064 $m^3/s$ in the mean annual flow of the creek.

Midwest Creek is a short creek with a catchment area of less than 10 $km^2$ and a mean annual flow of approximately 0.19 $m^3/s$. Streamflow data suggest that the creek may routinely cease to flow during dry periods. The creek likely provides poor fish habitat for most of the year, with higher value habitat provided during spring runoff when the creek would provide spawning habitat for spring-spawning species. Suckers have been observed in the creek during the spring freshet. Reductions in streamflow that are associated with a reduced catchment area would likely have a minimal effect on fish habitat, since normal high spring flows would be relatively unaffected by flow reductions associated with the reduced catchment area compared to streamflow at other times of the year. Flow reductions in Midwest Creek should not appreciably affect water levels or fish habitat in North McMahon Lake.

The effective drainage of Smith Creek, downstream of North McMahon Lake will be reduced by 2 to 3%. This change is not expected to appreciably affect water levels or fish habitat in North McMahon Lake or fish habitat in Smith Creek.

Mitigation Measures

Specific mitigation measures to reduce changes to drainage areas include:

- a monitoring program will be in place during periods of increased flow during dewatering in order to reduce the likelihood of channel and floodplain degradation at Midwest Creek. This will consist of weekly visual inspections along the stream, removal of accumulated woody debris, and measurement of stage and discharge

A list of AREVA's commitments, mitigation practices, and best management practices to reduce effects on the geological/hydrogeological environment are further described in table 9-3.

Residual Effects and Significance

The effects resulting from the loss of Mink Arm and the effects these losses may have on flows in Midwest Creek and Smith Creek are considered a residual effect.

As the effective drainage area of Midwest Creek and Smith Creek will be reduced by the Midwest Project and will result in the permanent loss of the Mink Arm portion of South McMahon Lake, the effects are considered irreversible. The effect is considered low in magnitude, as water levels will be monitored and contingency measures implemented, if necessary. The effects will occur within the local assessment boundary. The frequency

is considered isolated, as the loss of drainage areas will occur once during construction. Although the changes to the drainage area of Midwest and Smith Creek are not anticipated to affect surface water quantity in the downstream receiving environment, changes to individuals within populations may be affected (Level 1). The effects from changes in drainage areas are expected to have a negligible effect on human health, well being and traditional resources. The adverse residual effects of the Midwest Project on loss of drainage areas are considered not significant.

Conclusions

In reaching a conclusion on the significance of the potential environmental effects on loss of drainage areas, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the Midwest Project is not likely to cause significant adverse environmental effects to the geological/hydrogeological environment.

## 9.2.3 Aquatic Environment

### *9.2.3.1 Aquatic Habitat and Aquatic Biota*

Potential Effects

Effects to aquatic habitat may result from changes in surface water flows, drainage patterns, water levels of local water bodies, and the stability of stream channels. The construction of stream crossings may result in sedimentation of streams from construction activities and erosion from disturbed sites, changes in channel morphology due to alterations in streamflow during construction, or improperly designed or installed stream crossing structures, the replacement of natural substrates by stream crossing structures, the permanent loss of fish habitat from channel infilling, and short-term or long-term impacts on fish passage from construction activities or improperly designed or installed stream crossing structures. Air emissions, dust deposition and the release of treated effluent may negatively affect the quality of aquatic habitat. Surface water runoff and associated soil erosion may negatively affect surface water quality, aquatic habitat, and aquatic biota. Spills of deleterious substances on-site or along the transportation corridor may negatively affect fish habitat and increase the risk of mortality to fish.

Prediction

Air emissions are predicted to be within acceptable provincial and federal limits at all discrete receptor locations beyond the surface lease boundary (i.e. the site assessment boundary) and emissions will be controlled when conditions dictate. As such, the effects from air emissions and dust deposition on aquatic habitat and aquatic biota will be confined to the site assessment boundary, with negligible effects on adjacent habitat. Therefore, the effects are not carried forward to the residual effects assessment.

Chemical spills will be localized and low in frequency. With the implementation of the McClean Lake Operation Emergency Preparedness and Response Plan, the predicted effects to aquatic habitat and aquatic biota are predicted to be negligible. As such, effects from spills on-site are not carried forward to the residual effects assessment.

It is predicted that Mink Arm can be dewatered with minimal impacts to South McMahon Lake and the downstream receiving environment, as water quality between Mink Arm and South McMahon Lake will be managed to maintain SSWQO and the rate of discharge from Mink Arm through Midwest Creek will be subject to flow constraints and regular monitoring.

Local lake levels may be reduced during the Midwest pit dewatering but an operational contingency to discharge high quality RO permeate to lakes that are drawn down beyond the zone of normal fluctuation will offset the impacts resulting from reduced lake levels, thereby avoiding the HADD of fish habitat. As such, changes in local lake levels on fish habitat are not carried forward to the residual effects assessment.

Open pit mine development is predicted to result in the HADD of fish habitat as reinforcement of the existing Mink Arm dam and the subsequent dewatering of Mink Arm will be required. The installation of culverts at stream crossings is also predicted to result in the HADD of fish habitat. Approximately 51 ha of Mink Arm and 662 $m^2$ (north route) or 680 $m^2$ (south route) of aquatic habitat will be lost through the development of the Midwest Project.

Mitigation Measures

Specific mitigation measures to reduce effects to aquatic habitat and aquatic biota include:

- fish habitat losses are anticipated as a result of the Midwest Project that cannot be mitigated or otherwise avoided. AREVA has developed a FHCP which outlines a habitat compensation program to address the DFO policy objective of no net loss of fish habitat productive capacity (Appendix C). The FHCP will become part of an Authorization for the HADD of fish habitat resulting from the Midwest Project
- any works in navigable waterways for the purpose of the FHCP will be approved under the NWPA
- the existing Mink Arm dam will be used to minimize fish habitat loss in Mink Arm
- all upgrades and/or repairs to the exiting Mink Arm dam (including the secondary retention dam) will be undertaken on the Mink Arm side of the dam to minimize habitat loss in South McMahon Lake
- the intake pipe in Mink Arm will be situated in the deepest part of the water body and suspended off the bottom of the lake bed to prevent fish entrapment and entrainment of suspended particulates
- during the dewatering of Mink Arm, the maximum rate of discharge through Midwest Creek will normally be 0.17 $m^3/s$ – the mean annual flood. If dewatering occurs during a wet year, flows through Midwest Creek will not exceed 0.3 $m^3/s$, which is the calculated 1 in 10 year return flow

- during higher flow periods, a monitoring program will be implemented during dewatering in order to reduce the likelihood of channel or floodplain degradation at Midwest Creek. The program will consist of weekly visual inspections along the creek, the removal of accumulated woody debris where required, and the measurement of stage and discharge
- the discharge pipeline into South McMahon Lake will be terminated far from the shoreline to minimize the potential for the disruption of fish habitat and scour lakebed sediments
- DFO guidelines to prevent the HADD of fish habitat will be followed
- the discharge pipeline will be equipped with a diffuser to minimize velocities at the outlet
- water intake and discharge locations and the quantity and quality of the water discharged will be controlled to reduce the potential HADD of fish habitat during dewatering of Mink Arm
- during the dewatering of Mink Arm, a daily water sample will be collected and measured for pH, TSS and conductivity. If TSS exceeds 29 mg/L, water will be directed to the Midwest WTP instead of being released to South McMahon Lake in order to protect aquatic biota in South McMahon Lake
- appropriate 90 m buffer zones around fish habitat and placement of rip-rap or other barriers to prevent erosion and sedimentation will be implemented to reduce the potential effects of aquatic habitat during construction
- construction activities will be scheduled to avoid spawning times of resident fish species
- in-stream work will be scheduled during low flow periods and in accordance with DFO's construction timing windows to minimize erosion and prevent harm to fish
- erosion and sediment control measures will be applied to prevent discharge of sediments into fish bearing waterbodies
- stream crossings will be designed to meet DFO fish passage requirements
- as per DFO's operational protocol for Saskatchewan In-Water Closed Construction Timing Windows, waterbodies in northern Saskatchewan with no lake sturgeon present, no in-water works are to occur from May 1st to July 15th without site- or project-specific review by DFO. If release of Mink Arm water to South McMahon Lake occurs during this time period, AREVA will work with DFO to develop acceptable criteria for water release
- a fish removal and transfer program will be undertaken to capture and transfer fish from Mink Arm to South McMahon Lake prior to dewatering
- the Emergency Preparedness and Response Plan will be implemented to reduce the potential effect on fish from spills

A list of AREVA's commitments, mitigation practices, and best management practices to reduce effects on the aquatic environment are further described in table 9-3.

### *Fish Habitat Compensation Plan*

In consultation with DFO and the SMOE, AREVA has determined that the preferred compensation option is to restore connectivity at the Montreal River weir while maintaining the existing weir's spill elevation by creating a pool and riffle fishway and stabilizing the existing weir. The Montreal River weir is located approximately 20 km north of Montreal Lake. Montreal Lake is a 45,000 ha lake that supports provincially-important subsistence, sport and commercial fisheries (figure 9-1). Details of the physical aspects of the FHCP will be determined at the Midwest Project licensing stage with the regulatory agencies. A specific date for commencement of the Montreal River weir habitat compensation plan is not known, as AREVA's decision to proceed with the Midwest Project is linked to market conditions. A summary of the conceptual FHCP is attached in Appendix C.

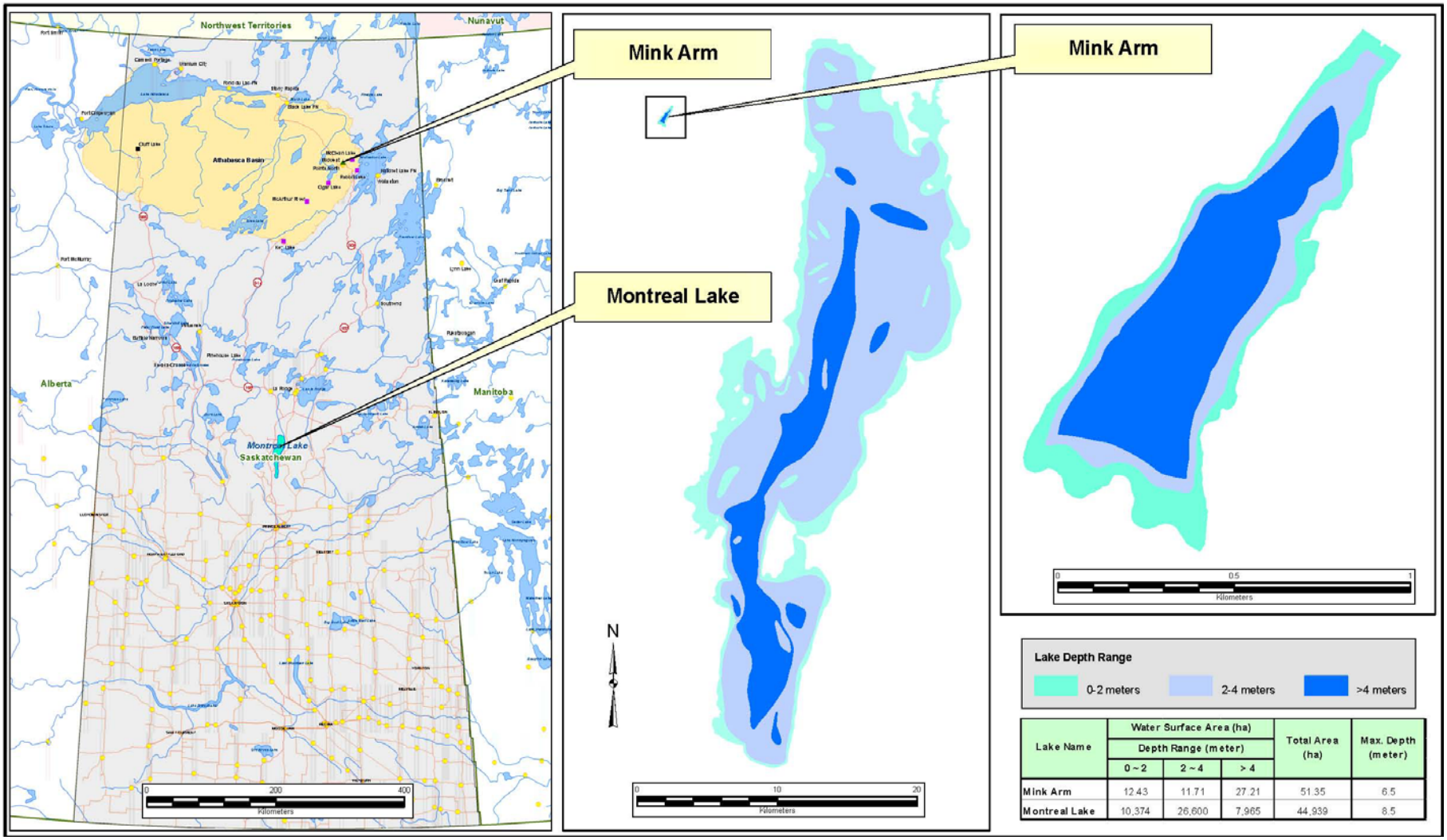
Residual Effects and Significance

Although there will be a permanent loss of fish habitat from the development of the Midwest Project, the effect is considered reversible, as the no net loss guiding principle of DFO and the consequent development of a FHCP will enhance fish habitat elsewhere. The proposed habitat enhancement at the Montreal River weir will compensate for the permanent loss of aquatic habitat, changes to aquatic habitat quantity and the ability to support fish populations. The effects of habitat loss are considered low in magnitude with the development of a habitat compensation plan and local in geographic extent. The frequency of occurrence for the effect is isolated, as the loss of habitat will occur once during construction and fish habitat enhancement will occur once during the life of the Project. The loss and subsequent enhancement of fish habitat may have a Level 1 effect on ecological considerations as individuals within populations may be affected but the effect is not anticipated to result in changes in the capacity of the local assessment boundary to support fish populations. Although the alternative ecosystem will have a modified structure and function, the socio-economic and human environment implications are considered negligible. The adverse residual effects of the Midwest Project on the capacity of aquatic habitat and the effect on aquatic biota are considered not significant.

Conclusions

In reaching a conclusion on the significance of the potential environmental effects on aquatic habitat and aquatic biota, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), including the requirement for a section 35(2) Authorization under the *Fisheries Act* and the conceptual FHCP (Appendix C), the SMOE and the RAs are satisfied that the Midwest Project is not likely to cause significant adverse environmental effects to the aquatic environment.




| Lake Name | Water Surface Area (ha) | | | Total Area (ha) | Max. Depth (meter) |
|---|---|---|---|---|---|
| | Depth Range (meter) | | | | |
| | 0 ~ 2 | 2 ~ 4 | > 4 | | |
| Mink Arm | 12.43 | 11.71 | 27.21 | 51.35 | 6.5 |
| Montreal Lake | 10,374 | 26,600 | 7,965 | 44,939 | 8.5 |

**Figure 9-1** Proposed Fish Habitat Compensation Plan Location Relative to the Midwest Project Site

#### *9.2.3.2 Surface Water Quality Downstream of Treated Effluent Release*

Potential Effects

The release of treated effluent may affect COC concentrations in water quality in the S/V TEMS and downstream in the receiving environment (McClean Lake and Collins Creek).

Effects to aquatic VECs (phytoplankton, zooplankton, macrophytes, benthic invertebrates, and predatory and bottom-feeding fish) may result from the dispersion of COCs (radionuclides and non-radionuclides) from treated effluent discharge downstream of the S/V TEMS.

Prediction

The predicted maximum mean and maximum 95$^{th}$ percentile water concentrations of non-radionuclide and radionuclide COCs in the S/V TEMS and downstream are outlined in table 9-5. The table also presents temporal variations by considering selected years during the operational and decommissioning period. Years considered included 2010 (early operation), 2030 (mid-operation), 2045 (end operation), 2056 (last year of WTP operation), and 2100 (post-decommissioning).

It is recognized that through bioaccumulation in the food chain, small increases in waterborne selenium can result in a disproportionate elevation of selenium in fish tissue. As such, there is the potential for selenium fish tissue concentrations to exceed toxicity benchmarks. The toxicity benchmarks indicate that at water concentrations of greater than between 1 and 5 µg/L, fish and waterfowl may have the potential to experience reproductive failure or mortality depending on the level of incorporation of selenium into the foodchain. This has been and will continue to be carefully monitored at this site as part of a specialized follow-up program to prevent the accumulation of selenium to levels of concern that have occurred in historical sites and operating sites with unregulated selenium releases.

SI values were predicted for aquatic VECs by comparing predicted maximum average and 95$^{th}$ percentile water concentration of non-radionuclide COCs at the S/V TEMS and downstream to toxicity benchmarks.

Effects of radionuclide exposure on aquatic VECs were evaluated by comparing water concentrations to the dose rate guidelines (Appendix B). A SI value of greater than one indicated that the dose rate guideline for an aquatic receptor was exceeded. The predicted maximum radionuclide concentrations in water and sediment were used.

**Table 9-5** Predicted Maximum Mean and 95th Percentile Water Quality Concentrations and Year of Occurrence - Midwest Project

| Constituent of Concern | Water Quality Objectives | Mean Baseline Concentration | Maximum Predicted Mean and 95th Percentile Concentrations and Year of Occurrence at Locations Downstream of Treated Effluent Release | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sink Reservoir | | | | Vulture Lake | | | | McClean Lake East Basin | | | | Kewen Lake Inlet | | | |
| | | | Mean | Year | 95th %tile | Year | Mean | Year | 95th %tile | Year | Mean | Year | 95th %tile | Year | Mean | Year | 95th %tile | Year |
| Total Ammonia (mg/L) | 1.54[b] | 0.058 | 9.24 | 2031 | 15.6 | 2031 | 6.84 | 2041 | 9.08 | 2041 | 0.93 | 2009 | 1.38 | 2009 | 0.56 | 2006 | 0.84 | 2009 |
| Chloride (mg/L) | - | - | 39.4 | 2034 | 46.0 | 2031 | 29.6 | 2042 | 33.1 | 2042 | 4.7 | 2009 | 5.7 | 2009 | 2.9 | 2009 | 3.5 | 2009 |
| Sulphate (mg/L) | - | - | 877 | 2041 | 1070 | 2025 | 656 | 2042 | 755 | 2025 | 75 | 2009 | 94 | 2009 | 44 | 2009 | 55.9 | 2009 |
| TDS (mg/L) | - | - | 1010 | 2040 | 1670 | 2040 | 733 | 2041 | 932 | 2025 | 99.6 | 2009 | 139 | 2005 | 59.1 | 2006 | 82.8 | 2009 |
| Arsenic (ug/L) | 5 | 0.5 | 12.4 | 2045 | 30.9 | 2045 | 6.37 | 2045 | 12.5 | 2044 | 2.2 | 2015 | 3.62 | 2011 | 1.49 | 2015 | 2.35 | 2009 |
| Cobalt (ug/L) | 0.4[e] | 1.0 | 2.09 | 2041 | 4.21 | 2035 | 1.47 | 2005 | 1.95 | 2045 | 1.13 | 2013 | 1.24 | 2009 | 1.08 | 2014 | 1.15 | 2009 |
| Copper (ug/L) | 2-4[d] | 2.0 | 2.44 | 2046 | 4.38 | 2045 | 2.21 | 2045 | 2.56 | 2046 | 2.03 | 2007 | 2.09 | 2015 | 2.02 | 2009 | 2.05 | 2009 |
| Lead (ug/L) | 1-7[d] | 1.0 | 1.56 | 2046 | 3.23 | 2020 | 1.23 | 2005 | 1.53 | 2020 | 1.04 | 2005 | 1.1 | 2005 | 1.02 | 2005 | 1.06 | 2006 |
| Molybdenum (ug/L) | 73[c] | 1.0 | 182 | 2007 | 390 | 2045 | 163 | 2007 | 330 | 2007 | 38.2 | 2009 | 69.2 | 2009 | 22.5 | 2009 | 40.8 | 2009 |
| Nickel (ug/L) | 25-150[d] | 1.0 | 19.7 | 2046 | 37.5 | 2043 | 13 | 2006 | 19.9 | 2045 | 3.53 | 2009 | 5.2 | 2009 | 2.47 | 2009 | 3.49 | 2009 |
| Selenium (ug/L) | 1 | 0.2 | 2.32 | 2038 | 4.75 | 2034 | 1.66 | 2043 | 2.31 | 2038 | 0.503 | 2009 | 0.662 | 2009 | 0.375 | 2009 | 0.473 | 2009 |
| Uranium (ug/L) | 15 | 0.25 | 17.05 | 2042 | 53.60 | 2030 | 7.01 | 2042 | 20.23 | 2042 | 1.938 | 2016 | 4.352 | 2009 | 1.233 | 2016 | 2.696 | 2009 |
| Zinc (ug/L) | 30 | 5.0 | 6.14 | 2015 | 8.66 | 2012 | 5.46 | 2015 | 6.36 | 2014 | 5.14 | 2014 | 5.4 | 2015 | 5.09 | 2015 | 5.25 | 2014 |
| Thorium-230 (Bq/L) | - | 0.005 | 0.015 | 2042 | 0.026 | 2042 | 0.011 | 2015 | 0.014 | 2016 | 0.007 | 2016 | 0.008 | 2016 | 0.006 | 2015 | 0.007 | 2016 |
| Lead-210 (Bq/L) | - | 0.027 | 0.035 | 2032 | 0.052 | 2019 | 0.030 | 2014 | 0.035 | 2016 | 0.028 | 2013 | 0.029 | 2009 | 0.028 | 2013 | 0.028 | 2009 |
| Radium-226 (Bq/L) | - | 0.003 | 0.011 | 2005 | 0.023 | 2020 | 0.006 | 2016 | 0.011 | 2021 | 0.004 | 2014 | 0.005 | 2014 | 0.004 | 2014 | 0.004 | 2015 |
| Polonium-210 (Bq/L) | - | 0.005 | 0.010 | 2016 | 0.020 | 2011 | 0.006 | 2013 | 0.010 | 2012 | 0.005 | 2016 | 0.006 | 2016 | 0.005 | 2016 | 0.006 | 2016 |

Note: Current licensed project predictions in bold exceed the stated objective
a = SSWQO were used where available, otherwise CCME criteria were used
b = from SSWQO at pH=7.5 and Temperature =20 degrees $C^{o}$
c = interim guideline from the Canadian Environmental Quality Guidelines
d = water hardness dependent criterion
e = British Columbia interim 30-day average concentration of total cobalt for the protection of aquatic life. No SSWQO or CCME guideline exists for cobalt
mg/L - milligrams per litre
Bq/L = Becquerel's per litre
"-" = objective not available

***S/V TEMS***

In Sink Reservoir and Vulture Lake, the maximum mean and 95$^{th}$ percentile levels are predicted to be above SSWQO and/or CCME water quality guidelines for some COCs, including total ammonia, arsenic, copper, cobalt, molybdenum, selenium, and uranium concentrations (table 9-5). Maximum water quality concentrations are generally predicted to occur at or near the end of the operational period of McClean Lake Operation (2045).

Predicted selenium concentrations downstream of treated effluent release indicate that the maximum mean and maximum 95$^{th}$ percentile concentration in Sink Reservoir approach the toxicity benchmark and decrease progressively downstream, with concentrations in Vulture Lake in the 2 to 3 µg/L range (table 9-5).

Potential effects were predicted for aquatic VECs (phytoplankton and zooplankton) from exposure to uranium, nickel, and arsenic within Sink Reservoir. However, the magnitude of effects of nickel and uranium vary as a function of water hardness, with higher water hardness reducing the effects of these COCs. Therefore, the elevated hardness of water in Sink Reservoir is predicted to minimize the potential effects of these COCs on phytoplankton and zooplankton populations.

No radiological effects are predicted to aquatic VECs in the S/V TEMS as all SI values were below one.

***McClean Lake East Basin and Collins Creek***

Concentrations of COCs were below SSWQO and CCME water quality guidelines in the receiving environment downstream of the S/V TEMS (at the outlet of McClean Lake east basin and downstream in Collins Creek), indicating the concentration of these COCs are minimally affected by the release of treated effluent.

In the McClean Lake east basin, waterborne selenium concentrations are predicted to be below the range of water concentrations expected to cause reproductive failure or mortality in either fish or waterfowl (table 9-5).

All SI values were below one in McClean Lake east basin and Collins Creek downstream, indicating no predicted impacts downstream of the S/V TEMS. No adverse residual effects are expected in the receiving environment based on water exposure.

No radiological effects are predicted to aquatic VECs in the McClean Lake or downstream as all SI values were below one.

Mitigation Measures

Specific mitigation measures to reduce changes to surface water quality include:

- conventional treatment of the RO brine solution will result in a reduction in loadings of COCs to the environment
- the Midwest site will be constructed to collect and contain contaminated and potentially contaminated waters and all water will be directed to the Midwest WTP, to eliminate or reduce potential effects from surface runoff and seepage to the aquatic environment

- water can be stored within the S/V TEMS reservoir during periods of low flow through the watershed to ensure adequate mixing of effluent in natural creek flows

A list of AREVA's commitments, mitigation practices, and best management practices to reduce effects on the aquatic environment are further described in table 9-3.

Residual Effects and Significance

***S/V TEMS***

In Sink Reservoir and Vulture Lake, predicted levels exceeded SSWQO and/or CCME water quality objectives for some COCs, which may change the surface water quality within the S/V TEMS. The effect would be limited to the S/V TEMS, as it is a localized area, and would be limited to the operational, decommissioning and post-decommissioning periods, after which water treatment plant operations will cease. The effect is considered reversible and water quality is predicted to improve in Sink Reservoir and Vulture Lake once effluent treatment is no longer required. Changes in surface water quality within the S/V TEMS has the potential to alter ecosystem structure and function (Level II), as concentrations of some COCs exceed water quality objectives. The effects are not anticipated to result in implications to human health, well being or quality of life; however some land use restrictions will apply within the surface lease during the life of the McClean Lake Operation. The adverse residual effect of the Midwest Project on surface water quality in the S/V TEMS is considered to be not significant.

