4. Implementation Plan

4.1 Identification of Work Packages

Closure of the Mine Area is best accomplished in stages that will focus on being incorporated into the overall closure schedule. The work packages identified for the Main Mine Area (MMA) and Remote Mine Area (RMA) rehabilitation program are listed in Table 4.1 below.

TABLE 4.1
IDENTIFICATION OF WORK PACKAGES

Package I.D.	Work Package Description
MMA-WP#1a	Excavation and removal of the materials at the former arsenic dump, a portion of the Moira River bank (if required), and within areas including sample locations GB3001, GB3002, GB3003, GB3004, GB3005, SS3022, SS3026, SS7030, SS7032, SS7033, SS7034, SA6, SA21, SA26 and 46, and the small volume (approximately 5 m^3) of low-level radioactive slag. Infilling of the excavations to grade with "clean" fill material, topsoil, and then vegetating, including reconstructing a portion of the Moira River bank (if required). If human health or ecological risk is present in underlying soil, those areas will require a minimum cover of 1,500 mm to top of topsoil (simple earth [clay] cap design).
RMA-WP#1b	Excavation and removal of soils within areas including SS7040, adjacent to Hawkeye Shaft; 72, adjacent to Pearce Shaft; and SS3002, SS3004, 56, and 57, adjacent to and west of the Tailings Area, followed by infilling of the excavations to grade with "clean" fill material, topsoil, and then vegetating.
MMA-WP#2a	Regrade and cover waste rock with geofabric filter; cover with clay, topsoil; then vegetate. Consolidate and cover the three suspected marginally leachable soil areas with clay, "clean" fill material, topsoil, and then vegetate. Clay to be compacted in place.
RMA-WP#2b	Regrade and cover waste rock with geofabric filter, cover with clay, "clean" fill material, topsoil, and then vegetate. Clay to be compacted in place.
MMA-WP#3	Tuttle Shaft pumping system installation: Pump, piping, overhead piping support structure, pipe insulation and heat tracing.

Note: Contaminated materials excavated as part of MMA-WP#1a and RMA-WP#1b will be transferred for consolidation in the Industrial Area and covered with an engineered cap.

4.2 Sequencing of Work Packages

It is recommended that the work packages be completed in the order presented in Table 4.1. The excavation and infilling of the contaminated areas, and covering of the waste rock in the Main Mine Area should coincide with the same activities in the Industrial Area. Changes to the pumping system and the installation of the required piping cannot occur until the lands between the Tuttle Shaft and the equalization pond have received final grading. In the Remote Mine Area, removal of highly leachable wastes and soils identified in the draft SSRA as requiring removal will provide the greatest environmental improvement effect, and infilling and grading of these areas can overlap into the RMA-WP#2b efforts.

4.3 Anticipated Construction Impacts and Mitigation Measures

Anticipated construction impacts and mitigation measures are summarized in Table 4.2.

TABLE 4.2
ANTICIPATED CONSTRUCTION IMPACTS AND MITIGATION MEASURES

Construction Impacts	Mitigation Measures
Clearing and grubbing of trees and shrubs during site preparation	Altered areas should be revegetated with native/clonal species. If possible, minimize cutting trees larger than 100 mm diameter.
Suspended particulates in air from heavy equipment/vehicles adversely affecting air quality	Dust suppression methods will be utilized on an “as needed” basis.
Vegetation removal for temporary road construction or existing road upgrades to accommodate heavy vehicles	Roads not required for the future operation, maintenance, and monitoring (OMM) of the site will be excavated, backfilled with appropriate material, and revegetated to blend in with existing cover/cap requirements.
Suspended sediment in surface water	Diversion dams/trenches and geotextile silt fencing will be used to isolate surface water flows from active excavation areas. Sediment settling/retention ponds may be required.

4.4 Implementation Schedule

An implementation schedule for the five work packages is presented in Table 4.3.