Potential effects to aquatic VECs (phytoplankton and zooplankton) are predicted within the S/V TEMS. The potential for effects to aquatic VECs will be medium-term and extend into the post decommissioning period, but will be reversible following cessation of operational and decommissioning activities at the McClean Lake Operation. Surface water quality will recover naturally following cessation of operations at McClean Lake Operation, thus reducing exposure levels to phytoplankton and zooplankton VECs. The effects may alter the size and distribution of phytoplankton and zooplankton populations (Level II) but the effect will be confined to within the S/V TEMS. The effects are not anticipated to result in implications to human health, well being or quality of life; however some land use restrictions will apply within the surface lease during the life of the McClean Lake Operation. The adverse residual effect of the Midwest Project on aquatic VECs in the S/V TEMS is considered to be not significant.

***McClean Lake East Basin and Collins Creek***

Surface water quality at McClean Lake east basin and Collins Creek downstream is predicted to remain within SSWQO and CCME water quality guidelines. The effect would be limited to the local assessment boundary and during the operational, decommissioning and post-decommissioning period. The effect is considered reversible following cessation of operational and decommissioning activities and water quality are predicted to approach pre-operational conditions. Changes to surface water quality are expected to remain within federal and provincial guidelines but changes may affect individuals within populations (Level 1). Effects from surface water quality on socio-economic and human environment considerations are considered negligible. The adverse residual effect on surface water quality in McClean Lake east basin and downstream is considered to be not significant.

Potential effects to aquatic VECs (phytoplankton and zooplankton) were predicted to be low within McClean Lake east basin and Collins Creek downstream, as the exposure of aquatic VECs are less than reference criteria. Any effects would be limited to the local assessment boundary and would occur throughout the construction, operation, decommissioning and post-decommissioning periods. The effects may result in changes to individuals within populations but they are not anticipated to result in changes to ecosystem structure or function. The socio-economic and human environment considerations are considered negligible. The adverse residual effect of the Midwest Project on aquatic VECs within McClean Lake East Basin and Collins Creek downstream is considered to be not significant.

Conclusions

In reaching a conclusion on the significance of the potential environmental effects on surface water quality and the effect on aquatic VECs, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in Table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the Midwest Project is not likely to cause significant adverse environmental effects to the aquatic environment.

#### *9.2.3.3 Sediment Quality Downstream of Treated Effluent Release*

Potential Effects

The release of treated effluent may affect COC concentrations in sediment quality in the S/V TEMS and downstream in the receiving environment (McClean Lake east basin and Kewen Lake).

Effects to aquatic VECs (benthic invertebrates) may result from the dispersion of COCs (radionuclides and non-radionuclides) from sediment concentrations downstream of the S/V TEMS.

Prediction

The predicted maximum mean and maximum 95$^{th}$ percentile sediment concentrations of non-radionuclide and radionuclide COCs is outlined in table 9-6. The table also presents temporal variations by considering selected years during the operational and decommissioning period. Years considered included 2010 (early operation), 2030 (mid-operation), 2045 (end operation), 2056 (last year of WTP operation), and 2100 (post-decommissioning).

SI values were predicted for locations progressively downstream of treated effluent release (S/V TEMS, McClean Lake east basin, and Kewen Lake) to assess potential effects of sediment exposure on aquatic VECs. The results were compared against CCME sediment quality guidelines and CNSC benchmarks (Appendix B).

**Table 9-6** Maximum Predicted Sediment Concentrations of Constituents of Concern

| Constituent of Concern | Sink Reservoir | | | | Vulture Lake | | | | McClean Lake East Basin | | | | Kewen Lake Inlet | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | Year | 95th %tile | Year | Mean | Year | 95th %tile | Year | Mean | Year | 95th %tile | Year | Mean | Year | 95th % | Year |
| Arsenic (µg/g) | 317 | 2046 | 679 | 2046 | 88.4 | 2022 | 193 | 2022 | 8.3 | 2016 | 17.9 | 2016 | 5.61 | 2016 | 15 | 2017 |
| Cobalt (µg/g) | 32.1 | 2042 | 61.5 | 2046 | 12.6 | 2046 | 25.5 | 2046 | 6.8 | 2016 | 18.7 | 2013 | 6.65 | 2016 | 18.6 | 2015 |
| Copper (µg/g) | 17 | 2046 | 36.3 | 2045 | 12.5 | 2047 | 29.3 | 2045 | 10.7 | 2005 | 26.7 | 2005 | 10.7 | 2005 | 26.7 | 2006 |
| Lead (µg/g) | 20.70 | 2046 | 32.8 | 2046 | 10.0 | 2046 | 16.8 | 2046 | 6.8 | 2012 | 13.3 | 2010 | 6.73 | 2013 | 13.2 | 2005 |
| Molybdenum (µg/g) | 4890 | 2007 | 13300 | 2006 | 1240 | 2006 | 3230 | 2005 | 64.7 | 2015 | 140 | 2016 | 30.8 | 2015 | 74.9 | 2016 |
| Nickel (µg/g) | 220 | 2046 | 428 | 2046 | 93.2 | 2047 | 135 | 2046 | 22.8 | 2016 | 33 | 2017 | 14.4 | 2016 | 28.1 | 2016 |
| Selenium (µg/g) | 21.00 | 2041 | 56.3 | 2044 | 3.0 | 2046 | 7.4 | 2047 | 0.52 | 2015 | 1.42 | 2016 | 0.409 | 2015 | 1.16 | 2015 |
| Uranium (µg/g) | 560 | 2045 | 1208 | 2046 | 125 | 2046 | 284 | 2046 | 12.4 | 2016 | 37.0 | 2017 | 9.40 | 2016 | 35.6 | 2016 |
| Zinc (µg/g) | 137 | 2041 | 295 | 2016 | 91.4 | 2016 | 228 | 2016 | 81.3 | 2016 | 220 | 2012 | 80.9 | 2011 | 219 | 2005 |
| Thorium-230 (Bq/g) | 0.210 | 2041 | 0.321 | 2045 | 0.084 | 2021 | 0.120 | 2021 | 0.027 | 2016 | 0.042 | 2016 | 0.024 | 2016 | 0.039 | 2016 |
| Lead-210 (Bq/g) | 1.060 | 2045 | 2.14 | 2046 | 0.551 | 2021 | 1.610 | 2017 | 0.463 | 2016 | 1.520 | 2005 | 0.460 | 2012 | 1.52 | 2005 |
| Radium-226 (Bq/g) | 0.899 | 2022 | 1.340 | 2021 | 0.139 | 2021 | 0.259 | 2021 | 0.044 | 2016 | 0.119 | 2015 | 0.042 | 2016 | 0.117 | 2005 |
| Polonium-210 (Bq/g) | 1.380 | 2021 | 2.05 | 2021 | 0.344 | 2016 | 0.883 | 2021 | 0.243 | 2016 | 0.749 | 2015 | 0.240 | 2005 | 0.747 | 2005 |

***S/V TEMS***

Within the S/V TEMS, sediment concentrations reflect the accumulative nature of COCs in this system, which experiences limited dilution potential. Sediment concentrations of arsenic, molybdenum, nickel, selenium and uranium at Sink Reservoir are predicted to exceed sediment quality guidelines at the 95th percentile concentrations, but decrease downstream (table 9-6). The maximum sediment concentrations are generally predicted to occur at or near the end of the operational period of McClean Lake Operation (2045).

Sediment SI values based on the lowest effect level (LEL) benchmark values (measure below which sediment biota are safe) at the maximum mean and 95th percentile concentrations indicate a potential effect to benthic invertebrates from exposure to arsenic, molybdenum, nickel, selenium, uranium and zinc within Sink Reservoir and Vulture Lake. Compared to the severe effect level (SEL) benchmark values (concentration at which pronounced effects can be expected for the benthic community), only molybdenum and selenium are identified as COCs within the Sink Reservoir. In Vulture Lake, only molybdenum is identified as a COC as the SI value exceeds one at the predicted 95$^{th}$ percentile concentration. Molybdenum levels are high in the S/V TEMS due to past discharges of treated effluent with elevated molybdenum levels but levels are expected to gradually decrease due to recent improvements to the treatment system. The incremental contribution of COCs to sediments and the corresponding effects on sediment dwelling organisms is predicted to be confined to the S/V TEMS.

***McClean Lake East Basin and Downstream***

In McClean Lake east basin and downstream (Collins Creek at Kewen Lake inlet), dilution potential is greater and surface water concentrations are lower. Maximum predicted sediment concentrations are predicted to occur around 2016, coinciding with the cessation of flows from the Midwest Project.

Within McClean Lake east basin and downstream, the maximum predicted mean and 95$^{th}$ percentile of COC concentrations are predicted to have negligible effects on sediment dwelling organisms. The concentration of molybdenum levels in sediments within McClean Lake east basin are expected to be above the no effect level sediment benchmark value but below the low effect level sediment benchmark value (Appendix B).

Mitigation Measures

Specific mitigation measures to reduce changes to sediment quality include:

- conventional treatment of the RO brine solution will result in a reduction in loadings of COCs to the environment
- the Midwest site will be constructed to collect and contain contaminated and potentially contaminated waters, to eliminate or reduce potential effects from surface runoff and seepage to the aquatic environment
- water can be stored within the S/V TEMS reservoir during periods of low flow through the watershed to ensure adequate mixing of effluent in natural creek flows

A list of AREVA's commitments, mitigation practices, and best management practices to reduce effects on the aquatic environment are further described in table 9-3.

Residual Effects and Significance

***S/V TEMS***

Within S/V TEMS, the maximum predicted concentrations of molybdenum and selenium exceed LEL and/or SEL benchmark values and, as such, sediment quality is predicted to affect sediment-dwelling organisms. The effect on sediment quality within the S/V TEMS is considered high in magnitude but will be localized within the S/V TEMS and limited to the operational, decommissioning and post-decommissioning periods. The effect is considered reversible as, once treatment plant operations cease, sediment quality recovery will occur during the decommissioning phase. Changes in sediment quality within the S/V TEMS may alter ecosystem structure and function, including reduced benthic invertebrate community richness (Level II). In accordance with the McClean Lake Operation preliminary decommissioning plan, sediments in Sink Reservoir will be remediated, if necessary. The effects are not anticipated to result in implications to human health, well being or quality of life; however some land use restrictions will apply within the surface lease during the life of the McClean Lake Operation. The adverse residual effect of the Midwest Project on sediment quality within S/V TEMS is considered to be not significant.

***McClean Lake East Basin and Downstream***

The magnitude of sediment quality effects within McClean Lake east basin and Collins Creek downstream is considered moderate, as concentrations of molybdenum in sediments are expected to be above the no effects sediment quality benchmark but below the low effects sediment quality benchmark over the operational life of the Project. The effect will be localized within the local assessment boundary. Improved WTP performance is anticipated to lower molybdenum levels in sediments. The effect is considered reversible, as the levels of COCs in the sediments will recover as a result of exchanges with the water column or burial by fresh sediment. The effects may result in changes to individuals within populations but they are not anticipated to result in changes to ecosystem structure or function. The socio-economic and human environment considerations are considered negligible. The adverse residual effect of the Midwest Project within McClean Lake east basin and downstream on sediment quality is considered to be not significant.

Conclusions

In reaching a conclusion on the significance of the potential environmental effects on sediment quality and the effect on aquatic VECs, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the Midwest Project is not likely to cause significant adverse environmental effects to the aquatic environment.

## 9.2.4 Terrestrial Environment

### *9.2.4.1 Soil Quality*

Potential Effects

Soil loss and soil erosion may result through site clearing, contouring, and excavation activities. Effects to soils may also result from direct loss, alteration of drainage patterns and alteration of surface water levels. The quality of soils may be affected by air emissions, dust deposition, and spills on-site or along the transportation corridor.

Prediction

Air emissions are predicted to be within acceptable provincial and federal limits at all discrete receptor locations beyond the surface lease boundary (i.e. the site assessment boundary) and emissions will be controlled when conditions dictate. The effects from air emissions and dust deposition on soil will be confined to the site assessment boundary, with negligible effects on adjacent habitat and therefore, the effects are not carried forward to the residual effects assessment.

Soil loss and soil erosion are predicted to result in decreased soil fertility, nutrient loss, and compaction. Existing disturbed areas will be used, where possible, to limit the effect and areas of exposed soil will be revegetated. As such, effects from soil loss and soil erosion are not carried forward to the residual effects assessment.

Surface runoff can cause soil erosion and changes to soil, vegetation and wildlife habitat. Surface runoff and seepage from the Midwest site will not be released to the environment during construction and operation and the site will be constructed to collect and contain contaminated water. As such, the effects from surface runoff are not carried forward to the residual effects assessment.

Effects on soil quality from spills throughout all phases of the Midwest Project will be negligible with the implementation of the McClean Lake Operation Emergency Preparedness and Response Plan as well as environmental design features. As such, the effects from spills on-site or along the transportation corridor are not carried forward to the residual effects assessment.

Residual Effects and Significance

Not applicable as residual effects to soils from air emissions, soil loss, soil erosion, and spills are anticipated to be negligible.

### *9.2.4.2 Terrestrial Habitat*

Potential Effects

Effects to terrestrial habitat quality and quantity may result from the direct loss or alteration of vegetation due to construction and operation of the Midwest Project.

Prediction

The predicted effect to vegetation and associated wildlife habitat is through a direct loss and fragmentation of habitat due to construction and operation of the Midwest Project. The local assessment boundary is approximately 66,800 ha and the Midwest Project and

McClean Lake Operation surface lease areas cover approximately 4,350 ha (6.5%) of the area within the local assessment boundary. The Midwest Project will result in an estimated 655 ha of habitat disturbance, which is approximately 1% of the local assessment boundary. The Midwest Project site layout and transportation corridor route were developed to reduce the disturbance of terrestrial habitats.

In order to assess the potential effect of habitat loss with the development of the Midwest Project, terrestrial habitats were ranked in terms of their capacity to support rare plant and animal species (moose and caribou), as well as VECs. Within the area classified in the local assessment boundary:

- approximately 89 ha (1.3%) of habitat considered to have a high potential to support rare plant species will be disturbed
- approximately 900 ha of the area is considered to have a high or very high potential to support spring, summer, and winter moose habitat requirements, of which approximately 12 ha (1.3%) of habitat will be disturbed
- the preferred site layout and transportation corridor is not likely to interact with any known active raptor nest sites

For woodland and barren-ground caribou, the baseline data indicated that these species are either sporadically present within the local assessment boundary (i.e. barren-ground caribou documented twice in the past 30 years) or were not determined to be present (i.e. woodland caribou). Habitat that would likely be suitable for caribou during the summer and winter seasons was identified within the local assessment boundary. Preferred caribou habitats for winter foraging include black spruce, jack pine forests, and shrubby and treed burns, while summer habitat include these habitat types as well as riparian habitat. Interactions between Project activities and caribou have been minimized to the extent possible through site and route selection. Based on the preferred site layout and transportation corridor option, the Midwest Project will disturb:

- approximately 562 ha (or 1.7%) of suitable summer caribou habitat
- approximately 550 ha (or 1.8%) of suitable winter caribou habitat

Although the Midwest Project area overlaps areas identified as suitable caribou habitat, the Project directly influences only a small portion of the available caribou habitat in the local study area (<2% of summer and winter habitat). It is acknowledged that woodland caribou in Canada have been identified as Threatened by the COSEWIC. EC's proposed recovery strategy, "Recovery Strategy for the Woodland Caribou (*Rangifer tarandus*), Boreal Population, in Canada" is currently out for public review. AREVA has stated that once the federal Recovery Strategy is made final and provincial management plans have been developed, AREVA will operate in accordance with this strategy.

Local conditions likely result in little use of the area by caribou. Specifically, the numerous mines, roads, exploration activities and ongoing operations at the Points North airport have reduced the overall value of the area for caribou habitat due to the already high level of disturbance. The additional disturbance from the Midwest Project will likely not significantly reduce the remaining habitat value in the area.

Mitigation Measures

Specific mitigation measures to reduce changes to terrestrial habitat include:

- construction activities for the Midwest Project will be completed outside of the breeding and migratory period for bird species (i.e. April 15 to July 31)
- if construction activities extend into the breeding and migratory period, clearing of vegetation will be done prior to the spring thaw to avoid disruption of breeding activities
- for construction activities within the breeding period, a monitoring program will be developed and implemented prior to and during the construction period, which may include a pre-construction bird survey for migrants and any nesting species to document the use of habitat within the Midwest Project site study area
- nest searches will be completed prior to and during the construction period and if found, AREVA will contact the Canadian Wildlife Service (CWS) for any appropriate mitigation measures
- minimum setback distances, as identified and confirmed by EC, will be implemented from active nests for song birds (30 m), waterfowl and waterbirds (100 m), short-eared owl and yellow rail (200 m), and SARA listed rusty blackbird, olive-sided flycatcher, and common nighthawk (100 m). AREVA will contact CWS for current setbacks and timing restrictions prior to and during construction
- AREVA will continue to work through the Saskatchewan Mining Association to contribute to EC's National Recovery Strategy for Woodland Caribou and will operate in accordance with the Strategy when it is finalized

A list of AREVA's commitments, mitigation practices, and best management practices to reduce effects on the terrestrial environment are further described in table 9-3.

Residual Effects and Significance

As the Midwest Project is expected to only affect between 1.3 and 1.7% of the habitat considered suitable to support moose, caribou and rare plants within the local assessment boundary, the effects are considered low in magnitude and local (Midwest Project site and transportation corridor). The effect of terrestrial habitat loss will be continuous until reclamation activities are implemented during the decommissioning phase of the Midwest Project. The effects of habitat disturbance are considered reversible as the terrestrial habitat lost will be reclaimed. The ecosystems affected will re-establish to baseline-like conditions and similar to terrestrial habitats in the local assessment boundary. The reclaimed terrestrial habitat may result in changes to both ecosystem structure and function (Level II). The loss of terrestrial habitat will have a negligible impact on the socio-economic and human environment considerations, as the habitats affected are not unique within the area. The effects to terrestrial habitat are not anticipated to result in effects to human health, well being or traditional resource use. The adverse residual effect of the Midwest Project on terrestrial habitat is considered to be not significant.

Conclusions

In reaching a conclusion on the significance of the potential environmental effects on terrestrial habitat, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the Midwest Project is not likely to cause significant adverse environmental effects to the terrestrial environment.

#### *9.2.4.3 Wildlife Movement and Behaviour*

Potential Effects

Effects to wildlife population size may result from spills on-site or along the transportation corridor, collisions with vehicles, human-wildlife interactions, and attractants to site and chemical exposure.

Altered behaviour and movement may result due to habitat loss, fragmentation, changes in habitat quality and sensory effects (noise, smells, lights, vehicles, and human presence).

Roads and increased road density may affect wildlife migration.

Prediction

Predicted effects on wildlife mortality from vehicle collisions and attractants to site are not carried forward to the residual effects assessment, as mitigation measures are predicted to result in a negligible effect on the persistence of wildlife populations (table 9-3).

Mitigation practices have been established to reduce the attraction of wildlife to the Midwest site, thereby reducing wildlife mortality from attractants to the site. The effect of human-wildlife interactions is not carried forward to the residual effects assessment.

Indirect changes to habitat quality from the Midwest Project are predicted to alter wildlife movement and behaviour. Sensory disturbance (e.g. noise, lights, smells, presence of humans) resulting from the construction, operation, and decommissioning of the Midwest Project can reduce habitat quality in both the Project footprint, as well as in adjacent habitats that are not directly affected by the Project. Loud construction-related activities and human activity may lead to displacement and avoidance in a localized area by some species and may increase stress to wildlife that remain in the area.

The addition of the proposed transportation corridor will increase the road density in the area, but overall the road density will be low. The addition of the transportation corridor to the area could potentially affect individual caribou, but it is not expected to have an affect on caribou populations. Because of the sporadic occurrence of barren-ground caribou, and no known occurrence of woodland caribou within the local assessment boundary of the Midwest Project (see section 8.6.3 under Ungulates), changes in caribou movement and behaviour caused by the Midwest Project are predicted to be negligible.

Results of moose habitat utilization studies conducted within the Midwest Project local assessment boundary indicate that moose were consistently utilizing high quality habitat (e.g. shrubby and treed riparian) in spite of existing industrial land use occurring in the region. Moose populations in the Midwest Project local assessment boundary are predicted to be strong, despite existing industrial activity levels.

Mitigation Measures

Specific mitigation measures to reduce changes to wildlife movement and behaviour include:

- food wastes will be incinerated
- personnel will not harass or feed wildlife or encourage the presence of wildlife in the area
- vehicle collisions with ungulates will be minimized through appropriate sight lines and posting and enforcing speed limits
- an environmental inspector will be present during site and road construction
- at the end of operation, reclamation activities will be undertaken to return the transportation corridor to a terrestrial environment reflective of that which existed before development
- AREVA will continue to work through the Saskatchewan Mining Association to contribute to EC's National Recovery Strategy for Woodland Caribou and will operate in accordance with the Strategy when it is finalized

A list of AREVA's commitments, mitigation practices, and best management practices to educe effects on the terrestrial environment are further described in table 9-3.

Residual Effects and Significance

Project-related sensory disturbance effects are anticipated to be localized and altered wildlife movement and behaviour is expected to be low, as most of the Midwest Project footprint occurs within or adjacent to existing disturbances, such as the existing Midwest test mine complex and the McClean Lake Operation. Potential changes to wildlife movement and behaviour from sensory disturbances will be most affected during construction, operation, and decommissioning activities but will cease following decommissioning. The effect is considered reversible, as wildlife will continue to use the area after reclamation. Individual wildlife may be influenced by sensory disturbance but individual fitness and population influences are not anticipated. In addition, observational data indicates strong moose populations in the area with the presence of existing industrial activities at the McClean Lake Operation. The effect may have a Level 1 effect, as individual wildlife may alter their movement and behaviour. Altered movement and behaviour are not anticipated to result in effects to human health, well being or traditional resource use. Adverse residual effects of the Midwest Project on wildlife movement and behaviour are considered to be not significant.

Conclusions

In reaching a conclusion on the significance of the potential environmental effects on wildlife movement and behaviour, the SMOE and RAs have taken into account the EIS,

which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the Midwest Project is not likely to cause significant adverse environmental effects to the terrestrial environment.

#### *9.2.4.4 Terrestrial Biota Downstream of Treated Effluent Release*

Potential Effects

Effects to terrestrial VECs (mallard, merganser, scaup, bald eagle, ptarmigan, caribou, snowshoe hare, moose, wolf, black bear, lynx, muskrat, beaver, and mink) with terrestrial-based and aquatic-based diets may result from the intake of COCs (radionuclides and non-radionuclides) downstream of the S/V TEMS.

Prediction

SI values were predicted for terrestrial VECs by comparing intake of COCs by VECs at locations downstream of treated effluent release to toxicity benchmarks (Appendix B). Muskrat, beaver, mink, lynx, hare, ptarmigan, mallard, scaup, and merganser were evaluated at locations downstream of the point of treated effluent release, including Sink Reservoir, Vulture Lake, McClean Lake east basin, and Collins Creek at Kewen Lake. Caribou and wolf VECs, due to their large home ranges, were evaluated based on the Midwest Project-McClean Lake Operation airshed. Moose, bear and bald eagle were assessed at two locations downstream of the treated effluent release, the S/V TEMS area and the Collins Creek watershed between McClean Lake and Kewen Lake (important habitat for moose).

Temporal variations were addressed by considering selected years during the operational and decommissioning period. Years considered included 2010 (early operation), 2030 (mid-operation), 2045 (end operation), 2056 (last year of WTP operation), and 2100 (post-decommissioning).

Effects of radionuclide exposure on terrestrial VECs were evaluated by comparing the maximum mean and 95$^{th}$ percentile calculated total internal dose with the dose rate guidelines (Appendix B).

No effects are predicted for ptarmigan, snowshoe hare, lynx, caribou (both woodland and barren-ground), wolf, and bear and eagle terrestrial VECs, as all SI values were below one.

***Waterfowl***

Potential residual effects to mallard and scaup VECs are predicted as molybdenum and selenium COC concentrations were above the SI value within the S/V TEMS. For the merganser VEC, the SI values are generally lower, indicating dietary difference between this VEC and the mallard and scaup. Potential effects to merganser are predicted through the uptake of selenium through dietary fish consumption within the S/V TEMS and at the 95$^{th}$ percentile exposure level in McClean Lake east basin and downstream.

Based on the radiation dose assessment, only the mallard and scaup VECs within the S/V TEMS may be affected by radiation exposure.

***Aquatic Furbearers***

Potential residual effects to aquatic furbearers (beaver, muskrat, and mink) are predicted. For beaver, SI values are predicted to be exceeded for molybdenum in the S/V TEMS only. For muskrat, molybdenum, selenium, and uranium are identified as COCs in Sink Reservoir and for molybdenum in McClean Lake. For mink, SI values are exceeded for selenium in the S/V TEMS only. The S/V TEMS and McClean Lake east basin have had limited utilization by aquatic furbearers.

***Mammals***

The assessment of the moose VEC entailed assessing moose exposure in two areas (S/V TEMS and Collins Creek). At the S/V TEMS location, there is a potential for effects on moose from exposure to arsenic and molybdenum. No COC concentrations above criteria were identified at the McClean Lake and Collins Creek locations.

Mitigation Measures

Specific mitigation measures to reduce changes to terrestrial biota include:

- conventional treatment of the RO brine solution will result in a reduction in loadings of COCs to the environment
- the Midwest site will be constructed to collect and contain contaminated and potentially contaminated waters, , to eliminate or reduce potential effects from surface runoff and seepage to the terrestrial environment
- water can be stored within the S/V TEMS reservoir during periods of low flow through the watershed to ensure adequate mixing of effluent in natural creek flows

A list of AREVA's commitments, mitigation practices, and best management practices to reduce effects on the terrestrial environment are further described in table 9-3.

Residual Effects and Significance

Potential effects to terrestrial VECs (waterfowl, aquatic furbearers, mammals) within the S/V TEMS are predicted to be high in magnitude and primarily associated with elevated uranium, molybdenum and selenium concentrations. The magnitude was considered high for waterfowl and aquatic furbearers VECs and low for mammal (moose) VECs. The effect is localized to the S/V TEMS and will extend into the post-decommissioning period. The effect is considered reversible following cessation of operational and decommissioning activities at the McClean Lake Operation, at which time water quality and sediment quality will recover naturally therefore reducing exposure levels to waterfowl, aquatic furbearers and mammals. The adverse effect on terrestrial VECs may be Level 1, as individuals within populations may be affected. The effect is not anticipated to result in changes in ecosystem structure or function, or in the size and distribution of waterfowl, aquatic furbearers or moose populations. The effects are not anticipated to result in implications to human health, well being or quality of life; however some land use restrictions will apply within the surface lease during the life of

the McClean Lake Operation. Adverse residual effects of the Midwest Project on terrestrial biota are considered to be not significant.