TABLE 4.3
IMPLEMENTATION SCHEDULE OF WORK PACKAGES

Package I.D.	Work Package Implementation Schedule
MMA-WP#1a	Excavation and removal of the waste materials and low-level radioactive slag; infilling of the excavations to grade with “clean” fill material and topsoil; then vegetating in Year 1, including reconstructing a portion of the Moira River bank (if required).
RMA-WP#1b	Excavation and removal of soils; infilling of the excavations to grade with “clean” fill material and topsoil; then vegetating in Year 1. (As before, a thicker 1.5-m cap may be needed.)
MMA-WP#2a	Regrading and covering of waste rock with geofabric filter; covering with clay (compacted), and topsoil; then vegetating in Years 1 and 2. Consolidating and covering the marginally leachable soil areas with clay (compacted), “clean” fill material, topsoil, and then vegetating in Years 1 and 2.
RMA-WP#2b	Regrading and covering waste rock with geofabric filter, clay (compacted), and topsoil, and then vegetating in Year 1.
MMA-WP#3	Installing pump and piping in year following the completion of the Industrial Area closure between the Tuttle Shaft and the equalization pond.

Figure 4-1 illustrates the proposed project schedule.

Figure 4-1
Proposed Project Schedule

Deloro Mine Site Cleanup, Mine Area Rehabilitation Closure Plan Implementation

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Ontario

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		Year 1				Year 2			
Work Package ID Number	**Description**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**
	Project Initiation								
MMA-WP#1a	**Excavation and removal of the waste materials and low-level radioactive slag; infilling of the excavations to grade with "clean" fill material and topsoil; then vegetating, including reconstructing a portion of the Moira River bank (if required).**								
RMA-WP#1b	**Excavation and removal of soils; infilling of the excavations to grade with "clean" fill material and topsoil; then vegetating**								
MMA-WP#2a	**Regrading and covering of waste rock with geofabric filter; covering with clay (compacted) and topsoil; then vegetating. Consolidating and covering the marginally leachable soil areas with clay (compacted), "clean" fill material, topsoil, and then vegetating**								
RMA-WP#2b	**Regrading and covering waste rock with geofabric filter, clay (compacted), and topsoil, and then vegetating**								
MMA-WP#3	**Install pump and overland piping in year following the completion of the Industrial Area closure between the Tuttle Shaft and the equalization pond**								

4.5 Cost Opinion for Each Work Package

A cost opinion for each work package is presented in Table 4.4. Operation, maintenance, and monitoring (OMM) costs are also provided in Table 4.4.

TABLE 4.4
ESTIMATED COSTS FOR IMPLEMENTING RECOMMENDED ALTERNATIVE

Mine Area Closure Plan

Work Package Identification Number	Description	Estimated Cost* (2004 dollars)
Capital Cost Items		
MMA-WP#1a	Excavate Highly Leachable Wastes, Radioactive Slag, and Infill/Vegetate and Reconstruct Riverbank (if required)	$1,095,000
RMA-WP#1b	Excavate Impacted Soils and Infill/Vegetate	$360,000
MMA-WP#2a	Cover Waste Rock, Consolidate/Cover Marginally Leachable Soils, and Vegetate	$531,000
RMA-WP#2b	Cover Waste Rock and Vegetate	$134,000
MMA-WP#3	Upgrade Tuttle Shaft Pumping System Installation and Install Overland Piping to Industrial Area	$73,000
Total Capital Costs		**$2,193,000**
OMM Cost Items (Average Weighted Annual Costs)		
Total Average Weighted Annual OMM Cost		**$66,430****
NPV OMM Costs		**$1,091,000*****
NPV of Capital and OMM Costs		**$3,284,000**

*All costs have been developed using 2004 pricing and do not include an escalation factor.

**Includes OMM of Tuttle Shaft pumping, maintenance of capping, and monitoring program.

***Net Present Value (NPV) of averaged weighted annual OMM costs using an effective interest rate of 5 percent, and a 20-year planning horizon.

The net present value (NPV) costs presented above are the sum of the capital cost and the net present value of the OMM costs. The annual OMM costs have been transformed to a net present value assuming an effective interest rate of 5 percent and a planning horizon of 20 years. The effective interest rate includes inflationary effects. It should be noted that OMM effort and costs would be required beyond the 20-year horizon. The 20-year period was selected based on the assumption that it is a reasonable period for budgetary planning purposes.

A cost estimate for replacement monitoring wells, associated with post-remediation groundwater monitoring, is not included in Table 4.4, since the number of groundwater monitoring locations will require further evaluation.