Potential effects to terrestrial VECs (waterfowl, aquatic furbearers, mammals) within McClean Lake east basin and Collins Creek downstream are predicted to be low in magnitude and within the local assessment boundary. Concentrations of COCs (selenium and molybdenum) are expected to decline following the post-decommissioning period and therefore, the effect is considered reversible as surface water and sediment quality will recover naturally, thus reducing exposure levels to waterfowl, aquatic furbearers and mammals. The effects on ecological, socio-economic and human environment considerations are considered negligible. The potential adverse effects to terrestrial VECs are considered to be not significant.

Conclusions

In reaching a conclusion on the significance of the potential environmental effects on terrestrial biota, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the Midwest Project is not likely to cause significant adverse environmental effects to the terrestrial environment.

### 9.2.5 Long-Term Effects on the Hydrogeological Environment

Potential Effects

Long-term residual effects are associated with the release of COCs from the tailings disposal (JEB TMF) and special waste rock disposal (JEB, Sue and Midwest sites) and the transport of COCs to surface water receptors by groundwater flow. Groundwater is the main pathway for potential interactions between the tailings and special waste rock and the receiving surface water environment. These effects are predicted to occur within the long-term timeframe (>1000 years).

Prediction

After the tailings have consolidated and the TMF has been decommissioned, constituents dissolved in the tailings pore water can diffuse out of the TMF and be carried by groundwater flows to surface recharge areas. The concentration of constituents dissolved in the consolidated pore water is predicted to be the source for potential long-term effects. Surface recharge areas associated with the JEB TMF include Fox Lake, Pat Lake, and Collins Creek. Surface recharge areas associated with the Sue site include Telephone Lake, Candy Lake, and Collins Creek. Potential surface recharge areas from the Midwest site include South McMahon Lake, Shallow Lake and Collins Creek. At Collins Creek, the predicted concentrations are added from all sources (JEB TMF, Sue and Midwest sites).

Predicted long-term mass flux of arsenic to Collins Creek from the Midwest mining area, the JEB TMF area, and the Sue mining area indicate the Sue and Midwest sites comprise the main contributions to the long-term loadings (see figure 9-2). Figure 9-2 also

illustrates the time required for arrival of chemical constituents from the source areas to Collins Creek. The average arrival time of the contribution from the JEB site is expected to be approximately 1000 years, followed by those from the Midwest site at 4000 years, and the Sue site at 6000 years.

The potential long term effects from the JEB TMF on local recharge lakes were quantitatively estimated using groundwater contaminant transport models. The model predicted water quality effects in Pat Lake and Fox Lake that are negligibly different from baseline (figure 9-3). The long-term surface water quality in the receiving surface water bodies affected by tailings and waste rock management facilities is predicted to fall within surface water quality objectives (SSWQO) and show little variation from baseline concentrations.

Residual Effects and Significance

The assessment of potential long-term effects of groundwater and arsenic contaminant flux to surface waters from the Midwest mining area, the JEB TMF area and the Sue mining area indicate minimal effects on background concentrations of COCs in local lakes and streams. As such, the potential effects to surface waters are expected to fall within the range of background concentrations (i.e. low magnitude) and the long-term effects are considered reversible and with negligible ecological, socio-economic and human environment considerations. The potential long-term effects associated with the release of COCs to the receiving surface waters are considered not significant.

Conclusions

In reaching a conclusion on the significance of the potential long term environmental effects, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, and the evaluation of the significance of residual effects described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the Midwest Project is not likely to cause significant adverse environmental effects over the long term.

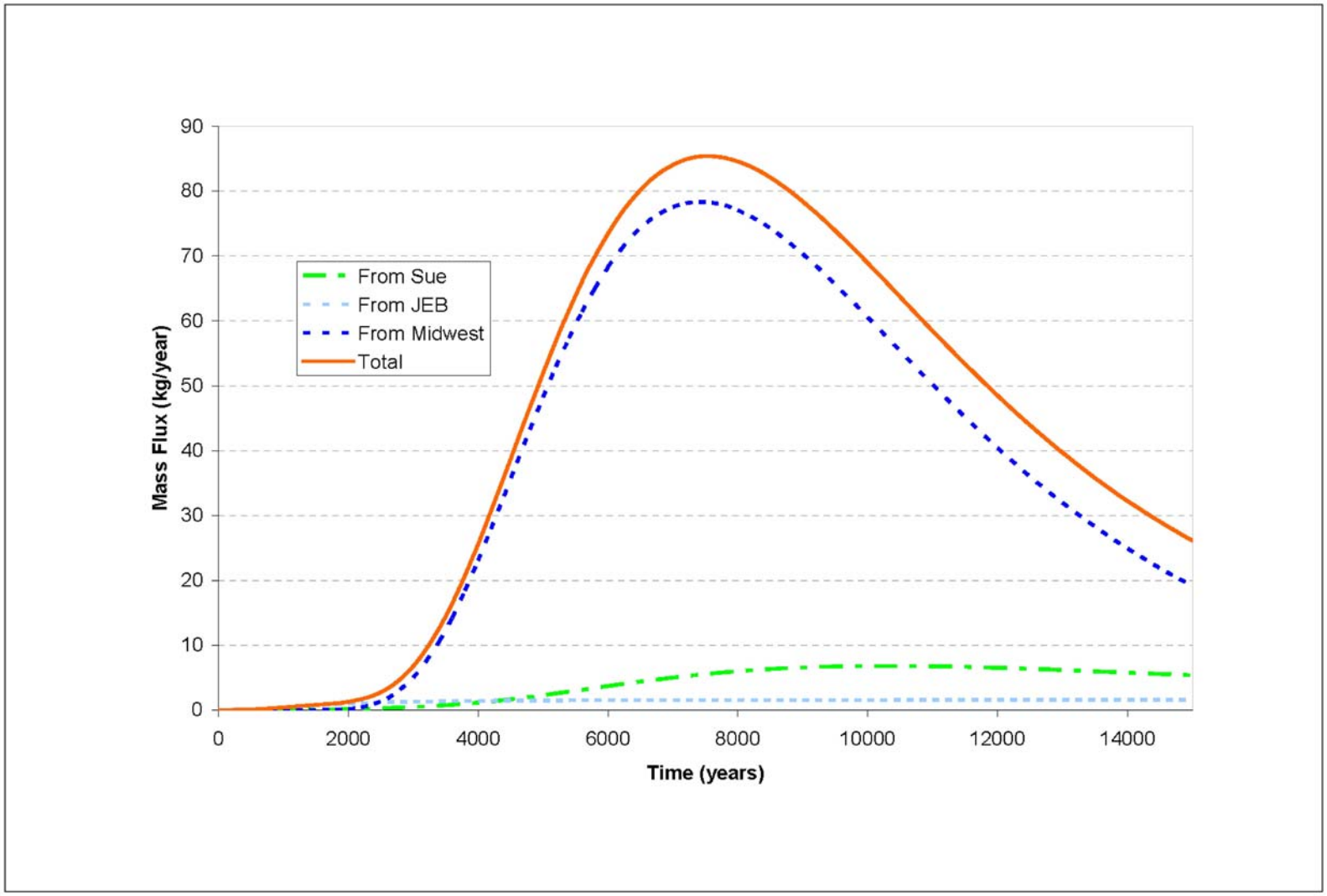
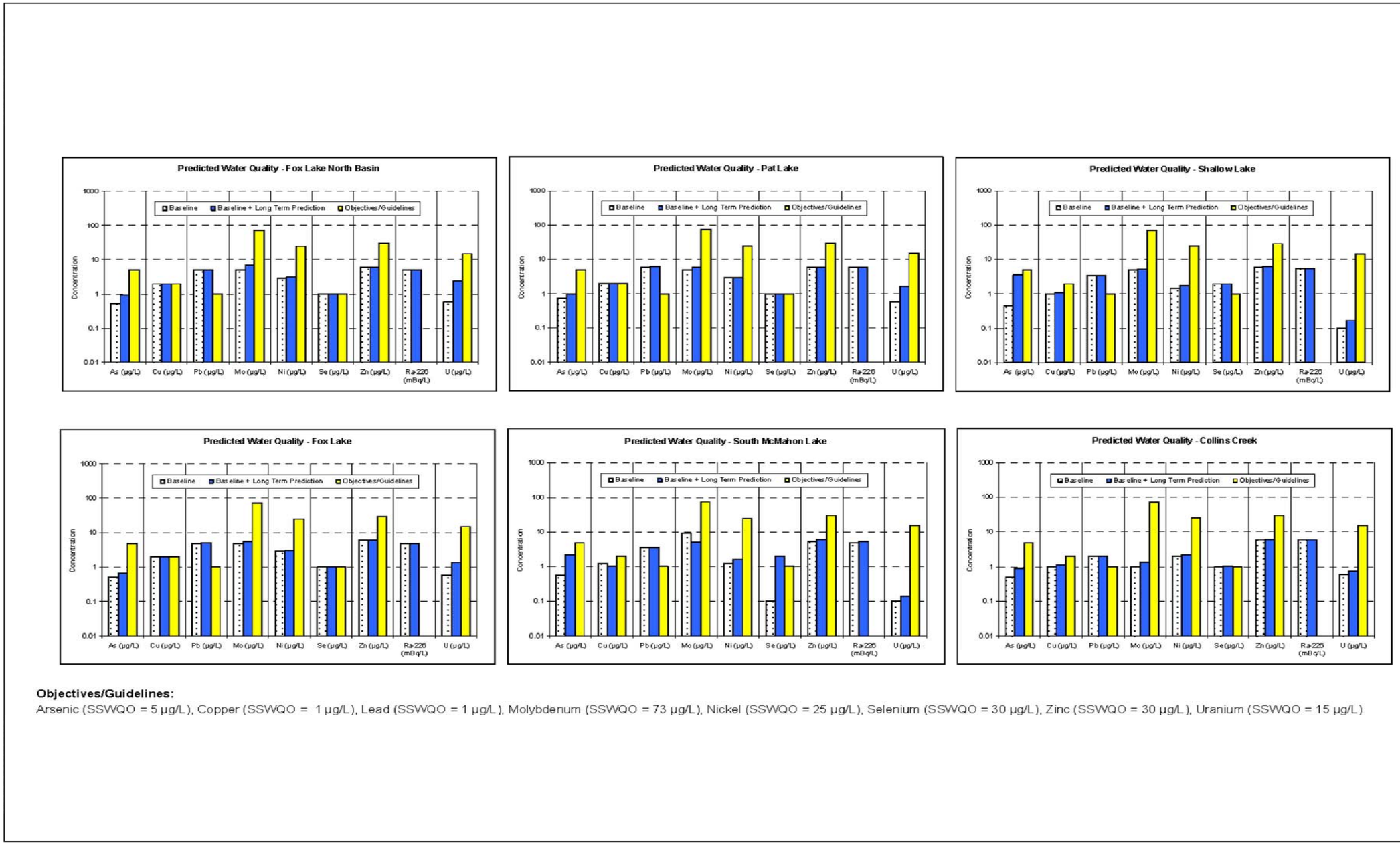



**Figure 9.2** Predicted Mass Flux of Arsenic to Collins Creek




**Objectives/Guidelines:**
Arsenic (SSWQO = 5 µg/L), Copper (SSWQO = 1 µg/L), Lead (SSWQO = 1 µg/L), Molybdenum (SSWQO = 73 µg/L), Nickel (SSWQO = 25 µg/L), Selenium (SSWQO = 30 µg/L), Zinc (SSWQO = 30 µg/L), Uranium (SSWQO = 15 µg/L)

**Figure 9.3** Water Quality Predictions

## 9.2.6 Human Environment

### *9.2.6.1 Workers*

Potential Effects

Mine and mill workers are those routinely exposed to potential sources of radioactivity. Radioactive material relevant to the McClean Lake Operation is uranium-238, and its radioactive progeny in its radioactive decay chain, including thorium-230, radium-226, radon-222, lead-210, and polonium-210.

At McClean Lake Operation, radiation exposure can be divided into three components:

- gamma radiation – gamma rays emitted by uranium and its radioactive progeny giving the recipient an external exposure
- radon and radon progeny – radon is a gaseous decay product of uranium which is released when ore is crushed and dissolved in the milling process. Radon and progeny can be inhaled giving the recipient an internal exposure
- long-lived radioactive dust – dust containing radioactive material that can be inhaled or ingested giving the recipient an internal exposure

Mine workers may be exposed to gamma radiation, radon and radon progeny, and radioactive dust from the development of the mine pit, blasting in ore, excavation and haulage of ore, stockpile management and maintenance, and loading ore trucks.

Mill workers may be exposed to gamma radiation through routine and non-routine mill process-related exposures. Radioactive dust exposure may result from ore stockpiles, ore grinding and residue remaining after a spill. The only source of radon from within the mill is through leakage from the closed equipment and process ventilation systems.

Workers may also be exposed to air emissions ($SO_2$, $NO_2$, TSP, radon, dust, metals and greenhouse gases) and increased noise levels from Midwest Project activities.

Workers may be exposed to conventional chemicals (acids, reagents, solvents) through routine and non-routine mill processes.

Prediction

Estimations of future radiation doses are dependent on the quantity of uranium mined and radiation exposure to workers during the mining and milling activities. The radiation dose estimates are based on operational data from similar work being conducted at other uranium mining and milling projects.

The overall average radiation dose predicted during mining of the Midwest pit is 2.8 mSv. On average, 69% of the total dose will be attributed to external radiation sources and 13% will be attributable to internal exposures due to radon progeny and long-lived radioactive dusts. The maximum radiation dose estimated for mining of the Midwest open pit is 13.8 mSv, which is well below the annual effective dose limit for a NEW of 50 mSv/y (or 100 mSv/5 year period).

The predicted average annual dose during milling of McClean Lake and Cigar Lake ores is 3.4 mSv/y and the maximum for any job group is 9.4 mSv/y. The overall maximum value for an individual worker is estimated to be 13.4 mSv/y. .

The effects of dispersion of airborne metals, radionuclides and dust were evaluated for potential effects on human receptors in section 9.2.1 and the effects of increased noise levels on human receptors was evaluated in section 9.2.2.

Mitigation Measures

Specific mitigation measures to reduce health risk to workers include:

- adherence to the McClean Lake Operation Radiation Protection Program and Occupational Health and Safety Program
- open pit mining will allow natural ventilation which will provide increased distances from workers to ore
- waste rock mined at all stages of pit development will be sampled and monitored, to ensure the materials are properly classified and separated
- the Radiation Protection Program at McClean Lake Operation will be extended to include the Midwest site to maintain worker doses from radiation as low as reasonably achievable (ALARA)
- drivers will be trained on road safety and speed limits will be posted and enforced. Road surfaces will be well maintained and watered when conditions dictate to manage dust. Traffic on the transportation corridor will be planned and closely monitored via regular radio contact
- a workplace hazardous materials information system has been established at the McClean Lake Operation which will be used at the Midwest site to minimize worker exposures to chemical hazards

A list of AREVA's commitments, mitigation practices, and best management practices to reduce effects on the human environment are further described in table 9-3.

Residual Effects and Significance

There will be no significant adverse effects on human health for those working in the study area from potential radioactive exposure from either the Midwest Project or current activities considered at the McClean Lake Operation.

Conclusions

In reaching a conclusion on the significance of the effects to workers, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the Midwest Project is not likely to cause significant adverse environmental effects to the human environment.

### *9.2.6.2 Members of the Public*

Potential Effects

A human health risk assessment (HHRA) was conducted to assess potential risk to human health. The HHRA provided an assessment of various pathways by which plants, animals, and humans may be exposed to emissions from the McClean Lake Operation and the Midwest Project. The key constituents that were assessed included: radionuclides (thorium-230, radium-226, lead-210 and polonium-210) and non-radinuclides (arsenic, cobalt, copper, lead, molybdenum, nickel, selenium, uranium and zinc). Inhalation of dust, radon and groundshine were considered for the radiation dose calculations.

Twelve human receptors were identified for the Midwest Project. Table 9-7 provides a list of human receptors identified for the Project. Exposure to radionuclides and chronic effects related to non-radionuclides were assessed for a toddler, child and adult receptor.

The pathways of exposure considered in the HHRA included the ingestion of soil, water, wild game, fish, berries and garden vegetables and the period of occupancy at the assessment location (table 9-8). The assessment of non-radionuclides looked at both carcinogenic (arsenic only) and non-carcinogenic effects. For substances that were considered to be potentially carcinogenic, a lifetime exposure (70 years) was assumed.

Members of the public may also be exposed to air emissions ($SO_2$, $NO_2$, TSP, radon, dust, metals and greenhouse gases) and increased noise levels from Midwest Project activities.

**Table 9-7** List of Human Receptors

| Human Receptor | Description/Location |
|---|---|
| 1a, 1c, 1t | Adult (1a), child (1c) or toddler (1t) Wollaston Lake resident located on Wollaston Lake, living/working in town |
| 2a, 2c | Adult (2a) or child (2c) Wollaston Lake resident, with trapline along Collins Creek |
| 3a, 3c | Adult (3a) or child (3c) Wollaston Lake Lodge operator located on Hidden Bay, Wollaston Lake |
| 4 | Rabbit Lake Operation camp worker located at the Rabbit Lake site (i.e., not nuclear energy worker) |
| 5 | McClean Lake Operation JEB camp worker (i.e., not nuclear energy worker) |
| 6 | Points North worker located on Glove Lake |
| 7a, 7c | Adult (7a) or child (7c) Hatchet Lake Lodge operator located at Hatchet Lake |

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**Table 9-8** Pathways Considered in the Human Health Risk Assessment

| Receptors | Wollaston Lake Resident | Wollaston Lake Trapper | Wollaston Lake Lodge Operator | Rabbit Lake Worker | JEB Worker | Points North Worker | Hatchet Lake Operator |
|---|---|---|---|---|---|---|---|
| Water | Wollaston Lake (1.0) | Wollaston Lake (0.75)<br>Collins Bay (0.25) | Wollaston Lake (1.0) | Collins Creek, near Collins Bay (1.0) | Pat Lake upstream of McClean Lake Operation- unaffected by operation (1.0) | Commercial supplier (i.e. bottled water) (1.0) | Hatchet Lake (1.0) |
| Dust, Radon, Groundshine | Wollaston Lake community area (1.0) | Wollaston Lake community area (0.75)Collins Creek airshed (0.25) | Hidden Bay airshed (1.0) | Rabbit Lake Camp airshed (1.0) | McClean Lake mine site airshed (1.0) | Points North airshed (1.0) | Hatchet Lake airshed (1.0) |
| Barren-ground caribou | Outside study area (1.0) | Outside study area (1.0) | Outside study area (1.0) | -- | -- | -- | Outside study area (1.0) |
| Moose | Wollaston Lake community area (1.0) | Collins Creek watershed (1.0) | Collins Creek watershed (1.0) | -- | -- | -- | Hatchet Lake airshed (1.0) |
| Beaver | Wollaston Lake (1.0) | Kewen Lake (1.0) | Wollaston Lake (1.0) | -- | -- | -- | -- |
| Hare | Wollaston Lake community area (1.0) | Collins Creek airshed (1.0) | Hidden Bay airshed (1.0) | -- | -- | -- | Hatchet Lake airshed (1.0) |
| Ptarmigan | Wollaston Lake community area (1.0) | Collins Creek airshed (1.0) | Hidden Bay airshed (1.0) | -- | -- | -- | Hatchet Lake airshed (1.0) |
| Ducks | Wollaston Lake (1.0) | Kewen Lake (1.0) | Wollaston Lake (1.0) | -- | -- | -- | -- |
| Fish – predator | Wollaston Lake (1.0) | Wollaston Lake (0.75)<br>Kewen Lake (0.25) | Wollaston Lake (1.0) | Collins Bay (0.1)<br>Kewen Lake (0.1) | -- | Kewen Lake (0.2) | -- |
| Fish – bottom feeder | Wollaston Lake (1.0) | Wollaston Lake (0.75)<br>Kewen Lake (0.25) | Wollaston Lake (1.0) | Collins Bay (0.1)<br>Kewen Lake (0.1) | -- | Kewen Lake (0.2) | -- |
| Berries | Wollaston Lake community area (1.0) | Wollaston Lake community area (0.75)<br>Collins Creek airshed (0.25) | Hidden Bay airshed (1.0) | Rabbit Lake Camp airshed (1.0) | McClean Lake mine site airshed (1.0) | Points North airshed (1.0) | Hatchet Lake airshed (1.0) |
| Soil | Wollaston Lake community area (1.0) | Wollaston Lake community area (0.75)<br>Collins Creek airshed (0.25) | Hidden Bay airshed (1.0) | Rabbit Lake Camp airshed (1.0) | McClean Lake mine site airshed (1.0) | Points North airshed (1.0) | Hatchet Lake airshed (1.0) |
| Vegetables | Wollaston Lake community area (0.05) | Wollaston Lake community area (0.05) | -- | -- | -- | -- | -- |
| Fraction of year spent at location | 1.0 | 1.0 | 0.25 | 0.5 | 0.5 | 0.5 | 0.25 |

Note: Fraction of diet obtained from the identified sources shown in brackets.

Prediction

***Radiation Dose Effects***

The incremental annual radiation dose resulting from the Midwest Project and the McClean Lake Operation Project activities were calculated for each of the twelve human receptors. The highest predicted incremental dose to the public as a result of the Midwest Project was 8 µSv/y for the Wollaston Lake trapper child receptor. The highest predicted cumulative dose, resulting from the Midwest Project in combination with other projects and activities, is 20 µSv/y for the Wollaston Lake trapper child receptor. These doses are well below the annual effective dose limit of 1000 µSv/y, as specified in the *Radiation Protection Regulations* for members of the public. The incremental dose to the on-site JEB camp worker was predicted to be 120 µSv/y, which is also below the annual effective dose limit for a member of the public.

***Carcinogenic Effects***

Over a lifetime, daily arsenic intake is considered to present some risk in developing skin cancer. The incremental life time risk of developing skin cancer was estimated for the various receptors, with the Health Canada "acceptable" risk limit of 1 in 100,000. The Wollaston Lake trapper is the only receptor that exceeds the Health Canada "acceptable" risk limit. The estimated risk for the Wollaston Lake trapper was from 4 in 100,000 (Midwest Project base case) to 2 in 10,000 (Midwest Project cumulative case).

***Non-Carcinogenic Effects***

An assessment of non-carcinogenic effects related to intake of non-radionuclides (arsenic, cobalt, copper, molybdenum, nickel, lead, selenium, uranium, and zinc) was completed for the Wollaston Lake residents and trappers as maximum incremental project related effects were predicted only for these human receptors, as they consume significantly higher portions of local food harvested in the area. The exposure of other receptors that may be affected would be below those of the Wollaston Lake residents and trappers. Intake from natural background concentrations, intake via market food and incremental McClean Lake Operation and Midwest Project effects were compared to exposure limits (Tolerable Daily Intakes estimated by Health Canada). Natural background and market food intakes accounted for the majority of exposure for all non-radionuclide exposure for the Wollaston Lake residents and trappers, with exposure from the McClean Lake Operation and Midwest Project accounting for 2% or less of the intake.

***Air Emissions and Noise***

The effects of dispersion of airborne metals, radionuclides and dust were evaluated for potential effects on human receptors in section 9.2.1 and the effects of increased noise levels on human receptors was evaluated in section 9.2.2.

Mitigation Measures

Specific mitigation measures to reduce human health risk to members of the public include:

- Exposure pathways to humans include the atmospheric, aquatic and terrestrial environment. Therefore, the mitigation measures proposed for these environmental components (Aquatic Environment and Terrestrial Environment, see table 9-3) will also apply to the protection of human health.

A list of AREVA's commitments, mitigation practices, and best management practices to reduce effects on the human environment are further described in table 9-3.

Residual Effects and Significance

Radiation dose to members of the public were below regulatory dose limits. Exposure to non-radiological COCs were determined to be negligible. The effect on human health for members of the public is low in magnitude and confined to the local assessment boundary, as local communities are several kilometers from the site. The potential effects on human health are continuous until the post decommissioning phase and reversible following the cessation of activities at the McClean Lake Operation. The effects of the Midwest Project on human health from potential exposure to liquid effluent release and atmospheric emissions from either the Midwest site or McClean Lake Operation are considered not significant.

Conclusions

In reaching a conclusion on the significance of the effects to members of the public, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the Midwest Project is not likely to cause significant adverse environmental effects to the human environment.

#### *9.2.6.3 Transportation*

Potential Effects

Provincial Road 905, an all-weather gravel road, provides access to the McClean Lake Operation and Midwest Project sites. Land-based trucking is the mode of operation to deliver supplies, materials, and fuel, and ship products from the site to outside markets. Traffic related to the McClean Lake Operation and Midwest Project is expected to increase slightly.

A transportation corridor between the Midwest site and McClean Lake Operation is proposed to be constructed as part of the Midwest Project and it is proposed that access to the road will be restricted for safety and security reasons. The proposed transportation corridor is considered to be a significant improvement that will address Joint Panel recommendations, as it will divert all mine related traffic to a dedicated road.

Radiation exposures during campaigns of ore haulage will be monitored and controlled under the Radiation Protection Program.

Prediction

The small increase in traffic on Provincial Road 905 is not expected to result in significant increases in road hazards for the public or in notable degradation of road safety and is therefore, not carried forward to the residual effects assessment.

Past experience has indicated that an increase in radiation dose is expected during ore haulage. These campaigns of ore haulage will be short in duration. At the McClean Lake Operation, worker exposure levels have been maintained well below required levels as a result of the Radiation Protection Program. This program will be used for the Midwest Project. Dose exposure for workers is assessed in section 9.4.1 Human Health.

Expected traffic accident frequencies along the transportation corridor were calculated from predicted transportation corridor traffic frequencies and existing traffic accident statistics. It is predicted that the number of trips per day between the Midwest site and McClean Lake Operation will be approximately 76 round trips per day, with approximately 943,000 km travelled annually. Based on accident statistics for semi-trailers in northern Saskatchewan, the reportable accident frequency equalled 0.66 accidents per million vehicle kilometres travelled. The rollover rate for large trucks equalled 0.066 rollovers per million vehicle kilometres travelled. For the Midwest Project, the accident frequency was estimated to be 0.2 per year and an accident resulting in a rollover from large trucks was estimated to be 0.02 per year.

Overall, the potential for accidents from traffic on the transportation corridor between the Midwest site and McClean Lake Operation and for radiation exposure during campaigns are anticipated to result in negligible residual effects and have not been carried forward to the residual effects assessment.

## 9.2.7 Socio-Economic Environment

### *9.2.7.1 Heritage Resources*

In 2006, a Heritage Resource Impact Assessment (HRIA) was completed for the two proposed transportation corridor options. In 2008, an additional HRIA was completed for the proposed Midwest site. No heritage resources were identified during these assessments. A subsequent shovel testing program revealed that this locale was of limited archaeological potential. The effects from the Midwest Project on heritage resources are not carried forward to the residual effects assessment.

### *9.2.7.2 Sustainable Use of Renewable Resources*

Potential Effects

Potential changes associated with the Midwest Project may affect renewable or non-renewable resources to the point where either is not sustainable, including changes to traditional land and resource use.

Prediction

The physical disturbance associated with the Midwest Project will be confined to the immediate area surrounding the Project footprint, the transportation corridor, and the existing McClean Lake Operation. Approximately 1% of the local assessment boundary

will be disturbed from the construction of the Midwest Project, which will have a negligible effect on the sustainable use of renewable resources. Reclamation activities will return the site to an environment reflective of that which existed prior to development. The decommissioned and reclaimed site will allow unrestricted use of the area for hunting, trapping and fishing, consistent with the traditional and non-traditional use of the land.

Access to the Midwest site and McClean Lake Operation is restricted by the presence of a locked gate, which has been in place for over 20 years for safety and security reasons. Upon request, access can be granted by contacting personnel at AREVA's McClean Lake Operation. AREVA has worked with the trappers on their lease (two traditional users have been identified for both the Midwest and McClean Lake Operation) and Trapper Compensation Agreements are in place for these parties who traditionally access the local assessment area. The recent increase in industrial activity in the Midwest and McClean Lake Operation project area will have minimal impacts on trapping in the larger surrounding area. Most trapping activity in the area does not occur within or in close proximity to the local assessment boundary.

The potential for habitat and sensory disturbance to influence the distribution of wildlife will have a negligible effect on resident wildlife populations, as field surveys conducted in 2003/2004 showed that moose were consistently using high quality habitat, in spite of the industrial activity occurring in the region.

For both the Midwest Project and McClean Lake Operation, institutional controls will be required to prevent permanent residency or use of localized groundwater for potable use in the vicinity of the Midwest pit, JEB TMF, and Sue C pit area.

Mitigation Measures

Specific mitigation measures to reduce changes to the sustainable use of renewable resources include:

- existing roads will be used as much as possible
- fishing by personnel working at the McClean Lake Operation and/or Midwest site is only allowed on designated lakes within the McClean Lake Operation with certain restrictions (i.e. only one boat is allowed on each lake at a time, barb-less hooks must be used, and only one of each species can be kept per person per week)
- all personnel of the Midwest Project and/or McClean Lake Operation must hold a valid fishing licence, except where exempted by law
- use of clear span bridges at stream crossings with potentially important fish habitat
- personnel will not harass or feed wildlife or encourage the presence of wildlife in the area

A list of AREVA's commitments, mitigation practices, and best management practices to reduce effects on the human environment are further described in table 9-3.

Residual Effects and Significance

With reclamation, residual effects from the Midwest Project will have a minimal effect on the capacity of renewable resources and a negligible effect on traditional resource use

in the regional assessment boundary. The magnitude of the effect is considered negligible and will not extend past the post decommissioning period. The effects on the capacity of renewable resources will be reversible following the cessation of operation and decommissioning activities at McClean Lake Operation. The effects of the Midwest Project on sustainable use of renewable resources are considered not significant.

Conclusions

In reaching a conclusion on the significance of the effects on sustainable use of renewable resources, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the Midwest Project is not likely to cause significant adverse environmental effects to the renewable resources.

#### *9.2.7.3 Navigation*

Potential Effects

As identified in section 6.2 Scope of Assessment, an environmental effect includes any changes in the environment that may cause an indirect impact on socio-economic conditions or on the current use of resources for traditional purposes, including navigation. The design and location of the Midwest Project may affect navigation in the waterways within and surrounding the Midwest Project area.

Prediction

The effects on navigation use are predicted to be limited to the surface lease boundary (i.e. the site assessment boundary) and the Montreal River. The components of the Midwest Project that have the potential to have an environmental effect on navigation include; the proposed transportation corridor; the components related to Mink Arm; the drawdown of local lake levels; and the existing weir on the Montreal River for the purpose of the FHCP.

***Transportation Corridor***

Predicted impacts to navigation from the transportation corridor include: two crossings for the preferred north route, Crossing N4 (culvert) and Crossing N5 (clear span bridge) or three crossings for the alternate south route, Crossing S4 (culvert) and Crossings S5 and S6 (clear span bridges).

Navigable culverts and clear span bridges have been proposed for navigable crossings along both the north and south transportation corridor option. For Crossing N4, in order to maintain navigation, it will be necessary to split the effluent pipeline from the transportation corridor. The pipeline will traverse the stream on a dedicated clear-span trestle adjacent to the road crossing, which will allow for a shorter culvert configuration. The transportation corridor, as designed, is not likely to cause significant effects on navigation and it is predicted that navigability of stream crossings will not be affected.

### *Mink Arm*

Components related to Mink Arm that are predicted to impact navigation include: the existing Mink Arm dam, proposed upgrades to the existing Mink Arm dam, construction of a new secondary retention dam at Mink Arm and dewatering of Mink Arm. Dewatering of Mink Arm will eliminate the possibility of navigation.

AREVA's preferred option of dewatering Mink Arm is to discharge as much of Mink Arm surface waters over the dam into the adjacent South McMahon Lake. The rate of discharge to South McMahon Lake will be determined by the determined by the stream flow capacity of Midwest Creek and subsequently into Smith Creek. The effective drainage area of Midwest Creek is predicted to be permanently reduced by approximately 25% (including the area of Mink Arm) and the effective drainage of Smith Creek is predicted to be permanently reduced by about 2 to 3%. However, as both creeks were assessed by TC in 2007 to be non-navigable, there is no predicted effect to navigation.

The existing Mink Arm is a headwater to South McMahon Lake with no inflowing streams or tributaries. Mink Arm is approximately 800 m long and the existing Mink Arm dam that is in place prevents navigation from Mink Arm to South McMahon Lake without portaging over the dam. Access to Mink Arm from the shoreline is restricted by the presence of an 8-foot high locked gate on AREVA's surface lease. Despite the presence of the locked gate, Mink Arm could potentially be accessed via cutlines around the waterbody or via portaging the dam from South McMahon Lake into Mink Arm.

A surface lease for the site has been issued by the Province of Saskatchewan since 1987 and the site has been licensed by the CNSC and the province since this time. The Midwest site is currently under care and maintenance activities. As stated, access to the site has been restricted by the presence of a locked gate, which has been in place for over 20 years. Parties interested in accessing the Midwest site for any purpose, including navigation, must contact personnel at AREVA's McClean Lake Operation. This information has been made available to the public.

The Midwest Project has gone through three previous environmental assessment processes, all of which have involved stakeholder consultations with various northern communities. AREVA recently met with northern communities in October 2011 to discuss various ongoing and proposed projects at the McClean Lake Operation, including the Midwest Project EA. An update on the Midwest Project was provided, including the dewatering of Mink Arm and the proposed FHCP to compensate for the loss of fish habitat at Mink Arm. Participants were made aware of this component of the proposed Project at these and previous meetings and no concerns to date regarding the loss of navigability have been made. In addition, AREVA has no records indicating that it has received requests to access the property for navigation purposes.

Based on this information, it is unlikely that Mink Arm is being accessed for navigation purposes. Section 23 of the NWPA provides that the Governor in Council may declare section 22 exempt in whole or in part from the operation of this section when it is shown to the satisfaction of the Governor in Council that the public interest would not be injuriously affected.

***Drawdown of Local Lake Levels***

As per section 9.2.2.2 Groundwater Levels and Drawdown of Lake Levels, open pit dewatering will result in the development of a sink in the groundwater regime which may result in changes to groundwater flow and local lake levels, the three potentially most impacted being Too Small Lake, Shallow Lake and South McMahon Lake. The maximum predicted impact is to Too Small Lake, where the lake is predicted to be fully drained after four years of pit dewatering. For Shallow Lake and South McMahon Lake, the predicted drawdown range from approximately 0.60 m to 1.60 m, respectively, and these lakes are not predicted to be fully drained. These predictions are considered conservative.

***Existing Weir on Montreal River (for Proposed FHCP)***

The proposed FHCP option is to establish connectivity in the Montreal River and preserve water levels in Montreal Lake by constructing an engineered pool and riffle fishway at the Montreal River. The current weir configuration may cause a change in the environment with a potential effect on public navigation of the Montreal River.

Mitigation Measures

Specific mitigation measures to ensure that the indirect environmental effects on navigation are minimized include:

- construction material and debris will not become waterborne
- all temporary piles and debris will be removed from waterways
- in the event that work is terminated, AREVA will be responsible for removing the works and associated equipment in its entirety
- AREVA will not be permitted to dewater the Mink Arm portion of South McMahon Lake until an Order in Council in accordance with section 23 of the NWPA has been received
- if lake level fluctuations are occurring in a manner inconsistent with reference lake levels and beyond the range of natural variation (0.4 m), clean RO permeate will be diverted from the water treatment process, if required. RO permeate will be diverted to the affected lakes through a temporary pipeline, which will be designed so as to not impact navigation
- appropriate signage will be installed around the weir, if required, to warn travellers of riffle hazard

A list of AREVA's commitments, mitigation practices, and best management practices to reduce effects on the human environment are further described in table 9-3.

Residual Effects and Significance

The effects on navigation use are expected to be low in magnitude and limited to the site study area and Montreal River.

Based on the proposed design of the transportation corridor, impacts to navigation are not likely to be significant.

Based on evaluation of the current negligible use and accessibility of the Mink Arm portion of South McMahon Lake, the magnitude of the potential environmental effect on navigation will be low. It is expected that effects to navigation resulting from works associated with Mink Arm are not likely to be significant.

Based on the proposed mitigation measure to divert clean RO permeate from the water treatment process to the three most potentially impacted lakes (Too Small Lake, South McMahon Lake and Shallow Lake), local lake levels are not predicted to be drawn down and therefore, impacts to navigation are not likely to be significant.

Based on the proposed mitigation measures, the existing weir on the Montreal River is not predicted to cause significant adverse environmental effects on navigation.

Conclusions

In reaching a conclusion on the significance of the effects on navigation, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the Midwest Project is not likely to cause significant adverse environmental effects to the renewable resources.

## 9.3 Effects of the Environment on the Project

Potential effects of the environment (i.e., unusual geologic or climatic events), the potential effects of long-term climate change, and the potential interactions between the natural hazards (i.e., forest fires) on the Project were considered. The implications of these environmental effects on mitigation measures for the Midwest Project were also assessed.

### 9.3.1 Seismic Events

Potential Effects

Project infrastructure may be damaged from seismic activity.

Prediction

The Canadian Shield is known as one of the most tectonically stable regions in the world. Therefore, the risk of seismic events to the Midwest Project is low due to the low probability of significant seismic activity in the region.

Mitigation Measures

Although the Midwest Project is in a stable seismic zone, structures and slopes have been engineered to protect against seismic events. Controlled blasting techniques will be employed to ensure the stability of open pit mines and maintain competent walls. Safety berms will be constructed to provide catchment plateaus for falling material in all active pits. The slopes of the active pits will be monitored for stability at locations susceptible to potential slippage/failure.

Residual Effects and Significance

The significance of any risk from seismic events will be minimized as a result of these designs features and the low probability of seismic activity.

Conclusions

In reaching a conclusion on the significance of the effects on seismic events, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the environment will not likely cause significant adverse effects on the Midwest Project.

### 9.3.2 Extended Drought

Potential Effects

Potential effects of a drought are primarily related to the ability to maintain the minimum mixing ratio for treated effluent release in Collins Creek of at least 5 parts natural Collins Creek flow to 1 part WTP effluent flow.

Prediction

Flows in Collins Creek may become depressed and extended low flows could restrict treated effluent release if persistent drought conditions were to arise, which would result in treated effluent having to be stored in Sink Reservoir.

Mitigation Measures

A series of operation contingency measures for persistent drought conditions is outlined in the McClean Lake Operation IQMS. Actions include temporarily restricting release from Sink Reservoir or applying for a temporary increase in the maximum allowable Sink Reservoir water elevation.

Residual Effects and Significance

The effects of a drought are not expected to adversely affect water quality in Collins Creek.

Conclusions

In reaching a conclusion on the significance of the effects on extended drought, the SMOE and RAs have taken into account the EIS, a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the environment will not likely cause significant adverse effects on the Midwest Project.

### 9.3.3 Major Precipitation

Potential Effects

In order to prevent the inadvertent release of deleterious substances to the receiving waters, water holding structures will be designed to accommodate extreme precipitation events. The 24-hour Probable Maximum Precipitation (PMP) value of 488 mm was used to design containment facilities at both Midwest and McClean Lake Operations. The water holding facilities are not designed to individually hold a PMP event but are designed to ensure that potentially contaminated waters do not enter receiving waters. The effects of an extreme precipitation event are not expected to adversely affect surrounding receiving waters.

Prediction

Under a PMP event, South McMahon Lake could rise to an elevation of approximately 480 masl.

The treated effluent monitoring ponds at McClean Lake are sized to accommodate a PMP event. Sink Reservoir has been designed to accommodate a storm event of 245 mm.

Mitigation Measures

To provide protection from over-topping and flooding due to set-up and waves, Mink Arm dam at the Midwest site will be upgraded as necessary to control seepage as well as ensure slope stability and a full supply level of 480 masl.

The discharge of waters from Sink Reservoir is of limited concern from a water quality perspective as the reservoir waters have been treated and would have an increased dilution potential during a PMP event. In order to maintain the integrity of the Sink Reservoir during extreme rainfall events, an emergency spillway has been constructed.

The dewatering wells surround the JEB TMF are operated to maintain a water level differential of approximately 500 mm between the water level in the wells and the water level in the TMF. This water level differential is sufficient to accommodate a PMP event.

Residual Effects and Significance

No significant adverse effects to the environment or the safety of workers are expected as a result of a major precipitation event.

Conclusions

In reaching a conclusion on the significance of the effects on major precipitation events, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the environment will not likely cause significant adverse effects on the Midwest Project.

### 9.3.4 Climate Change

Potential Effects

Damage to Project infrastructure may result from flooding events, which may result in weakened infrastructure for containing contaminated water.

Prediction

The lifespan of the Midwest Project is approximately 10 years. The effects of climate change are expected to be minor and unlikely to have a significant effect on the environment within this timeframe.

Effects from climate change may include changes in precipitation, temperature, evaporation and evapotranspiration, which could potentially impact the performance of the Midwest Project. General Circulation Models (GCM) were used to model the radiative effects of greenhouse gases on the global climate. The evaluation of GCM under a variety of emissions scenarios provides a basis to evaluate the possible effects of global warming on the Project. The models generally predict higher average annual temperatures, with noticeably warmer fall and winter periods, and suggest increased winter precipitation, which may lead to more intense runoff events.

Mitigation Measures

The potential increases in runoff will be accommodated by infrastructure that is designed to handle the more serious PMP events.

Residual Effects and Significance

No significant adverse effects are expected as a result of climate change.

Conclusions

In reaching a conclusion on the significance of the effects on climate change, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the environment will not likely cause significant adverse effects on the Midwest Project.

### 9.3.5 Forest Fire

Potential Effects

Damage to Project infrastructure may result from fire activity.

Prediction

Severe fire seasons are generally associated with intense and extended droughts.

Mitigation Measures

In the event of a forest fire, buffer zones surrounding the facility infrastructure will be maintained to minimize risk. The Fire Protection Plan and Emergency Response

Procedures will detail the location of the fire breaks. On-site emergency response includes fire suppression capabilities and the fire fighting capabilities of the Province of Saskatchewan.

Residual Effects and Significance

Forest fires in northern Saskatchewan are not expected to have a significant effect on the Midwest Project.

Conclusions

In reaching a conclusion on the significance of the effects on forest fires, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that the environment will not likely cause significant adverse effects on the Midwest Project.

## 9.4 Malfunctions and Accidents

Potential Effect

Accidents and malfunctions that may occur during construction, operation, decommissioning and post-decommissioning have the capacity to affect the environment.

Prediction

Credible malfunctions or accidents related to the proposed Midwest Project include: general malfunctions and accidents, mining at the Midwest site, ore haul from the Midwest site to the JEB Mill, milling at the JEB site, and transfer of effluent from the Midwest WTP to the S/V TEMS. The primary mechanism for accidents and malfunctions is spills or accidental releases of hazardous substances (chemicals, reagents, petroleum products) or process materials (ore, tailings, effluent) onto the land or water.

Table 9-9 outlines the potential malfunctions or accidents related to all aspects of the Midwest Project. These malfunctions and accidents were considered in terms of their probability of occurring; the potential effects; measures employed through facility design and/or operational procedures to prevent and mitigate the effect; and potential residual effects and significance. Significance of malfunctions and accidents was calculated in terms of a calculated risk, probability and severity based on a 5-point scale.

**Table 9-9** Malfunctions and Accidents

| Malfunction and Accident Scenario | Potential Environmental Effect | Mitigation Measures | Residual Effect and Significance | Probability | Severity | Risk Factor |
|---|---|---|---|---|---|---|
| **Malfunctions and Accidents - General** | | | | | | |
| Hazardous Substance Storage | A major spill of such materials to the environment has the potential to affect groundwater quality. | Secondary containment and high level alarms to prevent overfilling are provided for all hazardous substance storage facilities. Fuelling facilities are equipped with concrete pads. Tertiary containment is provided for hazardous substances stored within JEB Mill. Emergency response procedures are in place. | Considering design and operational controls in place, the expected frequency of such an incident is low. Malfunctions associated with hazardous substance storage are expected to result in minimal residual effects to the environment. | 2 | 2 | 4 |
| Leakage from external ponds | External lined ponds are used to contain site runoff, contaminated water, and treated effluent. Ongoing leakage through the liners of these ponds could result in adverse effects to groundwater quality. | All lined ponds have been designed in accordance with the provincial Draft Construction Guidelines for Pollution Control Facilities at Uranium Mining and Milling Operations [16]. Ponds have been designed with double or single liners and containment and leak detection systems. Synthetic pond liners are inspected regularly to ensure their integrity. | Any interaction with site groundwater will be localized with negligible environmental effect. | 2 | 1 | 2 |
| Spills from external pipelines | External pipelines are used to collect pit dewatering water, transport contaminated water to the WTPs, transfer treated and dewatering effluent to its point of discharge, and transport tailings from the mill to the JEB TMF. There is a potential that spills to the environment may occur. | Effluent discharge lines are patrolled on a regular basis to identify early detection of any leaks or ruptures. Containment ponds will be located at regular intervals along the utility corridor to provide temporary containment of water for the purpose of preventing excess erosion in undisturbed areas adjacent to the roadway. Dual containment is provided for the tailings lines to prevent the release of tailings as a result of pipeline rupture. | Residual environmental effect will be negligible. | 4 | 1 | 4 |
| **Malfunctions and Accidents – Midwest Site** | | | | | | |
| Pit Slope Failure | Minor slippages of the pit slope and major failure of the pit slope may result, even with detailed geotechnical studies and design. | Minor slippages of the pit slope will be contained by safety berms, typically 6 to 10 m wide, established in the pit slopes. Action to be taken in response to detected pit wall movements will depend on the characteristics of failure and my include pinning the slope with grouted steel bars or cable to allow the slope to collapse and subsequently remove fallen rock and flatten the slope. | Pit design and monitoring will mitigate the effects of a major pit wall failure, resulting in no residual environmental effects. | 1 | 5 | 5 |
| Release of contaminants from surface ore stockpiles | The release of contaminants from surface ore stockpiles to the groundwater could result from a leak in the ore pad liner. This would be detected by a deterioration of groundwater quality downgradient of the ore stockpile pads. | Ore stockpiles at the Midwest site will be contained within an engineered lined pad, designed to meet the provincial Draft Construction Guidelines for Pollution Control Facilities at Uranium Mining and Milling Operations. Intrusive groundwater investigation would be conducted to identify the location of the leak and the liner would be unearthed and repaired, as required. | The release of contaminants from the ore stockpiles will result in localized, short-term interactions with the site groundwater, with negligible environmental effect. | 3 | 1 | 3 |
| **Malfunctions and Accidents – JEB site** | | | | | | |
| Spills from mill and effluent treatment process tanks and pipes | An uncontrolled discharge of process solutions from a tank overflowing or a ruptured pipeline could result in a release to the environment. | Concrete dykes are in place around each process tank within the JEB Mill to contain any spillage. The dykes drain to sumps which collect any spilled material. Tertiary containment is provided for any material that might escape the containment dykes. Emergency response procedures are in place if a spill | The expected frequency of a spill of process solution are low and spill response and site design of runoff control works will ensure that any spill are contained, thereby resulting in minimal residual effects to the | 2 | 1 | 2 |

| Malfunction and Accident Scenario | Potential Environmental Effect | Mitigation Measures | Residual Effect and Significance | Probability | Severity | Risk Factor |
|---|---|---|---|---|---|---|
| | | escapes the JEB Mill. | environment. | | | |
| Stack scrubber failure | Stacks associated with processes at the JEB Mill have been equipped with scrubbers to reduce air emissions resulting from the operation. Failure of a scrubber could result in elevated air emissions of total particulate and various other contaminants. | All scrubbers are on a rigorous preventative maintenance program to ensure their proper function. | Any period of elevated air emissions due to scrubber failure would only be of short duration. Any interaction, in addition to normal operating conditions, would be negligible. | 3 | 1 | 3 |
| Acid plant malfunction | An acid plant malfunction could result in low conversion efficiencies and subsequently high stack sulphur dioxide emissions, which may result in elevated ambient sulphur dioxide concentrations downwind of the acid plant. | Continuous stack monitoring for sulphur dioxide emissions and operational controls (action levels) ensure proper acid plant function. This system of monitoring and operational controls minimizes the potential for upset conditions. | Environmental effects related to acid plant malfunctions will be minor and will result in minimal residual effects to the environment. | 3 | 4 | 12 |
| Power outages | Extended power failure could result in exposure of operators to high radon concentrations and loss of containment of chemicals, process solutions, and contaminated water. | Emergency power is available for critical facilities. A plan is in place which includes: evacuate the plant, followed by supervised re-entry using a filtered air breathing system or self-contained breathing apparatus to assess hazards, measure radon progeny concentrations at various locations, and close critical valves. | Emergency power is available for critical facilities and will enable normal ventilation to be re-established and allow critical sump pumps to be started, which will result in negligible residual environmental effects. | 5 | 1 | 5 |
| Fire in JEB Mill | An extended shutdown due to a major fire within the JEB Mill could result in extended shutdown. Damage to the JEB Mill effluent and water treatment circuits could also result in a shutdown of those circuits and the inability to treat JEB Mill effluent and JEB TMF reclaim water. | Emergency response plans are in place for facility fires, along with conventional fire protection systems (sprinklers, pumps, hydrants, fully equipped fire truck) for fighting fires. | Repairs would be conducted as quickly as possible and temporary equipment will be installed as necessary to allow water treatment of the JEB TMF, which will result in negligible environmental effects. | 1 | 5 | 5 |
| **Malfunctions and Accidents – Transportation** | | | | | | |
| Transportation of ore | During active hauling, minor spillage from haul trucks could result from overfilling or dusting. | Minor spillage will be controlled by limiting the maximum loads and by watering the load. | Spill response and clean up will mitigate the effects of an ore spill, resulting in no residual environmental effect in addition to those associated with normal operating conditions. | 3 | 1 | 3 |
| Transportation Accidents | Transportation accidents involving one or more vehicles could result in the accidental release of hazardous substances (fuel, chemical reagents, and U3O8 equivalent) to the environment. | Emergency and spill response plans are in place to respond to transportation accidents both on and off of the site. | Through proper emergency response and subsequent cleanup activities, the effects of such an incident may be mitigated and will result in minor environmental interactions over the short term, with negligible residual environmental effects. | 2 | 5 | 10 |

| Risk Factor | Probability | Potential Severity |
|---|---|---|
| 5 | Probable | Fatality |
| 4 | Possible | Lost time accident |
| 3 | Unusual | Modified work injury |
| 2 | Rare | Medical aid |
| 1 | Unlikely | First aid |

Residual Cumulative Effect and Significance

Table 9-9 outlines the residual cumulative effect and significance for each malfunction and accident scenario.

Provided that the required mitigation measures and applicable emergency response procedures are followed, accidents and malfunctions are unlikely and the Midwest Project will not cause significant adverse environmental effects.

Conclusions

In reaching a conclusion on the significance of the effects on accidents and malfunctions, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects, evaluation of the significance of residual effects, and mitigation measures described within this section.

Provided that AREVA successfully implements the mitigation measures outlined in the CSR and in table 9-3 (Commitments, Mitigation Practices, and Best Management Practices), the SMOE and the RAs are satisfied that accidents and malfunctions will not likely cause significant adverse effects on the Midwest Project.

## 9.5 Cumulative Effects

Cumulative effects are effects that are likely to result from the residual effects of project activities in combination with other projects and activities that have been or will be carried out. The cumulative effects of malfunctions and accidents were not assessed, as these are hypothetical, generally require simultaneous and unrelated failures, and have a very low probability of occurring.

The Midwest Project cumulative effects assessment considered existing and reasonably foreseeable projects and activities. These projects include:

- the proposed development of the Caribou Project, an open pit uranium mine project
- the proposed transport, receipt and processing of high grade ore from the McArthur River mine at the McClean Lake Operation JEB Mill
- the proposed JEB TMF Expansion Project to expand the existing JEB TMF
- the proposed Key Lake Extension Project to extend the life of the Key Lake operation
- the proposed Millennium Project, an underground uranium mine project
- the proposed Golden Heart Gold Mine Project, a gold mine project
- the proposed managing of Cigar Lake waste rock in the mined-out Sue C pit

The Midwest Project considered the waste water-environment interactions for both the Midwest Project and the McClean Lake Operation. The Midwest Project cumulative case assumed that the proposed Midwest Project waste water management infrastructure could be utilized for an extended period of time, until the end of the operating life of the McClean Lake Operation (2045). This hypothetical case was considered in the cumulative effects assessment.

### 9.5.1 Terrestrial Habitat Disturbance

Potential Effect

The Caribou open pit and clean waste rock pile will be entirely developed within the existing surface lease boundary of the McClean Lake Operation. Approximately 850 ha of habitat have been lost due to infrastructure development at the existing McClean Lake Operation, with an additional 80 ha proposed for the Caribou Project. Approximately 655 ha of habitat will be disturbed with the development of the Midwest Project.

Prediction

The cumulative habitat disturbed by the McClean Lake Operation, Caribou Project and Midwest Project is estimated at approximately 1,585 ha, which represents 2.4% of the 66,800 ha of natural forest landscape within the local assessment boundary.

Residual Cumulative Effect and Significance

There will be cumulative residual effects on terrestrial habitat but the effect is considered low in magnitude, as the disturbed areas comprise a small percentage of the habitats with the potential to support rare or endangered species and VECs. All existing and potential terrestrial habitat disturbance will be contained within the existing and proposed surface lease boundaries of the McClean Lake Operation and Midwest Project (i.e. the local assessment boundary). The effect is reversible as, following completion of operational activities, disturbed lands will be allowed to reclaim naturally.

Conclusions

In reaching a conclusion on the significance of the cumulative effects on terrestrial habitat disturbance, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects and an evaluation of the significance of residual effects described within this section. The SMOE and the RAs are satisfied that the cumulative environmental effects will not likely cause significant adverse effects on the Midwest Project.

### 9.5.2 Surface Water and Sediment Quality

Potential Effect

Waste water released from the Midwest Project in conjunction with current and future activities at the McClean Lake Operation could potentially affect surface water and sediment quality.

Prediction

Maximum mean water quality predictions within the S/V TEMS for the Midwest Project cumulative case are similar to those predicted for the Midwest Project base case. Downstream of the S/V TEMS, the cumulative water quality predictions are similar or negligibly higher than the Midwest Project base case (see table 9-10).

Maximum sediment quality predictions within the S/V TEMS for the Midwest Project cumulative case are comparable to the Midwest Project base case, with predicted concentrations for several parameters slightly lower than the Midwest Project base case.

Downstream of the S/V TEMS, the Midwest Project cumulative case indicates similar to slightly higher concentrations.

Residual Cumulative Effect and Significance

The magnitude of cumulative effects on surface water and sediment quality within S/V TEMS is anticipated to be high, but with the cessation of activities at the McClean Lake Operation, surface water quality will rapidly approach pre-operational conditions. Sediment quality will respond in a slower manner, but will improve following decommissioning. Therefore, changes to surface water and sediment quality are anticipated to be reversible in the medium-term. Any residual COCs within the S/V TEMS will be addressed through the McClean Lake Operation preliminary decommissioning plan.

Conclusions

In reaching a conclusion on the significance of the cumulative effects surface water and sediment quality, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects and an evaluation of the significance of residual effects described within this section. The SMOE and the RAs are satisfied that the cumulative environmental effects will not likely cause significant adverse effects on the Midwest Project.

**Table 9-10** Predicted Maximum Mean and 95th Percentile Values Water Quality – Midwest Project Cumulative Case

| | Water Quality Objectives(a) | Sink Reservoir | | | | | | Vulture Lake | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1991 EIS Maximum Mean | 1995 EIS Maximum Mean | Sue E EIS Maximum Mean | Midwest Project Base Case Maximum Mean | Midwest Project Cumulative Case | | 1991 EIS Maximum Mean | 1995 EIS Maximum Mean | Sue E EIS Maximum Mean | Midwest Project Base Case Maximum Mean | Midwest Project Cumulative Case | |
| | | | | | | Maximum Mean | 95th Percentile | | | | | Maximum Mean | 95th Percentile |
| Ammonia (mg/L) | 1.54 (pH=7.5, T=20ºC) | 5.27 | 7.26 | 5.52 | 9.24 | 4.19 | 10.7 | 4.83 | 5.99 | 3.76 | 6.84 | 3.63 | 5.53 |
| Chloride (mg/L) | - (c) | - | - | 36.6 | 39.4 | 20.6 | 24.9 | - | | 24.9 | 29.6 | 18.1 | 20.2 |
| Sulphate (mg/L) | - | 1590 | 1440 | 735 | 877 | 350 | 459 | 1156 | 1244 | 496 | 656 | 312 | 358 |
| TDS (mg/L) | - | 2250 | 2005 | 1290 | 1010 | 482 | 804 | 1695 | 1770 | 880 | 733 | 417 | 533 |
| Arsenic (µg/L) | 5 | 88 | 81 | 18.4 | 12.4 | 11.2 | 27.7 | 51 | 42 | 13.2 | 6.37 | 5.62 | 11.4 |
| Cobalt (µg/L) | - | - | - | 2.46 | 2.09 | 1.66 | 2.79 | - | - | 1.7 | 1.47 | 1.43 | 1.79 |
| Copper (µg/L) | 2 – 4(b) | 55 | 51 | 2.22 | 2.44 | 2.38 | 4.12 | 36 | 29 | 2.11 | 2.21 | 2.17 | 2.55 |
| Lead (µg/L) | 1 – 7(b) | 14 | 15 | 1.4 | 1.56 | 1.5 | 2.64 | 7.4 | 8 | 1.21 | 1.23 | 1.21 | 1.47 |
| Molybdenum (µg/L) | - | 3570 | 3360 | 241 | 182 | 182 | 345 | 2620 | 1990 | 276 | 163 | 163 | 330 |
| Nickel (µg/L) | 25 – 150(b) | 121 | 123 | 18 | 19.7 | 16.9 | 33.6 | 94 | 76 | 10.2 | 13 | 11 | 16.9 |
| Selenium (µg/L) | 1 | 19 | 19 | 3.13 | 2.32 | 1.67 | 2.83 | 12.4 | 10 | 1.98 | 1.66 | 1.37 | 1.87 |
| Uranium (µg/L) | 15 | 542 | 581.7 | 16.2 | 17.0 | 11.7 | 33.4 | 332 | 316 | 9.59 | 7.0 | 5.8 | 14.6 |
| Zinc (µg/L) | 30 | 84 | 88 | 7.22 | 6.14 | 6.53 | 9.77 | 58 | 55 | 5.77 | 5.46 | 5.72 | 6.81 |
| Thorium-230 (Bq/L) | - | 0.035 | 0.033 | 0.017 | 0.0152 | 0.014 | 0.020 | 0.016 | 0.016 | 0.013 | 0.0113 | 0.012 | 0.014 |
| Lead-210 (Bq/L) | - | 0.333 | 0.108 | 0.044 | 0.0349 | 0.035 | 0.049 | 0.176 | 0.06 | 0.036 | 0.0303 | 0.031 | 0.036 |
| Radium-226 (Bq/L) | - | 0.093 | 0.088 | 0.028 | 0.011 | 0.011 | 0.023 | 0.057 | 0.048 | 0.019 | 0.00603 | 0.006 | 0.011 |
| Polonium-210 (Bq/L) | - | - | - | 0.023 | 0.0104 | 0.011 | 0.021 | - | - | 0.013 | 0.00639 | 0.007 | 0.010 |

Note: Highest maximum mean is shaded. Predictions that exceed the stated objective are shown in bold. Definition of units: mg/L = milligrams per litre; µg/L = micrograms per litre; Bq/L = Becquerel's per litre.
(a) = SSWQO (Saskatchewan Environment 2006) [17]
(b) = Objective depends on hardness. In Sink Reservoir and Vulture Lake the hardness is estimated to be greater than 180 mg/L; in McClean Lake the hardness is estimated to be 80 mg/L and downstream the hardness is estimated to be less than 60 mg/L.
(c) = objective not available, or predicted concentration not available.
(d) = 1991 EIS Maximum Mean Concentration for Kewen Lake Outlet.

**Table 9-10** Predicted Maximum Mean and 95th Percentile Values Water Quality – Midwest Project Cumulative Case (continued)

| | | McClean Lake | | | | | | Collins Creek at Hwy 905 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Water Quality Objectives | 1991 EIS Maximum Mean | 1995 EIS Maximum Mean | Sue E EIS Maximum Mean | Midwest Project Base Case Maximum Mean | Midwest Project Cumulative Case | | 1991 EIS Maximum Mean[(d)] | 1995 EIS Maximum Mean | Sue E EIS Maximum Mean | Midwest Project Base Case Maximum Mean | Midwest Project Cumulative Case | |
| | | | | | | Maximum Mean | 95th Percentile | | | | | Maximum Mean | 95th Percentile |
| Ammonia (mg/L) | 1.54 (pH=7.5, T=20ºC) | 0.91 | 0.94 | 0.69 | 0.93 | 0.93 | 1.38 | 0.47 | 0.20 | 0.40 | 0.56 | 0.56 | 0.85 |
| Chloride (mg/L) | - [©] | - | - | 4.32 | 4.68 | 4.68 | 5.67 | - | 1.06 | 2.47 | 2.89 | 2.89 | 3.54 |
| Sulphate (mg/L) | - | 177 | 170 | 77.1 | 74.6 | 76.1 | 105 | 72 | 14.3 | 40.8 | 43.5 | 45.1 | 66.6 |
| TDS (mg/L) | - | 282 | 264 | 139 | 99.6 | 99.6 | 139 | 129 | 25.8 | 74.3 | 59.1 | 59.1 | 82.8 |
| Arsenic (µg/L) | 5 | 6 | 5 | 2.62 | 2.2 | 2.2 | 3.62 | 3 | 0.871 | 1.6 | 1.49 | 1.49 | 2.35 |
| Cobalt (µg/L) | - | - | - | 1.11 | 1.13 | 1.14 | 1.25 | - | 1.02 | 1.06 | 1.08 | 1.08 | 1.15 |
| Copper (µg/L) | 2 – 4[(b)] | 7.7 | 0.6 | 2.02 | 2.03 | 2.03 | 2.09 | 5 | 2.01 | 2.01 | 2.02 | 2.02 | 2.05 |
| Lead (µg/L) | 1 – 7[(b)] | 3.5 | 3 | 1.03 | 1.04 | 1.04 | 1.11 | 3.5 | 1 | 1.02 | 1.02 | 1.02 | 1.07 |
| Molybdenum (µg/L) | - | 390 | 270 | 54.4 | 38.2 | 38.2 | 69.2 | 180 | 39.7 | 29.2 | 22.5 | 22.5 | 40.8 |
| Nickel (µg/L) | 25 – 150[(b)] | 15 | 12 | 2.51 | 3.53 | 3.53 | 5.2 | 8 | 1.3 | 1.78 | 2.47 | 2.47 | 3.49 |
| Selenium (µg/L) | 1 | 1.9 | 2 | 0.51 | 0.503 | 0.50 | 0.66 | 1 | 0.258 | 0.36 | 0.375 | 0.38 | 0.47 |
| Uranium (µg/L) | 15 | 43.5 | 40.2 | 1.81 | 1.93843 | 2.04 | 4.35 | 19 | 0.46 | 1.06 | 1.23 | 1.29 | 2.70 |
| Zinc (µg/L) | 30 | 12 | 12 | 5.11 | 5.14 | 5.21 | 5.53 | 8 | 5.04 | 5.06 | 5.09 | 5.13 | 5.31 |
| Thorium-230 (Bq/L) | - | 0.01 | 0.011 | 0.006 | 0.007 | 0.007 | 0.008 | 0.011 | 0.005 | 0.006 | 0.006 | 0.006 | 0.007 |
| Lead-210 (Bq/L) | - | 0.045 | 0.035 | 0.028 | 0.028 | 0.028 | 0.030 | 0.037 | 0.027 | 0.028 | 0.028 | 0.028 | 0.029 |
| Radium-226 (Bq/L) | - | 0.01 | 0.009 | 0.006 | 0.004 | 0.004 | 0.005 | 0.006 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| Polonium-210 (Bq/L) | - | - | - | 0.006 | 0.005 | 0.005 | 0.006 | - | 0.005 | 0.006 | 0.005 | 0.005 | 0.006 |

Note: Highest maximum mean is shaded. Predictions that exceed the stated objective are shown in bold. Definition of units: mg/L = milligrams per litre; µg/L = micrograms per litre; Bq/L = Becquerel's per litre.
a = SSWQO (Saskatchewan Environment 2006)
b = Objective depends on hardness. In Sink Reservoir and Vulture Lake the hardness is estimated to be greater than 180 mg/L; in McClean Lake the hardness is estimated to be 80 mg/L and downstream the hardness is estimated to be less than 60 mg/L.
c = objective not available, or predicted concentration not available.
d = 1991 EIS Maximum Mean Concentration for Kewen Lake Outlet.

### 9.5.3 Groundwater Levels

Potential Effect

Mine dewatering activities could result in depressed groundwater levels within the local assessment boundary.

Prediction

Depressed groundwater levels may be affected in the immediate vicinity of the Midwest pit, Caribou pit, JEB TMF, and the Sue mining areas. The potential effects from these activities are anticipated to last throughout the active operating periods. Groundwater level effects are not anticipated to overlap spatially or temporally. Once dewatering activities cease, the groundwater system will recover to natural conditions.

Residual Cumulative Effect and Significance

Cumulative effects from mine dewatering activities are not anticipated due to the limited extent and the relatively short duration of the dewatering effects on groundwater.

Conclusions

In reaching a conclusion on the significance of the cumulative effects groundwater levels, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects and an evaluation of the significance of residual effects described within this section. The SMOE and the RAs are satisfied that the cumulative environmental effects will not likely cause significant adverse effects on the Midwest Project.

### 9.5.4 Long-term Effects on the Hydrogeological Environment

Potential Effect

Long-term effects are attributed to the disposal of waste and special waste at the Midwest Project, the disposal of waste and special waste at the McClean Lake Operation, and the disposal of tailings at JEB TMF, including from the Caribou Project.

Prediction

Over the life of the McClean Lake Operation, approximately 450 million lbs of $U_3O_8$ will be processed through the JEB Mill, of which, approximately 18,500 $m^3$ of ore will be from the Caribou pit for a total of about 2.6 million lbs $U_3O_8$ equivalent. Ore volumes and the resulting tailings volumes associated with the Caribou deposit constitute less than 1% of the total to be processed and managed at the JEB site. This small contribution will not noticeably affect the predicted long-term effects associated with tailings management at McClean Lake Operation.

Residual Cumulative Effect and Significance

Residual cumulative effects are anticipated with the transport of COCs to surface water receptor locations, but they are not considered to be significant. The transport of COCs from the JEB TMF to Pat Lake and Fox Lake will have a low magnitude of effect on background concentrations in these lakes (see section 9.3). Similarly, the transport of COCs from the Sue area and Midwest area will also have a low magnitude of effect on

background water concentrations in Collins Creek. For most COCs, the incremental increase will be small and indistinguishable from background.

Conclusions

In reaching a conclusion on the significance of the cumulative effects on surface water quality, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects and an evaluation of the significance of residual effects described within this section. The SMOE and the RAs are satisfied that the cumulative environmental effects will not likely cause significant adverse effects on the Midwest Project.

### 9.5.5 Cumulative Effects Within the Athabasca Basin

Potential Effect

The proposed Midwest Project is located in the Athabasca Basin of northern Saskatchewan which hosts several other uranium mines. Regional cumulative effects could arise as a result of emissions from other operations that overlap spatially with the Midwest Project

Prediction

Emissions from Cameco's Rabbit Lake Operation, the upgrade of the Athabasca seasonal road, and the construction and operation of the Wollaston Lake road are predicted to overlap spatially with the Midwest Project.

A Cumulative Effects Monitoring (CEM) program was developed by SMOE and the CNSC in response to the 1992 Joint Panel recommendation to examine potential regional impacts of uranium mining on the environment. The CEM program monitors regional effects from mining operations.

A second initiative involves the Athabasca Working Group (AWG) that manages the Impact Management Agreement (IMA) between mining companies and the Athabasca communities (Hatchet Lake, Black Lake and Fond du Lac First Nations; northern hamlets of Wollaston Lake and Stony Rapids; and northern settlements of Uranium City and Camsell Portage). The IMA includes an environmental protection and compensation component. The AWG environmental monitoring program was initiated in 2000 and the study area comprises the geographic areas in close proximity to the Athabasca communities.

Residual Cumulative Effect and Significance

The McClean Lake Operation EMP demonstrates that any influence on the environment as a result of emissions from mining and milling are negligible within a short distance from the source and there is no overlap of emissions which would result in a potential cumulative environmental effect. This finding is supported by CEM program. Residual cumulative effects of the Midwest Project in conjunction with the Rabbit Lake Operation are anticipated to be negligible.

It is not anticipated that the environmental effects of the Midwest Project will overlap with the environmental effects associated with the development of the Wollaston Lake road or the upgrade of the Athabasca seasonal road, as the location of these projects is

largely outside the Midwest Project local assessment boundary. The residual cumulative effects of the Midwest Project with these road projects are anticipated to be negligible.

Conclusions

In reaching a conclusion on the significance of the cumulative effects on regional projects, the SMOE and RAs have taken into account the EIS, which includes a description of the potential Project effects and an evaluation of the significance of residual effects described within this section. The SMOE and the RAs are satisfied that the cumulative environmental effects will not likely cause significant adverse effects on the Midwest Project.

# 10 MONITORING AND FOLLOW-UP

## 10.1 Follow-Up under the CEA Act

The purpose of a follow-up program under the CEA Act is to verify the accuracy of the EA and to determine the effectiveness of the mitigation measures taken to mitigate the adverse environmental effects of the Midwest Project. Where appropriate, the results of a follow-up program may also support the implementation of adaptive management measures to address previously unanticipated adverse environmental effects.

The follow-up program components described in table 10-1 for the construction, operation, and decommissioning phases of the Midwest Project are outlined at a high level. The specific follow-up program elements (location, reporting, frequency and timelines) may need to be modified based on future permits, licences, authorizations and/or approvals, and will be subject to adaptative management measures based on changes in environmental conditions and observations of the Midwest Project's effects on the environment.

AREVA will be required to design and implement an EA follow-up program in consultation with relevant regulators, which will be developed prior to the permitting stage. The CNSC licensing and compliance program will include expected timelines and will be used as the mechanism for ensuring the final design and implementation of the follow-up and monitoring program, and for the reporting of the program results. In addition, DFO will incorporate into their *Fisheries Act* authorizations conditions which will require compliance monitoring to determine the effectiveness of mitigation measures in protecting fish and fish habitat. Once a CNSC licensing decision has been made, the requirements for the follow-up program will be specified as a condition of the CNSC licence. Monitoring requirements of DFO, TC and NRCan under their legislation would be determined prior to the granting of any authorizations.

Preliminary details of the proposed monitoring and follow-up program are provided in table 10-1. The full program will be designed by the RAs, in consultation with the proponent, the SMOE and Aboriginal groups, following the Minister of the Environment's EA Decision Statement.

## 10.2 Monitoring

Nuclear sites regulated by the CNSC are required to have extensive waste management and environment monitoring programs (EMPs) integrated within an environmental or quality management system. The EMP is used to support the periodic assessment of environmental performance relative to predicted impacts as required by the SMOE Status of the Environment reports and the Canadian Standards Association (CSA) N288.4 Standard for Environmental Monitoring at Class I Nuclear Facilities and Uranium Mines and Mills.

AREVA currently has EMPs in place at the McClean Lake Operation to help maintain operational performance standards and determine operational related effects. Many of the monitoring program requirements associated with the Midwest Project will be captured by the existing McClean Lake Operation EMPs. The EMPs will continue to be

used to evaluate current environmental conditions and any changes over time. Information obtained from these existing EMPs will help to support the validation of the EA predictions of the Midwest Project.

## 10.2.1 Existing Environmental Monitoring Programs at McClean Lake Operation

### *10.2.1.1 Integrated Quality Management System (IQMS)*

The IQMS at McClean Lake is very broad and covers most activities at site (see table 4-8). The system was designed to meet the requirements of the CNSC, SMOE, EC, ISO 14001 and OHASA 18001, as well as internal requirements. Additional monitoring requirements and follow-up programs associated with the Midwest Project will be incorporated into AREVA's IQMS.

### *10.2.1.2 Environmental Code of Practice (ECOP)*

Effluent discharges are governed by regulatory discharge requirements, including provincial and federal licence requirements, and federal MMER. At the McClean Lake Operation, effluent discharge is controlled and managed through the ECOP "administrative" (identify deviation from normal operating conditions) and "action" (prevent loss of control) levels for selected parameters. The ECOP has been established for both the JEB and Sue WTP effluent and the JEB dewatering well system discharges.

### *10.2.1.3 Environmental Monitoring Program (EMP)*

The existing EMP at the McClean Lake Operation has been established to monitor contaminant releases and their transport through the environment as well as any potential biological effects associated with these releases and other sources of perturbation at the site. The results of this program are reported in annual environmental reports submitted to the CNSC and SMOE. A comparison of existing impacts to the predicted EA impacts is included in the five year Status of the Environment (SOE) reports submitted to and evaluated by the SMOE and CNSC. The facility's environmental performance is also assessed and rated during the CNSC public hearing relicensing process.

The McClean Lake Operation EMP will be used should the Midwest Project proceed to the licensing stage with the results being assessed against the environmental performance predictions associated with Midwest Project. As the existing program will be a core element of the Midwest Project's EMP a brief description of this program is provided in the following paragraphs.

The EMP at McClean Lake Operation includes both emission/effluent monitoring as well as receiving environment monitoring. The receiving environment monitoring program includes the monitoring of contaminant levels in both terrestrial and aquatic ecosystems within a number of abiotic and biotic media as well as the monitoring of potential biological effects. The EMP documents the specific monitoring locations, sampling frequencies and the analytical parameters and/or biological metrics to be measured for each sample media. This program is reviewed and approved by both CNSC and SMOE.

Key receiving environment monitoring components of the McClean Lake Operation EMP include meteorology and air quality; terrestrial ecology (soil, plant and lichen chemical

analyses), surface water hydrology; water quality; aquatic ecology (sediment and fish tissue chemical analyses, fish population health assessments, benthic macro-invertebrate community analyses); and groundwater monitoring. Periodic special investigations or follow-up programs are completed as required in response to monitoring results or research investigations. The operational results of the EMP to date are discussed in Section 8 (Description of the Existing Environment).

The existing McClean Lake Operation EMP provides a template which will facilitate the development of the Midwest Project EMP. The additional monitoring requirements and follow-up activities and timelines identified in table 10-1 shall be tracked and carried forward into any future CNSC licensing activities should the Midwest Project proceed to licensing.

#### *10.2.1.4 Tailings Management Program*

The CNSC operating licence for McClean Lake requires tailings to be prepared and deposited as described in the approved licensing documents and certain parameters are subject to action levels and operating limits. The Tailings Optimization and Validation program (TOVP) evaluates the performance of the JEB TMF and promotes continual improvement of the operational processes performed within the mill and tailings management facility. Sampling, monitoring and research of the JEB tailings are carried out under the TOVP to optimize tailings performance and ensure that long-term predictions of effects to the receiving aquatic environment are consistent with previous approvals. The TOVP is a component of the McClean Lake Operation license, which requires that all information related to tailings performance be consolidated and provided to the CNSC for review every five years. The TOVP will be continued should approval be given to deposit Midwest tailings at the JEB TMF as highlighted in table 10-1.

#### *10.2.1.5 Waste Rock Management Program*

Waste rock will be segregated between special waste rock and clean waste rock. Special waste rock will be segregated based on radiological, hazardous (e.g. nickel, arsenic), and acid leaching potential. Clean waste rock does not require a management program. The ongoing special waste rock management program at McClean Lake Operation is required to demonstrate that the temporary management of special waste rock during the operational period will not pose a risk to the environment. It also facilitates the collection of solids and leachate data to for special waste rock characterization that is used for decommissioning plans.

#### *10.2.1.6 Waste Water Management Program*

At the McClean Lake Operation, waste water management is required throughout the operational and decommissioning periods. The effects of treated effluent discharge is based on extensive source characterization of COCs, as well as extensive monitoring of the interaction of treated effluent discharge and the receiving environment

**Table 10-1** Monitoring and Follow-up Program for the Midwest Project

| Environmental or Project Component | Purpose | Monitoring/Sampling Location | Project Phase | Primary Responsibility | Secondary Responsibility |
|---|---|---|---|---|---|
| **McClean Lake Operation** | | | | | |
| Aquatic Environment:<br><br>EMP | Assess predicted impacts at the McClean Lake Operation associated with the milling and water treatment activities resulting from the Midwest project:<br>▪ review adequacy of existing EMP based on most recent design associated with licence application<br>▪ ensure that temperature and pH are recorded whenever total ammonia measurements are made in receiving environment water samples | S/V TEMS and downstream with reference study areas | Construction<br>Operation<br>Decommissioning | CNSC | EC |
| | Periodic confirmation of sediment accumulation modelling:<br>▪ address accuracy of modelling predictions with respect to sediment accumulation as part of the routine Status of the Environment reviews | S/V TEMS and downstream | Operation | CNSC | SMOE |
| Aquatic Environment:<br><br>Follow-up | Selenium in fish:<br>▪ establish relationship between fish flesh (whole fish and filet) and fish gonad concentrations as present expectations are that levels in gonads will become the biological metric used for assessing impacts rather than water concentrations or | S/V TEMS and downstream with reference study areas. | Operation | CNSC | |

| Environmental or Project Component | Purpose | Monitoring/Sampling Location | Project Phase | Primary Responsibility | Secondary Responsibility |
|---|---|---|---|---|---|
| | whole fish tissue levels | | | | |
| Terrestrial Environment:<br><br>Follow-up | Special transfer coefficient for wildlife use of S/V TEMS:<br>▪ verify the accuracy or conservatism of the water to vegetation transfer coefficients for contaminants accumulating in the S/V TEMS | S/V TEMS and reference | Operation | CNSC | |
| Air Quality:<br><br>EMP | Verify predictions that air quality changes resulting from air emissions and dust deposition will meet applicable federal and provincial requirements:<br>▪ review adequacy of existing McClean Lake Program<br>▪ assess potential for overlapping influences from Midwest site | Site Study Area | Construction<br>Operation<br>Decommissioning | CNSC | |
| Tailings Management:<br><br>TOVP | Tailings Optimisation and Validation Program:<br>▪ verify the long-term behaviour of COCs and engineering properties associated with the management of Midwest tailings at the JEB TMF<br>▪ assess adequacy of existing TOVP with respect to Midwest tailings<br>▪ update contaminant transport model to demonstrate that long-term predictions of effects to the receiving | Physical and chemical/mineralogical characterization of the tailings. Tailings are sampled from several locations in the JEB at different depths every five years. | Operation<br>Decommissioning | CNSC | |

| Environmental or Project Component | Purpose | Monitoring/Sampling Location | Project Phase | Primary Responsibility | Secondary Responsibility |
|---|---|---|---|---|---|
| | aquatic environment are consistent with previous approvals | | | | |
| Tailings Management:<br><br>EMP | Review adequacy of existing groundwater network for assessing potential migration of contaminants from the TMF with the addition of Midwest tailings. | McClean Lake groundwater network | Operation<br>Decommissioning | CNSC | |
| **Midwest Project Local Assessment Boundary** | | | | | |
| Aquatic Environment:<br><br>EMP | Establish effluent monitoring program for Midwest WTP (See CSA N288.5):<br>▪ establish monitoring program for treated effluent released from the Midwest WTP to ensure compliance with licence limits | Dewatering well system<br>Midwest water treatment plant | Operation | CNSC | |
| Aquatic Environment:<br><br>Follow-up | Dewatering of Mink Arm:<br>▪ the Mink Arm dewatering program has been designed to ensure SSWQOs and CCME based TSS objectives are maintained/achieved and that the hydrology of Midwest Creek remains within historical ranges with no excessive stream bed or bank erosion. Environmental monitoring program will be established to demonstrate that these objectives have been achieved | Mink Arm dewatering water<br>North McMahon Lake<br>South McMahon Lake<br>Midwest Creek hydrology | Construction | CNSC | SMOE<br>EC |
| | Establish effluent and receiving environment monitoring program for: | Points of release and the relevant receiving | Operation | CNSC | |

| Environmental or Project Component | Purpose | Monitoring/Sampling Location | Project Phase | Primary Responsibility | Secondary Responsibility |
|---|---|---|---|---|---|
| | ▪ any releases of "clean" dewatering water to the receiving environment<br>▪ any releases of RO permeate to Midwest study area should it be needed to stabilise lake water levels | environment waters. | | | |
| | Monitor nutrient levels | Too Small Lake<br>Shallow Lake<br>South McMahon Lake | Construction<br>Operation<br>Decommissioning | CNSC | |
| | Construction monitoring will be a requirement of any Authorization issued under subsection 35(2) of the Fisheries Act. Best practices are to be incorporated into construction procedures when working near or around potential fish bearing waters. Any works in navigable waterways will have to be approved under the NWPA | Local Assessment Boundary | Construction | DFO | CNSC<br>SMOE<br>TC |
| | Construction activities associated with the development of stream crossing incorporate the Fish Habitat Protection Guidelines – Road Construction and Stream Crossings [18] | At stream crossings | Construction | DFO | CNSC<br>SMOE |
| | Fish Habitat Compensation Plan (Montreal River):<br>▪ undertake construction and post-construction monitoring as stated in the FHCP<br>▪ monitor the extent to which fish are moving upstream past the fishway | Montreal River weir | Construction<br>Operation | DFO | CNSC<br>SMOE |

| Environmental or Project Component | Purpose | Monitoring/Sampling Location | Project Phase | Primary Responsibility | Secondary Responsibility |
|---|---|---|---|---|---|
| | ▪ implement a contingency FHCP if required | | | | |
| Terrestrial Environment<br><br>Follow-up | Develop and implement a monitoring program for breeding birds prior to and during the construction period to include:<br>▪ a pre-construction bird survey for migrants and early nesting species<br>▪ nest searches prior to and during the construction period<br>▪ a commitment by AREVA to contact the Canadian Wildlife Service (CWS) for appropriate mitigation if nests are discovered | Construction footprint | Construction | EC | CNSC<br>SMOE |
| Hydrology / Groundwater Flow<br><br>EMP | Monitor both lake level and stream flow to confirm predictions regarding lake levels and flow volumes to detect changes. | Too Small Lake<br>South McMahon Lake<br>Shallow Lake<br>Midwest Creek<br>Smith Creek | Construction<br>Operation<br>Decommissioning | CNSC | SMOE |
| Hydrology / Groundwater Flow<br><br>Follow-up | Assess predictions with respect to:<br>▪ water inflow rate to the Midwest open pit<br>▪ rate of collected/intercepted groundwater from open pit perimeter wells<br>▪ comparison of actual rates and volumes to predictions and assessment of implications to water management plans | Midwest pit and associated cone of depression | Construction<br>Operation | CNSC | |

| Environmental or Project Component | Purpose | Monitoring/Sampling Location | Project Phase | Primary Responsibility | Secondary Responsibility |
|---|---|---|---|---|---|
| | Creation of a monitoring program and database for Midwest pit and associated cone of depression to inform the Midwest hydrogeological flow model in support of decommissioning plans. | Midwest pit and associated cone of depression. | Decommissioning<br>Post-Decommissioning | CNSC | |
| Waste Rock Management Program<br><br>Follow-up | Waste rock characterisation and management program:<br>▪ assess the mineralogy, radioactivity and chemical reactivity of the waste rock to confirm predictions of short and long term mobility upon decommissioning | Systematic sampling during mining of the Midwest ore | Operation<br>Decommissioning<br>Post-Decommissioning | CNSC | |
| Waste Rock Management Program<br><br>EMP | Assess the effects of any seepage from waste rock piles and demonstrate that the temporary management of waste rock during the operational period does not pose a risk to the environment:<br>▪ monitor and collect solids and leachate data for waste rock characterization that is used to confirm decommissioning plans<br>▪ develop a monitoring program to confirm predictions for final approved waste rock decommissioning program | Waste rock piles and associated ground water network.<br>Selected decommissioning sites. | Operation<br>Decommissioning | CNSC | |
| Hydrogeology<br><br>Follow-up | ▪ submit final design report for construction and upgrade of Mink Arm dam<br>▪ submit final pit slope design | Mink Arm | Construction | CNSC | |

| Environmental or Project Component | Purpose | Monitoring/Sampling Location | Project Phase | Primary Responsibility | Secondary Responsibility |
|---|---|---|---|---|---|
| | | | | | |
| **Combined McClean Lake Operation and Midwest Project Local Assessment Boundary** | | | | | |
| Terrestrial Environment<br><br>Follow-up | Develop and implement a periodic wildlife monitoring program to:<br>▪ confirm presence/absence of wildlife species in comparison to baseline conditions<br>▪ report the presence, location and date of any species at risk to the on-site environmental monitor during site and road construction with a commitment to develop follow-up actions with the appropriate regulatory agency to ensure protection of said species<br>▪ monitor habitat utilization and habitat connectivity as direct habitat loss and changes in habitat quality were predicted as a result of the development of the transportation and utility corridor. Specific focus on moose and caribou | Local Assessment Boundary | Construction<br>Operation<br>Decommissioning | EC | CNSC<br>SMOE |

# 11 CONCLUSIONS

In reaching a conclusion on whether the Midwest Project is likely to cause significant adverse environmental effects, the RAs have taken into account:

- the EIS, which includes a description of potential Project effects on the atmospheric, geological/hydrogeological, aquatic, terrestrial, human and socio-economic environments and AREVA's evaluation of the significance of residual effects
- comments on the proposed Midwest Project made by federal and provincial government agencies, Aboriginal communities and organizations, stakeholders, and the public, as well as AREVA's and the Crown's responses to these comments
- the information, analysis and conclusions included in this CSR
- the requirements for authorization under subsection 24(2) of the NSCA for a CNSC licence or licence amendment
- the proposed Fish Habitat Compensation Plan that will be required for a subsection 35(2) and section 32 Authorization under the *Fisheries Act*
- the requirements for approval under sections 5(3), 6(4), and 10(2) of the NWPA as well as an exemption under section 23 to allow for the interference to navigation
- the requirements for issuing a licence under paragraph 7(1)(*a*) of the *Explosives Act*

Taking into account the implementation of the mitigation measures proposed, commitments made by AREVA and the monitoring and follow-up design detailed in this CSR, CNSC, DFO, TC and NRCan, as RAs pursuant to the CEA Act, have determined that the proposed Midwest Project is not likely to cause significant adverse environmental effects.

# 12 REFERENCES

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# APPENDIX A PROJECT SPECIFIC GUIDELINES AND SCOPING DOCUMENT AND EA TRACK REPORT

See referenced document e-DOC 3849321

# APPENDIX B REFERENCE CONCENTRATIONS

## B.1. Reference Concentrations for the Atmospheric Environment

Federal ambient air quality standards and objectives and Saskatchewan standards and regulations for standard air pollutants (total suspended particulate, sulphur dioxide, nitrogen oxides) are intended to protect and prevent deterioration of air quality. There are no air quality standards for radioactivity. Radioactive air emissions are assessed through exposure pathways analysis. Radon gas (radon-222, Rn-222) is released into the atmosphere when radium-226 bearing materials are mined or processed. The *Radiation Protection Regulations* of the CNSC provide a means of assessing the Rn-222 attributable to a licensed facility. The assessment values for Rn-222 levels predicted in the air quality assessment were measured against an incremental value of 60 $Bq/m^3$. A summary of the available standards is provided in table B-1.

**Table B-1** Summary of Available Reference Levels for Standard Air Pollutants

| **Constituent** | **Averaging Time Period** | **Saskatchewan Standards / Regulations ($ug/m^3$) [19]** | **Federal Standards/Objectives [20]** | | |
|---|---|---|---|---|---|
| | | | **Maximum Desirable ($ug/m^3$)** | **Maximum Acceptable ($ug/m^3$)** | **Maximum Tolerable ($ug/m^3$)** |
| Sulphur Dioxide ($SO_2$) | 1 year | 30 | 30 | 60 | - |
| | 24 hour | 150 | 150 | 300 | 800 |
| | 1 hour | 450 | 450 | 900 | - |
| Nitrogen Oxides ($NO_x$) | 1 year | 100 | 60 | 100 | - |
| | 24 hour | - | - | 200 | 300 |
| | 1 hour | 400 | - | 400 | 1000 |
| Total Suspended Particulate (TSP) | 1 year | 70 | 60 | 70 | - |
| | 24 hour | 120 | - | 120 | 400 |

## B.2 Reference Concentrations for the Aquatic Environment

To evaluate the potential effects of the Project on water quality, the provincial interim water quality objectives and federal water quality guidelines were used to gauge potential changes in water quality associated with Project activities (table B-2). For most COCs, the Saskatchewan Surface Water Quality Objectives (SSWQO) and Canadian Water Quality Guidelines (CWQG) were equivalent. The two exceptions are for molybdenum and uranium.

**Table B-2** Provincial and Federal Water Quality Objectives and Guidelines

| Constituent | SSWQO [17] | CCME [21] |
|---|---|---|
| Total Ammonia (mg/L) | 1.54 | 1.54 |
| Arsenic (ug/L) | 5 | 5 |
| Cobalt (ug/L) | 0.4 | - |
| Copper (ug/L) | 2-4 | 2-4 |
| Lead (ug/L) | 1-7 | 1-7 |
| Molybdenum (ug/L) | - | 73 |
| Nickel (ug/L) | 25-150 | 25-100 |
| Selenium (ug/L) | 1 | 1 |
| Uranium (ug/L) | 15 | - |
| Zinc (ug/L) | 30 | 30 |
| Thorium-230 (Bq/L) | - | - |
| Lead -210 (Bq/L) | - | - |
| Radium-226 (Bq/L) | 0.11 | - |
| Polonium-210 (Bq/L) | - | - |

To evaluate the potential effects on sediment quality, a combination of national sediment quality guidelines, working benchmarks and regionally-specific toxicity benchmarks were used (table B-3).

**Table B-3** National Sediment Quality Guidelines, CNSC Working Benchmarks and Regional Toxicity Benchmarks

| Constituent of Concern | CCME [22] | | CNSC [23] | |
|---|---|---|---|---|
| | TEL | PEL | LEL | SEL |
| Arsenic (ug/g) | 5.9 | 17 | 10 | 346 |
| Cobalt (ug/g) | - | - | - | - |
| Copper (ug/g) | 35.7 | 197 | 22 | 269 |
| Lead (ug/g) | 35 | 91.3 | 37 | 412 |
| Molybdenum (ug/g) | - | - | 13.8 | 1238 |
| Nickel (ug/g) | 18 | 35.9 | 23 | 484 |
| Selenium (ug/g) | - | - | 1.9 | 16.1 |
| Uranium (ug/g) | - | - | 104 | 5874 |
| Zinc (ug/g) | 123 | 315 | - | - |
| Thorium-230 (Bq/g) | - | - | - | - |
| Lead-210 (Bq/g) | - | - | 0.6 | 14.4 |
| Radium-226 (Bq/g) | - | - | 0.9 | 21 |
| Polonium-210 (Bq/g) | - | - | 0.8 | 12 |

TEL = threshold effect level PEL = probable effect level
LEL = lowest effect level SEL = severe effect level

## B.3 Reference Concentrations for the Aquatic Environment

For the assessment of potential effects of radionuclides to the aquatic environment, the maximum predicted average and 95$^{th}$ percentile water and sediment concentrations were used to estimate the radiological dose to aquatic VECs. These estimated doses were then compared to the dose rate guidelines (DRG). Dose rate guidelines of 0.6 mGy/d (milligray per day) [24] and 10 mG/d [25] were used for fish; 3 mGy/d [24] and 10 mGy/d [25] for aquatic plants; and 6 mGy/d [24] and 10 mGy/d [25] for benthic invertebrates . A SI value of greater than one indicates that the DRG for an aquatic receptor is exceeded.

## B.4 Reference Concentrations for Terrestrial Wildlife

The potential effects of radionuclide exposure on terrestrial VECs were evaluated by comparing the calculated total internal dose with the dose rate guidelines of 1mGy/d [25]

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# APPENDIX C FISH HABITAT COMPENSATION PLAN

## C.1. Introduction

The proposed Midwest Project will result in the unavoidable project-fish interactions to the following:

- the loss of fish habitat at stream crossings along the proposed transportation corridor between the Midwest Project site and the McClean Lake Operation
- the loss of fish habitat within Mink Arm of South McMahon Lake in order to access the ore body by open pit mining

Sections 35 of the federal *Fisheries Act* prohibits any work or undertaking that causes the HADD of fish habitat unless authorized. Unavoidable fish habitat loss is subject to the no net loss (NNL) guiding principal of DFO's policy for the management of fish habitat [26]. NNL can be defined as "a working principal by which DFO strives to balance unavoidable habitat losses with habitat replacement on a project-by-project basis so that further reductions to Canada's fisheries resources due to habitat loss or damage may be prevented"[19]. The NNL policy requires, when Authorization has been given, that the lost habitat is compensated for by creating new or increasing the productive capacity of existing habitat.

To compensate for the Midwest Project's loss of fish habitat, AREVA originally proposed two conceptual plans to meet DFO's compensation hierarchy in earlier versions of the draft Midwest EIS. These plans were the Too Small Lake alternative and the Sue E Pit/Sils Lake alternative. The Too Small Lake alternative proposed the expansion, deepening and stocking of an existing lake. The Sue E Pit/Sils Lake alternative proposed the dewatering of an existing pit lake, constructing a channel to connect the pit to an existing lake, flooding the pit lake with water from a nearby lake (e.g. McClean Lake) and stocking the system with fish. Based on regulatory comments, neither the Too Small Lake nor Sue E Pit/Sils Lake alternatives' were supported by the SMOE. DFO was willing to work with AREVA to pursue these options but had concerns regarding the uncertainty of success. Local stakeholders questioned the utility of creating fish habitat when excellent fishing was abundant in the area.

AREVA, in consultation with DFO and the SMOE, determined a more suitable option to compensate for the loss of fish habitat associated with the Midwest Project. A conceptual plan was identified for the Montreal River weir, located approximately 20 km north of Montreal Lake. Currently, upstream fish passage on Montreal River is blocked or impeded by a weir which was constructed in 1948 to control water levels in Montreal Lake. To alleviate this barrier to fish passage, AREVA is proposing to stabilize the existing weir and construct an engineered pool and riffle fishway using the existing sheet pile weir as the hydraulic control. This proposed habitat compensation plan meets DFO's compensation hierarchy to create or increase the productive capacity in a different ecological unit.

## C.2. Residual Habitat Losses

### C.2.1 Stream Crossings

An evaluation for fish passage through culverts at stream crossings along the proposed north and south transportation corridors was conducted to minimize potential restrictions to fish movement

related to these crossings. Hydraulic modeling has been undertaken for the proposed culvert crossing structures so they meet DFO fish passage requirements and will not restrict fish movement. Crossings N4, N5, S5 and S6 were deemed navigable and therefore, a navigable culvert is proposed for crossing N4 and clear-span bridges are proposed at N5, S5 and S6. Any works in navigable waterways for the purposes of the fish habitat compensation will have to be approved under the NWPA.

Although no impediment to fish passage is anticipated as a result of installation of any of the proposed crossing structure, a HADD of fish habitat is likely to occur as a result of construction and installation of the culverts along the proposed transportation corridor.

The preferred north transportation corridor stream crossings N2, N3, N4 and N5 were identified as fish habitat. The alternate south transportation corridor stream crossings S2, S3, S4, S5 and S6 were identified as fish habitat. Based on the sensitivity of habitat at stream crossings N5, S5 and S6, clear span bridges are proposed which, by design, will not require infilling or alteration of the watercourse or impede natural fish movement.

For stream crossings where culvert installations are proposed, the in-filled area was calculated as the area adjacent to the culvert installation and 25% of the culvert inlet and outlet rip-rap zones representing the in-filled shoreline above the high water level. The altered area was calculated as the physical culvert flow area plus 75% of the in-stream inlet and outlet rip-rap zones. Calculations for the north transportation corridor indicate a total in-filled area of approximately 211 $m^2$ and an altered area of approximately 451 $m^2$. For the alternate south transportation corridor, the in-filled and altered area was calculated to be approximately 274 $m^2$ and 406 $m^2$, respectively.

### C.2.2 Mink Arm

Exploration of the Midwest ore body commenced in 1968. A test mine was developed in 1988 and involved the construction of an earthen dam across Mink Arm of South McMahon Lake and draining a portion of the lake south of the dam. Following completion of the test mining, the Mink Arm basin was allowed to reflood and an equalization culvert was installed in the dam to enable drainage to South McMahon Lake. The dam remains intact and except during high water periods, impedes fish movement between Mink Arm from the rest of South McMahon Lake.

Mink Arm has a surface area of approximately 51 ha, with maximum and mean depths of 6.5 m and 4 m, respectively. Six fish species were documented in Mink Arm, including both small-bodied species such as lake chub and large-bodied fish species, such as northern pike, longnose sucker, and white sucker. Spawning habitat in Mink Arm is considered to be marginal for all fish species. During the 2006 spring spawning survey, a small number of northern pike eggs (between 8 and 56 eggs) were considered appropriate for spawning. By comparison, spawned egg searches conducted in North McMahon Lake located more than 300 northern pike eggs. Lake whitefish were documented in Mink Arm during the 1979 and 1988 fish surveys when Mink Arm was connected to South McMahon Lake; however lake whitefish were not documented to occur in Mink Arm during the 2003 or 2009 fish survey. Larval tows were conducted in 2009 to determine the presence/absence of larval lake whitefish. Evidence gathered from the 2003 and 2009 fish population surveys and the 2009 larval fish tows suggest that lake whitefish no longer reside or spawn in Mink Arm.

### *Interaction of fish populations between Mink Arm and South McMahon Lake*

In order to assess the HADD of fish habitat in Mink Arm, it was important to assess if fish from the main basin of South McMahon Lake use Mink Arm for overwintering, spawning and/or juvenile rearing activities.

As stated, the Mink Arm dam is a barrier to fish movement between Mink Arm and South McMahon Lake. The only connection is a culvert that may only be accessible to fish under high water conditions. Surface water elevation monitoring data and the culvert outlet elevation indicate the culvert is perched above South McMahon Lake by at least 30 cm and, as a result of the construction of the dam in 1988; Mink Arm no longer contributes to the overwintering capacity of South McMahon Lake.

An assessment was also conducted to confirm that fish were not moving upstream from South McMahon Lake into Mink Arm through the culvert for spring spawning. A hoop net was installed on the Mink Arm side (south side) of the culvert to capture any fish moving upstream from South McMahon Lake into Mink Arm. The net was installed in June 2009 during the spring spawning period for northern pike and sucker species. Based on the assessment, it was concluded that the fish from South McMahon Lake are not likely accessing Mink Arm for the purpose of spawning.

Based on the data collected, the loss of fish habitat in Mink Arm will not affect the current productive capacity of South McMahon Lake. The water bodies are separated by a dam and only connected by a perched equalization culvert, which limits fish movement between the two waterbodies. As such, fish from South McMahon Lake are not likely relying on Mink Arm to provide critical overwintering, spawning or juvenile rearing habitat to sustain their populations.

## C.3. Proposed Fish Habitat Compensation Plan at Montreal River Weir

The residual effects of the Midwest Project on fish habitat are limited to the loss of fish habitat along the transportation corridor at stream crossings and the permanent loss of fish habitat within Mink Arm of South McMahon Lake. AREVA's preferred FHCP is to restore connectivity at the Montreal River weir while maintaining the existing weir's spill elevation by creating a pool and riffle fishway and establishing the existing weir.

### *Montreal Lake*

Montreal Lake is a 45,000 ha lake with maximum and mean depths of 8.5 m and 2.9 m, respectively (figure C-1). Montreal Lake supports provincially-important subsistence, sport and commercial fisheries, including fish populations of northern pike, walleye, yellow perch, lake whitefish, white sucker, burbot, and cisco [27]. Montreal Lake receives flow from a number of rivers and creeks, including the Bittern River, Waskesiu River, and MacLennan River. Montreal Lake discharges north to Lac La Ronge via the Montreal River.

The Saskatchewan government is responsible for fisheries management and marketing of fish within the province. As outlined in the SMOE's Fisheries Management Plan, one of the objectives is to maintain productive capacity. The Montreal Lake fishery has a management objective to maintain a walleye population with a gill net catch per unit effort (CPUE) of 9 fish or greater per 100 m net. SMOE's 2009 Fishery Stock Assessment for Montreal Lake identified that the CPUE for walleye was 3 fish/100 m net, below the management objective for this lake.

On the advice of SMOE, a three year voluntary closure of the commercial fishery was implemented by the Northland's Fisherman's Co-op in 2006 to address concerns over the declining walleye stock. The commercial fishery closure extended for another two years in 2009 and is scheduled to be reviewed again in 2011. Since 2006, the walleye sportfish limit for the lake has been reduced.

Based on results from the 2009 fishery stock assessment [27], the Montreal Lake walleye population remains in an exploited state and will not be able to support any significant increases in harvest levels in the immediate future. A walleye fry stocking program has been conducted by the SMOE at Montreal Lake annually from 2007 to 2009 with 1.0 to 1.5 million fry stocked per year. SMOE will continue to monitor the status of the Montreal Lake fisher, with the next fishery stock survey scheduled for 2014.

***Montreal River Weir***

The Montreal River weir is a low steel sheet pile weir originally constructed by the provincial Department of Natural Resources in 1948. Maintenance of the weir is the responsibility of the province of Saskatchewan. The weir is approximately 20 km north of Montreal Lake and was installed at the request of trappers and fishermen to increase muskrat and fish habitat in Montreal Lake. The weir has raised the water levels by an estimated 1.5 m in Montreal Lake and increased the lake surface area by approximately 7,000 ha. The installation of the weir has added significantly to the amount of fish spawning, rearing and overwintering habitat within Montreal Lake. Engineering assessments conducted in 2007 and 2011 indicate that the weir currently shows signs of deterioration. The sheet pile wall is leaning modestly, the sheet pile abutments have been heaved by frost action and are now at an angle and the soil backing the abutment indicates signs of erosion. Concerns have been expressed by surrounding community members, users of Montreal Lake, and the Montreal Lake First Nations with respect to the potential of the weir to fail and how this would impact water levels and fish habitat in Montreal Lake, which may precipitate further declines in the fishery.

***Connection between Montreal Lake and Montreal River Weir***

Construction of fish passage such as pool and riffle type fishways are recognized as important to restoring the longitudinal connectivity of rivers. Through proper design and construction of a pool and riffle fishway at the Montreal River weir, the potential barrier to fish passage will be removed, allowing increased access to Montreal Lake, particularly for spring-spawning species such as walleye, northern pike, white and longnose sucker, and certain forage species which are known to move upstream in search of spawning or rearing habitat. This will allow enhanced utilization of Montreal Lake fish habitat. The proposed pool and riffle fishway will also enable walleye, whose population has decreased in recent years in Montreal Lake, to traverse the weir, continue upstream in the Montreal River and spawn in Montreal Lake. Increasing the ability of fish to move upstream and spawn in Montreal Lake will contribute to the initiative to increase walleye and other fish stocks in Montreal Lake.

***Pool and Riffle Fishway***

An analysis conducted on the existing Montreal River weir identified that the weir is a barrier to fish movement approximately 94% of the time. Even at a flood out stage (flood exceeding the 1:25 year daily mean flow), the weir would present some obstruction to upstream fish migration.

A pool and riffle fishway is a natural type of in-stream structure constructed from gravel, cobble and boulders, which is used to reduce high flow velocities and upstream slope. Using this system, the large surface water elevation drop that exists over the existing Montreal River weir will be removed and replaced by a series of step-pools. The pool and riffle fishway at the Montreal River weir will serve to restore and enhance fish passage in this area. The riffle will be designed to dissipate energy (lower velocities and turbulence) so that migrating fish can more easily make their way past the weir under a variety of flow conditions. The riffle will include a series of pools to allow fish to rest as they move upstream.

The proposed rock construction will provide a structure that is natural looking and will require minimal maintenance and no ongoing operation once it is completed. The conceptual design is for a full-span engineered pool and riffle fishway across the 50 m wide channel. The existing sheet pile weir will be retained as the hydraulic control and the abutments will be reconstructed. Preservation of the fish habitat in Montreal Lake will be achieved by ensuring the riffle weir is designed and constructed to maintain the current spill elevation so that there will be no change to the existing Montreal Lake water elevations.

***Navigability on Montreal River***

The current weir configuration impedes public navigation of the Montreal River. There is no formally established portage location, rather an improvised landing and launch area is being used to portage around the weir.

***Timing***

Details of the physical aspects of the FHCP, including site access and construction will be determined at the Midwest Project licensing stage with the regulatory agencies. A specific date for Mink Arm dewatering and the corresponding commencement of the Montreal River weir habitat compensation plan is not known at this time, as AREVA's decision to proceed with the Midwest Project is linked to market conditions. AREVA will commence the construction of the pool and riffle fishway at the Montreal River weir within an approximate two-year timeframe of commencement of dewatering of Mink Arm.

***Monitoring***

Potential interactions of construction activities with Montreal River fish habitat include addition of suspended solids to the river during construction or accidental release of contaminants such as fuels. In accordance with DFO in-stream construction guidelines, appropriate sediment and erosion control measures will be employed as required to prevent soil from entering the river during construction. To minimize risks of fuel entering Montreal River, all machinery will be refuelled a minimum of 100 m from the river and secondary containment will be used during refuelling activities. Interference and disturbance of wildlife will be minimized from site access and construction activities.

Following construction, an as-built survey will be undertaken of the pool and riffle fishway and submitted to DFO for review. AREVA proposes a 5-year monitoring plan to assess riffle stability. The compensation plan will be considered successful when the pool and riffle post-construction as-built report demonstrates that the criteria of the DFO-approved design have been met. If the as-built does not meet DFO design criteria, efforts will be undertaken to correct the variance from design.

AREVA will develop and implement a DFO-approved monitoring plan to monitor the extent to which fish are moving upstream past the riffle. Monitoring will be part of the *Fisheries Act* Authorization.

## C.4. Conclusions

The proposed Midwest Project will result in unavoidable HADD of fish habitat through the dewatering of Mink Arm to allow for development of an open pit mine and the loss of habitat at stream crossings along the proposed transportation corridor. Where fish habitat loss is unavoidable, it is necessary to undertake habitat compensation.

AERVA's preferred fish habitat compensation is to establish connectivity in the Montreal River and preserve water levels in Montreal Lake by constructing an engineered pool and riffle fishway at the Montreal River weir, which will include reconstructing the abutments and reinforcing the weir. The compensation plan will be considered successful when the pool and riffle post-construction as-built report demonstrates the criteria of the DFO-approved design have been met.

The habitat surface area of Mink Arm is 51 ha compared to 45,000 ha for Montreal Lake. The conservation of Montreal Lake fish habitat results in the retention of substantial fish habitat, which greatly exceeds the fish habitat loss represented by Mink Arm.

The provincial crown will maintain its status of ownership of the weir and it is anticipated that AREVA will conduct the physical works to the weir, as a third party, on behalf of the crown.

# APPENDIX D CONSULTATION

Table D-1 outlines the opportunities provided to members of the public and Aboriginal groups to participate in the EA process for the Midwest Project, the key issues raised and the Crown's response.

Table D-2 outlines the consultation efforts undertaken by AREVA throughout the EA process for the Midwest Project.

Table D-3 outlines the key issues raised by Aboriginal groups during public consultation activities undertaken by AREVA and the responses provided by both AREVA and the Crown.

**Table D-1** Federal Opportunities to Participate in the EA Process

| Consultation | Purpose | Key Issue | Response |
|---|---|---|---|
| Project Specific Guidelines and Scoping Document and EA Track Report | Public and Aboriginal groups were invited to comment on the scope of the EA, including proposed scope of the project, the factors to be considered and the proposed scope of those factors.<br>Public comment period from December 2006 to January 2007 and from February to March 2007. | Comments received during the development of the PSG&SD are listed in Appendix I of Appendix A in the CSR | How the comments were addressed by the RAs and SMOE and revisions made to the PSG&SD are described in Appendix I of Appendix A in the CSR |
| Commission Hearing on Draft PSG&SD and EA Track Report | One-day public hearing in April 2007 to consider PSG&SD and EA Track Report | A request that risks posed by RA-226 and the loading capacity in the aquatic receiving systems be considered in the near field as well as the far field environment | PSG&SD already included requirements for assessment of both chemicals and radionuclides and the radiation effects on biota, including humans, is also included |
| | | A concern over the adequacy of the CNSC resources to conduct a comprehensive study. Proposed a review panel instead | The Commission stated during the hearing that CNSC had significantly increased its resources in environmental assessment and protection |
| | | A concern regarding safeguards and the potential misuse of the exported Canadian uranium | The Commission stated during the hearing that Canada, in close collaboration with the International Atomic Energy Agency, monitors potential diversion of uranium and any of its products to uses unauthorized by international obligations to which Canada has agreed |
| | | A concern with global impact of uranium mining in Saskatchewan through contamination by release of radioactive particulates from open mines in the atmosphere | CNSC staff responded during the hearing that maps showing naturally occurring radiation and changes in radiation over Canada were developed by NRCan |
| | | A request to develop different pre-apprenticeship programs for residents of northern Saskatchewan | AREVA stated during the hearing of its intention to engage the local communities |
| | | A request to add barren-ground caribou to the list of VEC | Barren-ground caribou added to VECs |

| Consultation | Purpose | Key Issue | Response |
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| Review of the EIS | Participant funding administered by CEA Agency to participate in the EA review of the Midwest Project EIS | Ionizing radiation, alpha and beta radiation and radioactive progeny not described | McClean Lake Operation's current radiation protection program adequately identifies and measures all types of ionizing radiation. This program will be used for the Midwest Project |
| | | Human receptors under 5 years of age were not included in risk assessment | AREVA included child under 6 in human receptor assessment |
| | | Long-range dust modeling not included | Long-range uranium transport via dust particles included in revised EIS |
| | | Request for more robust discussion of tailings management in short- and long-term | AREVA has a Tailings Optimization and Validation Program in place at McClean Lake Operation that is updated every five years to verify the long-term behaviour of contaminants of concern at the JEB TMF |
| | | Request for more robust discussion on caribou-lichen food chain | As part of the proposed monitoring and follow-up program, the accuracy or conservatism of the water to vegetation transfer coefficients for contaminants accumulating in the S/V TEMS will be verified |
| | | Alpha emitters and their potential risk not adequately addressed | Alpha emissions addressed in EIS through calculations of the releases of radionuclides, their transport and movement and potential accumulation through biological and non-biological compartments of the environment |
| | | Impact of another road to an existing road on barren-ground caribou migration routes | Recognition that roads and increased road density can affect wildlife migration; addition of the transportation corridor will add to the density but road density is low; no caribou observed and limited caribou sign evident within local assessment boundary |
| | | Long-term effects with respect to several contaminants and bioaccumulation from aquatic plants to aquatic wildlife to human not clearly addressed | COCs were examined both spatially and temporally and results of the ERA were interpreted in EIS and the human health risk assessment was conducted to assess potential risk to human health |
| | | Management consideration for rare species should be detailed in EIS | None of the species identified in the local assessment boundary have specific guidelines or management strategies associated with them |
| | | Lack of adequate consultation with stakeholders | Engagement for current Midwest Project commenced in 2005; summaries of engagement activities provided in EIS |

| Consultation | Purpose | Key Issue | Response |
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| | | Human health concerns from waste rock leaching, air quality, and gas emissions | AREVA has conducted a detailed human health risk assessment as part of their EIS |
| Aboriginal engagement on Draft CSR | Letter soliciting comments on Draft CSR and CD copy of CSR mailed to Aboriginal groups identified on distribution list.<br>Letter soliciting comments on Draft CSR and hard copy of CSR couriered to Aboriginal groups who received PFP funding. | **CONSULTATION**<br>• Uncertain whether the Crown's obligation regarding consultation with Aboriginal groups has been met.<br>• The methods used for consultation purposes are unsatisfactory. Recent community meetings held by the Athabasca Land Use (ALU) office stated that open-houses are not adequate in getting information out, and when information is given, it is highly technical.<br>• The Athabasca Denesuline (AD) maintains that the Athabasca Working Group (AWG) and Environmental Quality Committee (EQC) do not fulfill the Duty to Consult requirements.<br>• The AD community leadership does not have readily available internet, with no computers. However, the Regulatory Agencies continue to post links and cite websites for information to consult. Paper documents are highly technical and community leaderships do not have the capacity to decipher the documents.<br>• Communication should be clear, concise, plain language and translated into the Dene language. | The common law duty to consult with Aboriginal groups applies when the Crown contemplates actions that may adversely affect potential or established Aboriginal or treaty rights. Federal departments involved with the Midwest Project participated in a whole-of-government approach to uphold the honour of the Crown and consider Aboriginal peoples' potential or established Aboriginal or treaty rights pursuant section 35 of the *Constitution Act, 1982*. Following the whole-of government approach, Aboriginal consultation was integrated into the EA process to ensure that a coordinated, transparent, effective and efficient process was undertaken.<br><br>The Crown recognizes that the duty to consult is a Crown obligation under section 35 of the *Constitution Act, 1982*, and the duty to consult must be fulfilled by the Crown prior to the development of any project. The Crown also recognizes that the proponent may be best suited to provide information about the potential impacts of the Midwest Project and, as such, AREVA's consultation activities are important and can inform and assist the Crown in its consultation activities and the effectiveness of the Crown's decision-making.<br><br>AREVA developed their "Aboriginal and Public Involvement Program" for the Midwest Project, which outlined how AREVA intended to conduct its activities. The document was mailed to PAGC and is publicly available.<br><br>Throughout the EA process, AREVA and the federal and provincial governments met with Athabasca Basin communities, Athabasca stakeholder groups and Aboriginal communities and organizations to |

| Consultation | Purpose | Key Issue | Response |
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| | | • Open-houses and community meetings are poorly attended and should not be considered as consultation.<br>• If the CNSC, SMOE, DFO or even AREVA engaged the communities using the Athabasca Regional Government (7 First Nation and provincial communities) supported Consultation Policy, many of these issues would be corrected. | provide information on the Midwest Project, the potential environmental effects and to encourage participation in the EA review. Section 7 and Appendix D of the Comprehensive Study Report outlines the consultation activities undertaken, the key issues raised and both AREVA's and the Crown's response to the issues. The federal and provincial governments used various activities to consult with Aboriginal groups for the Midwest Project including letters, meetings and open house forums.<br><br>The public and Aboriginal groups have been consulted on the Midwest Project through the following activities related to the Midwest Project:<br>• Establishment of a public registry on CEAR<br>• Notification letters sent to all Aboriginal groups that may have an interest in the Project. These letters included information about the Project and the regulatory review process. These letters were followed up with telephone calls<br>• A public and Aboriginal review period was initiated in December 2006 to January 2007 and from February 2007 to March 2007 on the Project Specific Guidelines and Scoping Document (PSG&SD) and EA Track Report<br>• A one-day public hearing was held on April 12, 2007 on the PSG&SD and EA Track Report<br>• A public and Aboriginal review period on AREVA's Environmental Impact Statement was initiated on April 29, 2010<br>• Participant Funding Program (PFP) awarded funding in two phases of the review. Additionally, the Aboriginal Funding Envelope awarded funding to three Aboriginal groups on June 10, 2010<br>• An Aboriginal review period on the Draft CSR was initiated on December 2, 2011 |

| Consultation | Purpose | Key Issue | Response |
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| | | | The PSG&SD were provided directly to the distribution list of stakeholders and were made available at First Nations and Northern Hamlet offices in the Athabasca Basin Region and at the SMOE office in La Ronge. Hard copies of AREVA's EIS were provided directly to identified Aboriginal communities and organizations. Copies of the Draft CSR were couriered to PFP recipients and CD copies of the CSR were provided to the distribution list of Aboriginal communities and organizations. Hard copies of the Draft CSR were available upon request, but no requests were received.<br><br>Aboriginal communities and organizations were invited to comment on the provincial Project-Specific Guidelines and federal Comprehensive Study Scoping Document (PSG&SD) and EA Track Report, AREVA's Environmental Impact Statement (EIS) and the federal Draft CSR. Comments received during the public comment periods on the PSG&SD, EIS and CSR were considered by AREVA, the RAs and SMOE and revisions were made, where appropriate. Participant funding provided through the federal government was also made available to assist those interested in participating in the EA process. Funding has been granted for various purposes, including: hiring technical experts to review documents, host community meetings and travel.<br><br>AREVA supports independent environmental monitoring near the communities of the Athabasca Basin through the Athabasca Basin environmental monitoring program. Through this program, samples of air, water, sediment, and tissue from fish and animals that are traditionally harvested by northern people are collected by local hunters and other residents near the communities of the Athabasca Basin. |

| Consultation | Purpose | Key Issue | Response |
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| | | | Comments received during the EA process from public and Aboriginal communities and organizations were considered during the drafting of the CSR. Appendix D of the CSR outlines key issues and the federal responses received throughout the EA process. This is included in the CSR, as this document will be made available for a 30-day public review and Aboriginal engagement period and interested parties will be able to review how their comments were addressed by AREVA and the Crown.<br><br>The regulatory agencies shared information in various ways for the convenience of those interested in the Midwest Project. This included posting information on the internet and sending both electronic and hard copies of the documents to Aboriginal communities, as appropriate. Aboriginal communities and organizations were provided the opportunity to review both AREVA's EIS and the draft CSR. Both the EIS and CSR have included a plain-language Executive Summary and AREVA's Executive Summary was translated into the Cree and Dene language. To facilitate a broad range of participation in the EA process, AREVA provided live Dene and Cree translation during open houses held by AREVA, and informational pamphlets were written in plain-language and were also translated into Dene and Cree.<br><br>Engagement through the EQC and AWG was one form of consultation used during the EA process. As the EQC and AWG are composed of people nominated by their community to be a bridge between northerners, government and the uranium mining industry, AREVA consulted with them as one of the forms of consultation. It is the role of EQC and AWG members is to share any information received during meetings with their community.<br><br>Following the *Updated Guidelines for Federal Officials to Fulfill the Duty to Consult* (March 2011): Federal regulatory agencies, during a |

| Consultation | Purpose | Key Issue | Response |
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| | | | consultation process, must reasonably ensure that Aboriginal groups have an opportunity to express their interests and concerns and that they are seriously considered and, wherever possible, clearly reflected in a proposed activity. Aboriginal groups also have a reciprocal responsibility to participate in consultation processes.<br><br>The Crown recognizes that many Aboriginal communities and organizations have developed consultation policies, guidelines or protocols and request that the Crown adhere to them. Federal government departments and agencies are to follow the Updated Guidelines and their departmental or agency approaches. Where an Aboriginal group that is being consulted has developed a protocol, the federal Crown will try to work within its framework to the extent possible and where it does not compromise the Government of Canada. |
| | | **INFRINGEMENT ON TREATY RIGHTS**<br>• Removal of Mink Arm is a destruction to direct infringement on the Treaty Rights of the Denesuline to use of lands and resources and occupation including, destroying fish, removal of water quality and quantity, destruction of the landscape and the environment as a whole. There is no mention of this and no discussion of compensation or accommodation for this. The Regulatory Agencies MUST address Treaty Right Infringement with the AD before the Midwest Project is licensed. DFO confirms this by confirming that there will be a HADD, therefore they had to seek ministerial approval for destroying fish habitat. This shows a direct infringement. | AREVA has outlined mitigation measures which have been reviewed and approved by DFO, CNSC and the SMOE to mitigate effects on aquatic biota during dewatering activities at Mink Arm. This includes a measure to salvage as many fish as possible prior to dewatering activities through a fish removal and transfer program to capture and transfer fish from Mink Arm to South McMahon Lake.<br><br>A fish habitat compensation plan (FHCP) has been developed to mitigate the loss of Mink Arm. DFO policy regarding fish habitat compensation states that only physical actions intended to maintain the net production potential of fish habitat are acceptable as compensation. The location of the fish habitat compensation project outside of the Midwest Project area is consistent with current DFO policy regarding fish habitat compensation, which allows for the creation of fish habitat or an increase in the productive capacity of habitat in an ecological unit that is different from the ecological unit in the area of impact. |

| Consultation | Purpose | Key Issue | Response |
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| | | • Page 121 and 123) Mitigation practices for potential effects on the surface water environment includes "fishing only allowed on designated lakes (i.e. Pat Lake, Dwarf Lake, Torwalt Lake, and Moffat Lake) within McClean Lake Operation are with certain restrictions (i.e. only one boat is allowed on each lake at a time, barb-less hooks must be used, and only one fish can be kept per person per week". Restriction of this type on the Treaty Right to fish is a direct infringement. | AREVA has consulted with Aboriginal communities and organizations on the Midwest Project since 2005. As well, AREVA and the federal and provincial regulatory agencies have contacted Aboriginal groups that were identified as having an interest in the Midwest Project. No information has been provided by Aboriginal communities and organizations with respect to how the Midwest Project could potentially impact any asserted or established Aboriginal or Treaty rights.<br><br>AREVA, DFO and the SMOE believe that there has been adequate consultation concerning AREVA's proposed FHCP. Aboriginal communities and organizations have been consulted throughout the development of the FHCP, providing more information to groups as it became available.<br><br>The mitigation measure outlined in ARG's comment (fishing only allowed on designated lakes) will be changed in the CSR. The new mitigation measure will now state:<br>• Fishing by personnel working at the McClean Lake Operation and/or Midwest site is only allowed on designated lakes within the McClean Lake Operation with certain restrictions (i.e. only one boat is allowed on each lake at a time, barb-less hooks must be used; and only one fish can be kept per person per week)<br>• All personnel of the Midwest Project and/or McClean Lake Operation must hold a valid fishing licence, except where exempted by law<br><br>This mitigation measure only applies to personnel working at the McClean Lake Operation and/or Midwest site and does not apply to the general public or Aboriginal peoples. |

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| | | **IMPACT ON TRADITIONAL LAND USE**<br>• The Midwest Project directly impacts on the Denesuline access to use the land for hunting, fishing, trapping and cultural activities. There is no Methodology explaining how it was determined that there was little to no impact on land use. The AD requests the methodology used. The impacts to TLU assessment should be treated as diligently as the environmental assessment.<br>• AREVA is removing the public right to navigation on the waters (section 23 of the *Navigable Waters Protection Act*). This identifies concretely that the AD will be restricted and unable to use land that they have previously freely been able to use to practice Treaty and Aboriginal rights.<br>• Further impacts on land users will occur with the proposed 17 km transportation and utility corridor. Further increasing the amount of land inaccessible and un-useable for traditional land use activities and Treaty Rights.<br>• Even if land users were given permission to use the road to access and carry out traditional land use, the vast amount of traffic proposed to use it (76 round trips/day or 943,000 km/year) would interfere and result in unsuccessful and unpleasant experiences, let alone safety issues. The amount of traffic also impacts on wildlife | As outlined in Section 4.6.2 of the EIS produced by AREVA and Section 8.8.3 of the CSR produced by the federal regulatory agencies, Traditional Land Use was considered for the Midwest Project. Traditional land use research was conducted to assess the interactions of the Midwest Project with traditional land uses. This research was conducted under an Agreement Respecting the Land and Renewable Resource Use Planning and Management in Northern Saskatchewan – Lake Athabasca Region between the Government of Saskatchewan and Athabasca First Nation groups and communities. This research is based on information gathered from First Nations by the Prince Albert Grand Council (PAGC) and the PAGC is the custodian of this traditional land use research. AREVA considered this information, which illustrates 47 different traditional land use themes, including spiritual places, subsistence and commercial water use, overnight sites, plant and earth materials, large and other animal kill sites, and trapping boundaries within the area of interest. The survey of traditional land use activities identified that such activities have historically been confined to the larger lakes located at the periphery of the Midwest Project local assessment boundary. The research identified that the Midwest Project will have limited interaction with traditional land use, including along the proposed transportation corridor.<br><br>AREVA has consulted with Aboriginal communities and organizations on the Midwest Project since 2005. Following meetings held by AREVA and Aboriginal communities and organizations in April and May 2010, AREVA issued a letter to the Aboriginal communities and organizations leadership requesting feedback or information pertaining to traditional land use occurring near the Midwest Project. To date, AREVA has not received a response to the letters. Only two traditional users have been identified for both the Midwest site and McClean Lake Operation and Trapper Compensation Agreements are in place. |

| Consultation | Purpose | Key Issue | Response |
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| | | and avoidance of the entire area.<br>• A private road that cuts across the north for 17 km for use by AREVA has no benefit to the communities in the region.<br>• Table 9-3 under potential effects on the Human Environment, there is no mention of the loss of direct access and use of land being up-taken for the mine surface footprint, haul road and pipeline. This is a major omission and must be analyzed as a major human environmental effect. | AREVA has presented the Midwest Project to Aboriginal communities and organizations since 2005 and the dewatering of Mink Arm has always been part of the proposed Project. No records or evidence indicate there to be any concerns regarding the loss of navigability.<br><br>Road access to the Midwest or McClean Lake site is restricted by the presence of a locked gate, which has been in place for over 20 years for safety and security reasons. Upon request, access can be granted by contacting personnel at AREVA's McClean Lake Operation. AREVA has worked with trappers on their lease and to date, only two traditional users have been identified for both the Midwest site and McClean Lake Operation. No requests have been made to access either the Midwest site or McClean Lake Operation for traditional use, navigation purposes or other purposes.<br><br>The proposed transportation corridor to be used as a dedicated all-weather haul road between the Midwest site and the JEB site will address safety issues and concerns with using Provincial Road 905 to haul ore that was identified as one of the Joint Panel's recommendations.<br><br>The CSR will be revised in Section 4.6 to state:<br><br>AREVA is proposing to apply to have the corridor designated as a private road, which would be developed and operated by AREVA with restricted access and controlled access. This designation is being applied to address safety uses and concerns with using the road to haul ore. Access to the proposed transportation corridor will be located beyond the site security gates at both the Midwest and McClean Lake sites and access by |

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| | | | members of the public will require prior permission<br><br>Expected traffic accident frequencies along the transportation corridor were calculated from predicted transportation corridor traffic frequencies and existing traffic accident statistics. For the Midwest Project, the accident frequency was estimated to be 0.2 per year and an accident resulting in a rollover from large trucks was estimated to be 0.02 per year or 0.12 accidents for the duration of the Project.<br><br>Based on Saskatchewan Government Insurance (2007) statistics for all vehicles travelling on highways #102, 905, 165, 914 and 2 in northern Saskatchewan, there were a total of 659 accidents for a total distance travelled of 384,030,000 km. This equates to approximately 1.8 accidents per million kilometres travelled. For an estimated total traffic flow of 943,000 kilometres per year for all vehicles moving between the Midwest and McClean Lake sites, the annual accident frequency equates to 1.7 incidents per year.<br><br>Accident statistics reported by the Saskatchewan Government Insurance (2003) indicated that the number of vehicle-wildlife collisions in 2002 on Highways #905 and 102 were 2 and 0, respectively. Using the statistics from Highway #905, with a maximum of 76 trips per day on the transportation corridor between the Midwest and McClean Lake sites, the number of vehicle-wildlife collisions is expected to be less than 4 per year on the transportation corridor.<br><br>The Midwest site is remote, with no permanent residences located nearby. The potential environmental effects on the human environment from the mine surface footprint and transportation corridor are discussed in terms of the effects of changes to air, water, soil, vegetation quality |

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| | | | and aquatic and terrestrial exposure on human health. |
| | | **INADEQUATE PROTECTION OF SPECIES**<br>• The proposed Woodland Caribou recovery strategy identifies the need to conserve woodland caribou habitat. Through community TEK interviews, critical woodland caribou habitat was [sic] been identified in the proposed Midwest area. The EIS does not adequately address these concerns. AREVA needs to work with the communities, not only the Saskatchewan Mining Association regarding the woodland caribou. This strategy does not compare to the lifetimes and generations of knowledge amassed by the Athabasca Denesuline. If AREVA is sincerely concerned about the woodland AND barren-ground caribou, they should discuss their mitigation plans for these species with the AD.<br>• In section 9.2.4, p. 149, an area of 30,250 ha within the local assessment boundary was classified as being highly suitable summer and winter caribou habitat (it was not specified whether this was woodland or barren-ground caribou habitat). 1.7-1.8% of this habitat will be disturbed (unclear if this counts the 500 m buffer surrounding anthropogenic disturbances EC suggests in | The traditional land use and occupancy research undertaken by the PAGC included a survey of traditional land use where large animals and a variety of birds, waterfowl and small mammals have been harvested. The research generated was based on information gathered from Aboriginal communities and organizations by the PAGC, and represent a compilation of Aboriginal communities and organizations' land use knowledge based on information provided by interviews conducted with Elders and community members within the region.<br><br>Based on the preferred site layout and transportation corridor option, the Midwest Project will disturb approximately 562 ha (or 1.7%) of suitable summer caribou habitat and approximately 550 ha (or 1.8% of suitable winter caribou habitat). The Midwest Project directly influences only a small portion of the available caribou habitat in the local assessment boundary. As the niche that is applied to both woodland and barren-ground caribou is considered similar, the classification works for both species.<br><br>AREVA is committed to work with both the northern communities and the Saskatchewan Mining Association on the National Recovery Strategy for Woodland Caribou. This strategy was led by the Saskatchewan Mining Association, province of Saskatchewan and the EQC and AREVA has actively participated in the public consultation activities held by Environment Canada. When the Woodland Caribou Recovery Strategy is finalized and the provincial management plans are developed, AREVA will operate in accordance with the strategy and management plans. In addition, the CSR has identified that a periodic wildlife monitoring program to confirm the presence/absence of wildlife |

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| | | Strategy). In light of the Draft Woodland Caribou Strategy report, what will AREVA do in order to mitigate this further loss of critical habitat for a SARA listed?<br>• There are no mitigation measures suggested. The area can no longer support development which uptakes critical habitat for significant amounts of time, only to state that it will be re-established afterwards. This would take at a minimum 50-60 years post mine to return to old growth forest. The federal government has stated clearly that northern Saskatchewan has too much disturbed critical habitat for its local, unsustainable caribou populations. | species be developed and implemented as part of the follow-up program for the Midwest Project. AREVA will be required to report the presence, location and date of any species at risk observed during site and road construction and will monitor habitat utilization and habitat connectivity for moose and caribou as part of the Midwest Project follow-up program. AREVA currently has a program in place at McClean Lake Operation whereby McClean Lake Operation personnel are required to report any wildlife observed at the site. This program will also be implemented at the Midwest site.<br><br>It is estimated that approximately 1% of the habitat within the local assessment boundary will be disturbed with the proposed site layout for the Midwest Project. Upon completion of operational activities, disturbed lands will be levelled or recontoured and early successional terrestrial plant species will establish. Natural revegetation is expected to occur over a 10 to 15 year period following site closure and will stabilize disturbed surfaces. The decommissioned and reclaimed site will allow unrestricted use of the area for hunting, trapping and fishing, consistent with the traditional use of the land. |
| | | **INADEQUATE USE OF TEK AND LOCAL KNOWLEDGE**<br>• Although the EIS uses maps generated by the ALU office as a guide for AREVA to be able to more accurately determine impacts to Land use, they should not replace the need for AREVA to use TEK in any of its EIS data collection. TEK has far more value than just identifying Land Use. This map should be a starting point and an aide, not the only TEK used in the EIS. | Traditional land use and occupancy research undertaken by the PAGC identified that historically, several barren-ground caribou have been harvested within the Midwest Project local assessment boundary but harvesting of these large animals has historically been accomplished at the larger lakes located at the periphery of the Midwest Project local assessment boundary. Traditional harvest sites show that black bear and woodland caribou have historically been harvested outside of the assessment area.<br><br>The maps generated by the PAGC were based on information gathered from Aboriginal communities and organizations by the PAGC, and represent a compilation of Aboriginal communities and organizations |

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| | | • In Section 8.7.3 is an example of misinterpretation of information provided by the communities. A project of this size will not simply affect 2 trappers, but a whole generation of possible land use. Please provide us the methodology that was used to determine this, instead of subjective, inaccurate explanation. For example, one trapper prevented from trapping represents the loss of spiritual, health, cultural aspects. As well as inter-generational loss of experience and educational opportunities.<br>• Trappers unable to access their traditional trapping routes are impacted by the requirement to find alternate locations and alternate, often longer routes. There is a loss of not only income from the sale of furbearing animals but a loss of meat, potential clothing materials, family-based activities, survival training, etc. This is but a brief example of the loss of one trapper's right to access his/her trapline. This is without mention of sustenance fishers, berry pickers, leather-makers, etc.<br>• In Section 8.6.3 Wildlife, it is a clear example of where local and TEK should have been used to characterize the terrestrial environment. To characterize woodland caribou as not being in the local assessment boundary due to no sightings during aerial surveys is weak and incomplete. The local | land use knowledge based on information provided by interviews conducted with Elders and community members within the region.<br><br>AREVA has consulted with Aboriginal communities and organizations on the Midwest Project since 2005. AREVA has continually requested information regarding traditional land use from Aboriginal communities and organizations. Only two traditional users have been identified for both the Midwest site and McClean Lake Operation site and Trapper Compensation Agreements are in place. The trappers have been encouraged to continue trapping onsite and have been compensated for any potential losses. Access to traplines is permitted through existing roads on or near the Midwest site. AREVA is not preventing access to any known traplines and would make arrangements through discussions with any new identified users.<br><br>Following meetings held by AREVA and Aboriginal communities and organizations in April and May 2010, AREVA issued a letter to the Aboriginal communities and organizations leadership requesting feedback or information pertaining to traditional land use occurring near the Midwest Project. To date, AREVA has not received a response to the letters. |

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| | | elders/knowledge keepers from the region (primarily Hatchet Lake) have identified clearly that the area proposed for Midwest is a critical area for woodland caribou habitat. | |
| | | **FISH HABITAT COMPENSATION PLAN**<br>• The Fish Habitat Compensation Plan does not ensure that the fish habitat is compensated in the area that it was destroyed, albeit Montreal Lake is considered "northern", it is far removed from any benefit to the Athabasca region and not even in the boreal shield. It is understandable that areas that could be restored in the Athabasca are not prevalent; we suggest that in the event of this, that a Fund be developed by DFO for the Athabasca Region to be used for any subsequent fish habitat destruction, and/or educational programs for fish habitat protection in the schools. This would be far more beneficial for the Athabasca communities. There has not been adequate consultation on this compensation plan. | The location of the fish habitat compensation project outside of the Midwest Project area is consistent with current DFO policy regarding fish habitat compensation, which allows for the creation of fish habitat or an increase in the productive capacity of habitat in an ecological unit that is different from the ecological unit in the area of impact.<br><br>Current DFO policy does not allow for the provision of finances or educational programs to compensate for the harmful alteration, disruption or destruction (HADD) of fish habitat. Only physical actions intended to maintain the net production potential of fish habitat are acceptable as compensation.<br><br>AREVA, DFO and the SMOE believe that there has been adequate consultation concerning AREVA's proposed fish habitat compensation plan (FHCP). Aboriginal communities and organizations have been consulted throughout the development of the FHCP, providing more information to groups as it became available. |
| | | **INADEQUATE USE OF THE ATHABASCA LAND USE VISION**<br>• AREVA and the Federal and Provincial Crown continue to ignore and disrespect our Athabasca Land Use Vision in its environmental assessment process. Athabasca residents' aspiration and vision to manage the land and its resources involves as | The federal regulatory agencies are responsible for regulating Projects from cradle-to-grave, and therefore will be involved in projects from the early stages of development to the post-decommissioning phase. All federal regulatory agencies were involved in the whole-of-government approach to consultation and Aboriginal consultation was integrated into the EA process to ensure that a coordinated, transparent, effective and efficient process was undertaken. The federal regulatory agencies will continue to engage and encourage the participation of Aboriginal |

| Consultation | Purpose | Key Issue | Response |
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| | | to where, when and how development should proceed on our current land use and resource use for current and since time immoral. It is recommended that Industry and Government(s) will make reasonable efforts to work closely with us the impact communities and the Athabasca Lands office representing us as the ARG on proposed, licensing, relicensing, amending, granting permits and leases to proposed projects and existing developments within our Denesuline territory. It is our duty to exercise our Aboriginal and Treaty Rights and the right to access our lands for resource use for our way of life and as First Nation Peoples of this land without direct or indirect infringements from proposed developments. | peoples in relation to their regulatory decisions, as appropriate. |
| Public comment period on CSR | Administered by CEA Agency | To be determined | |
| Aboriginal engagement on CSR | Administered by CEA Agency | To be determined | |

**Table D-2** AREVA-Led Opportunities to Participate in the EA Process

| Presentation of Midwest Project Information to the Communities at Large | Public Review of Draft Project Specific Guidelines & Comprehensive Scoping Document (PSG&SD) | Ongoing Midwest Project Environmental Assessment Updates | Public Review of Environmental Impact Statement (EIS) Technical Review Comments and Comprehensive Study Report (CSR) |
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| Present key components of the Midwest project and related activities to the community members. This was achieved through jointly organized Cameco-AREVA northern tour where a summary of upcoming activities are presented. Opportunity to discuss the project more in detail (one-on-one) was provided after the presentation. | Consult the public on the content of the "Project Specific Guidelines and Comprehensive Study Scoping Document" (PSG&SD), which establishes both federal and provincial environmental assessment requirements. | Provide information to key stakeholders in order to promote a broader understanding of potential environmental effects of the project and proposed monitoring and follow-up programs, and to provide the opportunity to raise questions and/or identify issues. | Presentation of key environmental assessment findings, results and conclusions. |
| **Time Frame** | | | |
| **2006, Spring 2007 and 2008** | **Dec 5, 2006 to Jan 5, 2007** | **2006, 2007, 2008, 2010, 2011** | **To be determined** |
| Community meetings were held as follows:<br>**April 3 to May 9, 2006**<br>Clearwater, La Roche, Buffalo Narrows, Ile a-la-Crosse, Patuanak/English River, Beauval, La Ronge, Pinehouse, Saskatoon<br>**Oct 30 to Nov 30, 2006**<br>Fond du Lac, Stony Rapids, Wollaston, Black Lake<br>**Apr 30 to May 24, 2007**<br>Il-a-la-Crosse, Clearwater, La Roche, Buffalo Narrows, Beauval, Pinehouse, La Ronge, South end, Fond du Lac, Stony Rapids, Black Lake, Wollaston<br>**April 21 to April 25, 2008**<br>Patuanak, Buffalo Narrows, Il-a-la-Crosse, Beauval, La Loche<br>**May 5 to May 8 2008** | **December 5 to January 5, 2007**<br>PSG&SD released for 30-day public review by SMOE via direct distribution to communities in northern Saskatchewan and key environmental interest groups in Saskatoon; as well as advertisements in key publications and radio broadcasts in the north.<br><br>PSG&SD made available on CEA Act and SMOE websites, complete with contact information.<br><br>Commission Hearing on PSG&SD and relevant documents posted on CNSC website. | Presentation of project components and discussion with key target groups:<br>**January 26, 2006 and May 12, 2010**<br>AWG<br>**February 9, 2006**<br>EQC to discuss VECs<br>**March 16, 2006, May 25, 2006, November 16, 2006, March 19, 2007, May 18, 2010, November 29, 2010**<br>EQC<br>**August 9, 2006 and January 24, 2007**<br>Peter Ballantyne Cree Nation Chief and Council (PBCN)<br>**August 31, 2010**<br>AEDTC (in Uranium City)<br>**April 26, 2010** | EIS and Technical Review Comments to be released by SMOE via direct distribution to communities in northern Saskatchewan and key environmental interest groups; as well as advertisements in key publications and radio broadcasts in the north.<br><br>CSR to be released by Minister of the Environment and made available on CEA Act website.<br><br>CNSC Commission Hearing on CSR. Relevant documents will be posted on CNSC website.<br><br>Presentation to key target groups (e.g., EQC, AWG, AEDTC) and McClean Lake employees by AREVA. Following release of CSR, EIS and Technical Review Comments for public review |

| Presentation of Midwest Project Information to the Communities at Large | Public Review of Draft Project Specific Guidelines & Comprehensive Scoping Document (PSG&SD) | Ongoing Midwest Project Environmental Assessment Updates | Public Review of Environmental Impact Statement (EIS) Technical Review Comments and Comprehensive Study Report (CSR) |
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| Pinehouse, Pelican Narrows, La Ronge, South end<br>**May 20 to May 22, 2008**<br>Uranium City, Fond du Lac, Stony Rapids, Black Lake, Wollaston Lake | | ALUP<br>**March 21 and 28, 2007**<br>Presentation to McClean Lake Operation Employees<br>**April and May 2010**<br>Focused meeting with First Nation and Métis Leadership (Black Lake, Peter Ballantyne Cree Nation, Hatchet Lake, Barrenlands, Northlands, Fond du Lac, Buffalo River, Métis Nation – NR #1)<br>**September 2010**<br>Open house tour (Stony Rapids, Black Lake, Fond du Lac and Wollaston Post/Hatchet Lake)<br>**October 2010**<br>Black Lake Fist Nation (requested by Black Lake Chief to provide status update)<br>Presentation on key points on the environmental interactions, EA predictions, impacts to local land users and cultural aspects and social and economic benefits<br>Invited to give a presentation to Athabasca leadership and community members – (Black Lake, September 24, 2008)<br>**October 2011**<br>Open house tour (Black Lake, Fond du Lac, Stony Rapids) to provide updates on the Midwest Project and discuss the proposed Fish Habitat Compensation Plan | |

| Presentation of Midwest Project Information to the Communities at Large | Public Review of Draft Project Specific Guidelines & Comprehensive Scoping Document (PSG&SD) | Ongoing Midwest Project Environmental Assessment Updates | Public Review of Environmental Impact Statement (EIS) Technical Review Comments and Comprehensive Study Report (CSR) |
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| **Target Audience** | | | |
| Northern residents (including the impact communities in the Athabasca Basin), La Ronge and Saskatoon.<br>The presentation was made to the Peter Ballantyne Cree Nation Chief and Council, as they did not express any interest in hosting a community meeting. | Communities in northern Saskatchewan (including Athabasca communities, Peter Ballantyne Cree Nation, La Ronge), Prince Albert and Saskatoon (specifically environmental interest groups). | Residents and leadership of northern Saskatchewan (including Athabasca communities, Peter Ballantyne Cree Nation, La Ronge) and anyone expressing interest; key target groups (e.g., EQC, AWG, AEDTC, PAGC); and McClean Lake Employees. The September 2008 meeting in Black Lake also had representation from federal and provincial agencies (CEA Act, CNSC, DFO, INAC, TC, SRC, MOE EA Branch, Energy and Resources) | Communities in northern Saskatchewan and those groups that have shown interest in the Midwest Project (including Athabasca communities, Peter Ballantyne Cree Nation, La Ronge, Barrenlands, Northlands, PAGC, MN-S). Key target groups (EQC, AWG, AEDTC McClean Lake Employees and environmental interest groups). Aboriginal groups impacted by proposed Fish Habitat Compensation Plan |

**Table D-3** Summary of Key Issues/Concerns Raised from Consultation Activities Carried Out by AREVA

| Key Issue/Concern | AREVA's Response | Federal Response |
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| **EA Process** | | |
| Concern why the Midwest Project was not approved by the Joint Panel in 1993 | There were several reasons, but the two major ones were: the Panel thought that the mining technique proposed would lead to unnecessary high radiation exposure to miners, and waste water management issues were not adequately addressed to the satisfaction of the Panel. | The Midwest site history is presented in Section 3 of the CSR. |
| **Project Description** | | |
| Concern with what will happen to the transportation corridor following completion of the Project | The road will be part of the decommissioning plan. If there was no other use for the road, AREVA will be responsible for decommissioning it and returning it to a state similar to the surrounding environment. | Conceptual decommissioning and reclamation plan presented in section 4 of the CSR. |
| Concern with construction of a new road when there is a road that goes to Points North | A new transportation corridor is proposed because of the distance, the haulage of ore on a provincial road and the safety issue associated with the use of trucks that cannot pass each other on the existing road. The transportation corridor also addresses concerns raised by the Joint Panel about health and safety on a public highway. | The construction of a dedicated transportation and utility corridor is considered an improvement to the previous proposal of hauling ore on Provincial Road 905, as per Joint Panel recommendation. |
| Impacts of transportation corridor on wildlife and waterbodies | In designing the road and the berms for the pipeline, which will run alongside the road, provisions for larger animals to be able to cross the berms have been considered. In the long term the decommissioning plan considers the removal of the road if there is no use for it. | Section 8 and 9 of the CSR outline the existing environment and the potential effects, mitigation measures and environmental effects analysis of the transportation corridor on wildlife, aquatic habitat and biota and water quality. |
| Concern regarding restricting access | Access to the site can be requested and obtained by contacting the McClean Lake Operation. Access is restricted as AREVA has a surface lease agreement with the province and the agreement requires protecting the public to limit accidents on an industrial site. | AREVA is proposing to have the transportation corridor designated as a private road for safety and security reasons. |
| Concern with how the Midwest Project will be decommissioned | It is AREVA's intent to return the site back to pre-existing conditions as much as possible. | Conceptual decommissioning and reclamation plan presented in section 4 of the CSR.<br><br>AREVA will have to apply to the CNSC for a Licence to Decommission and will have to obtain regulatory approvals. |
| Explanation why AREVA chose open pit mining versus underground mining | Economics and utilization of the experience gained at mining numerous open pit mines at the McClean Lake Operation. As well, open pit mining will have lower occupational exposures than with underground mining. | Open pit mining an improvement over underground mining, as per Joint Panel recommendation. |

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| Radiation levels associated with open pit mining | Open pit mining will result in radiation exposure to workers but AREVA has significant operational experience and the radiation exposure will be managed to protect workers and the environment. | Section 8 and 9 of the CSR outline the existing environment and the potential effects, mitigation measures and environmental effects analysis on human health and the environment from radiation exposure. |
| **Water Quality** | | |
| Concern with Vulture Lake and the downstream effects | AREVA is committed to meeting the SSWQO in Collins Creek, downstream of the S/V TEMS. This has been met and no environmental effects downstream beyond Collins Creek have been observed. | Section 8 and 9 of the CSR outline the existing environment and the potential effects, mitigation measures and environmental effects analysis for water quality downstream of the S/V TEMS. |
| Concern with impacts downstream | The Ecological Risk Assessment completed as part of the EIS did not identify any effects downstream. | Section 8 and 9 of the CSR outline the existing environment and the potential effects, mitigation measures and environmental effects analysis for aquatic habitat and biota and water quality downstream of the S/V TEMS. |
| Concerns with spills from vehicles into waterbodies | All vehicles will be equipped with initial spill response units, which will allow the drivers to provide an initial response to a spill. As per AREVA's Emergency Response Assistance Plan – all necessary equipment will be in place. | Section 9 of the CSR identifies probable accidents and malfunctions and the mitigation measures to minimize the effects. |
| Concern with how chemicals used will affect fish | An environmental monitoring program is in place to monitor water quality, air quality, soil and aquatic habitat and biota. | Section 8 and 9 of the CSR outline the existing environment and the potential effects, mitigation measures and environmental effects analysis for aquatic habitat and biota and water quality. |
| Long term effects of COCs with respect to bioaccumulation from aquatic plants to aquatic wildlife | The effects of COCs were examined as part of the Ecological Risk Assessment completed for the EIS. | Section 8 and 9 of the CSR outline the existing environment and the potential effects, mitigation measures and environmental effects analysis of COCs on wildlife, aquatic habitat and biota and water quality. |
| **Wildlife** | | |
| Concern that wildlife will not return to area following completion of the Project | AREVA predicts a temporary disturbance to wildlife movements from noise during the Project but following completion it is predicted that wildlife behaviour will return to pre-existing conditions. | Section 8 and 9 of the CSR outline the existing environment and the potential effects, mitigation measures and environmental effects analysis for the terrestrial environment, including wildlife movement and behaviour. |
| Concern regarding the impact of barrenland caribou from the construction of the transportation corridor | AREVA acknowledges that increased road density can affect wildlife migration. However, the overall road density in the area is low. | Section 8 and 9 of the CSR outline the existing environment and the potential effects, mitigation measures and environmental effects analysis for the terrestrial environment, including wildlife movement and behaviour. |
| Management considerations of rare species | A rare plant survey was completed along the proposed corridor alignments and within the proposed Midwest mine site. No COSEWIC species or provincially | Section 8 and 9 of the CSR outline the existing environment and the potential effects, mitigation measures and environmental effects |

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| | listed plant species have ranges that overlap the local assessment boundary.<br><br>There is a potential for species at risk to occur within the local assessment boundary. Mitigation measures have been developed to minimize the impacts to these species. | analysis for the terrestrial environment, including terrestrial habitat and biota. |
| Concern regarding potential effects of terrestrial biota and waterfowl | The effects of COCs on the terrestrial environment was examined as part of the Ecological Risk Assessment completed for the EIS. | Section 8 and 9 of the CSR outline the existing environment and the potential effects, mitigation measures and environmental effects analysis of COCs on the terrestrial environment. |
| **Fish Habitat Compensation** | | |
| Success of fish habitat compensation plan | It is likely that the regulatory agencies, primarily DFO, will require that a research program be submitted as a follow-up program to monitor the success of the plan. | Success to be assessed through federal Follow-up Program, described in Section 10 of the CSR |
| Concern with who will receive money for the fish habitat compensation | The fish habitat compensation does not refer to a cash settlement but rather the creation of an equal amount of suitable fish habitat in a similar location. | Appendix C of the CSR discusses the proposed fish habitat compensation plan at Montreal River weir. |
| Allow fishing at Mink Arm prior to dewatering | AREVA will implement a fish transfer program to salvage as many fish as possible. | Section 8 and 9 of the CSR outline the existing environment and the potential effects, mitigation measures and environmental effects analysis for the aquatic environment. |
| Expansion of Too Small Lake for fish habitat compensation has no benefit as there is no commercial fishing in the area and non one will use it in the future | The Two Small Lake expansion was not supported by DFO or the SMOE. AREVA's preferred FHCP is to restore connectivity at the Montreal River weir. | Appendix C of the CSR discusses the proposed fish habitat compensation plan at Montreal River weir. |
| **Waste Management** | | |
| Concern with leaching of contaminants from waste rock | Only clean waste rock will be placed on the surface. Special waste (environmentally problematic) rock will be placed on the brow of the pit during operation and will be placed in the pit after operation. Portable x-ray fluorescence analyzer will be used to help ensure that only clean waste rock is disposed on surface stockpiles. | Section 8 and 9 of the CSR outline the existing environment and the potential effects, mitigation measures and environmental effects analysis for the geological and hydrogeological environment. |
| Concern over length of time special waste will be on the surface and how contaminant release will be controlled during this period | The special waste will be temporarily stockpiled on the surface within the pit footprint for approximately five years. During this period, any leached contaminants will drain into the pit. The pit water will be treated by the water treatment plant and transported to McClean Lake for release to the S/V TEMS. | Section 8 and 9 of the CSR outline the existing environment and the potential effects, mitigation measures and environmental effects analysis for the geological and hydrogeological environment. |
| Concern that waste rock will remain at | Clean waste rock will always remain on the surface. It will be only the special | Section 8 and 9 of the CSR outline the existing environment and the |

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| surface | waste that is returned to the pit, covered with a layer of till material and then flooded. The pit will never be connected to McMahon Lake as there will be the dike as well as a waste rock pile in between. | potential effects, mitigation measures and environmental effects analysis for the geological and hydrogeological environment. |
| Concern that the height of the waste rock piles will interfere with the landing strip at Points North | The height of the waste rock pile at the end of the runway will be a single layer which is less than 15 m high. This will be compliant with the needs of the existing operation as well as any future expansion of the runway. | Waste rock component of the Midwest Project are presented in Section 4 of the CSR. |
| **Human Health** | | |
| Concern that human health impacts with respect to gas emissions, vehicle use and air quality | Two major short term effects are liquid effluent release and atmospheric emissions. The effects will be localized and will return to background level following completion of the Project. Cameco and AREVA participate in the Athabasca Working Group environmental monitoring program, which has been in operation for 10 years to study impact of uranium mining on communities. | Section 8 and 9 of the CSR outline the existing environment and the potential effects, mitigation measures and environmental effects analysis on human health. |
| Concern regarding radiation protection, arsenic consumption and human in the surrounding communities in the long term | There is a national dose registry with a backlog of data on the impact of nuclear energy workers and the information is available to the public. Human beings are considered a Valued Ecosystem Component within the airshed (75km). There could be some consumption from hunters and trappers and community members. Arsenic consumption is on level with averages across the country. | Section 8 and 9 of the CSR outline the existing environment and the potential effects, mitigation measures and environmental effects analysis on human health and the environment from radiation exposure. |
| Length of time it will take to return the land to its original form | Decommissioning will take 7 years and 10 to 100 years for the land and water quality to return. | Conceptual decommission and reclamation plan presented in Section 4 of the CSR.<br><br>Section 9 of the CSR outlines the potential effects, mitigation measures and environmental effects analysis for long-term impacts of the Project on the environment. |
| Concern with Mink Arm if project does not proceed | The Mink Arm of South McMahon Lake will be drained to become part of the open pit mine. At the end of mining, the pit will become a pit lake. If there are any significant adverse effects identified then the Project will not get approved and therefore will not proceed. | Dependent on decision from the federal Minister of the Environment |
| **Socio-Economic** | | |
| Concern with how trappers and fishermen will be compensated for the draining of Mink Arm | AREVA is required to have a financial decommissioning plans and financial assurances in place to rehabilitate the area with a monitoring program. AREVA has worked with trappers on their lease and Trapper Compensation Agreements are in place. | Success of the fish habitat compensation plan to be assessed through federal Follow-up Program, described in Section 10 of the CSR.<br>Success to be assessed through federal Follow-up Program, described in Section 10 of the CSR. Current DFO policy does not allow for the provision of finances or educational programs to compensate for the |

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| | | HADD of fish habitat. Only physical actions intended to maintain the net production of potential fish habitat are acceptable as compensation. |
| Lack of employment opportunities | The Impacts Management Agreements (IMA) that are in place with industry and First Nations and northern communities focuses on training, business development and employment. The IMA includes preferential hiring for residents of these communities through the Multiparty Training Plan Agreement. | |
| Lack of education and training | AREVA currently has training programs that are in place through the IMA (GED, apprenticeships, scholarships). | |
| **Compensation** | | |
| Concern for compensation for land-users after project is complete | AREVA has worked with trappers on their lease and Trapper Compensation Agreements are in place. | |
| **Traditional Land Use** | | |
| Identification of traditional use in the region | AREVA completed traditional land use research. PAGC is the custodian of the traditional land use research. The research identified that the Midwest Project would have limited interaction with traditional land use. | The interaction of the Midwest Project with traditional land uses is presented in Section 8 of the CSR. |
| **Monitoring** | | |
| Inadequate monitoring programs | McClean Lake Operation has an extension Environmental Monitoring Program in place that is reviewed and approved by the regulatory authorities. | Existing monitoring programs with the McClean Lake Operation and proposed monitoring programs for the Midwest site are presented in Section 10 of the CSR. |
| | AREVA supports independent environmental monitoring through the Athabasca Working Group environmental monitoring program. The Athabasca environmental monitoring program allows Athabasca Basin community members to test the environment around their communities for contaminants that could come from active uranium mining and milling operations. Samples of air, water and sediments are collected near the communities of the Athabasca Basin with the help of local hunters and other residents. The monitoring program also gathers tissue from fish and animals that are traditionally harvested by northern people. | |