As shown above, the estimated capital cost for the recommended alternative is $2,193,000, and annual weighted OMM costs are $66,430. The NPV of the recommended alternative, assuming an effective interest rate of five percent and a planning horizon of 20 years, is $3,284,000.

The costs required to implement the recommended rehabilitation alternative for the Mine Area of the Deloro site were developed previously in the report entitled *Deloro Mine Site*

Cleanup – Mine Area Rehabilitation Alternatives, Final Report (CH2M HILL, October 2003a). The costing performed for the above report has been used to assign a cost estimate for each of the five work packages as shown in Table 4.1. SSRA work completed since that time has resulted in an estimated increase from approximately 4,800 m^3 to 32,405 m^3 (6.8 fold increase) in the approximate volume of contaminated materials. The costs provided in Table 4.4 have been revised to account for the increased volume of contaminated materials.

To date, suitable clay has not been confirmed locally. It has been conservatively assumed that all clay (i.e. 100 percent) will have to be imported from a non-local source, compared to 50 percent as was indicated in the Mine Area alternatives report. OMM costs have increased following a more detailed evaluation, and the costs estimated for the monitoring program were not previously presented in the Mine Area alternatives report. Also, while the need to reconstruct a portion of the Moira River bank in the Main Mine Area is not clearly defined, a cost allowance has been included in Work Package MMA-WP#1a (see Appendix A).

The capital costs presented in Table 4.1 include overhead and remote location costs, the federal Goods and Services Tax (GST), a 15 percent contingency for the capital costs, a 5 percent contingency for the OMM costs, and the cost of insurance and various construction bonds associated with the work. The costs presented are expected to have accuracy on the order of +/-25 percent. A breakdown of the estimated costs is provided in Appendix A. The major assumptions used in making this cost estimate are also provided in Appendix A. The costing in Appendix A has been completed at the preliminary design level and should be considered as a "cost opinion" to assist in budgeting. An appropriate allowance should be included in any budget planning to account for cost escalation factors for work after 2004. Costs can further be refined once the recommended alternative has been accepted and the detailed design and approach have been finalized.

4.6 Health Hazard Assessment

A document entitled *Deloro Mine Rehabilitation Project – General Health and Safety Plan (GHASP), Final Report* (CH2M HILL, January 2002) has been developed to identify the main hazards, and to provide a basis for the health and safety protocols.

The GHASP identifies the following health hazards associated with the Deloro Mine Site, that could be encountered while undertaking site inspections, site investigations, and remedial cleanup:

- Arsenic and arsenic compounds, other metals, and silica
- Radiological hazards
- Heat and cold stress
- Buried utilities
- General physical (safety) hazards
- Biological hazards
- Chemicals existing at or brought onto site

The GHASP outlines and describes appropriate procedures and protocols to effectively deal with the above hazards associated with the Deloro Mine Site. The GHASP addresses hazard evaluation and control procedures, and protocols (including action levels), personal protective equipment to be used, air monitoring protocols and specifications,

decontamination procedures and protocols, spill containment procedures, confined space entry procedures, emergency response plans, and emergency contacts.

Addenda to the GHASP will address specific work packages identified in this and the other three Closure Plans.

Radiological hazards result from radioactive slag, some tailings-like material in the Industrial Area, and sediments in the onsite Young's Creek Area contaminated by radium and uranium tailings eroded from the Tailings Area. The slag represents an external hazard from radiation fields, whereas the tailings-like material and sediments represent both external hazards due to radiation fields and internal hazards from potential ingestion and/or inhalation during the handling activities. Although ambient radiation fields in most of the work areas are expected to be below 1 μSv/h, standard radiation protection procedures as described in the GHASP will be employed to minimize doses to workers during the various remediation activities. Routine radiation field monitoring will be used to identify those areas in which radiation protection procedures must be implemented. Contamination control procedures will also be implemented as described in the GHASP. Decontamination procedures are outlined in Section 4.7.4 of this Closure Plan.

4.6.1 Main Mine Area

The health hazard to workers will be greatest during removal of the arsenic dump area wastes/soils, and the clearing and grubbing of the Main Mine Area. The regrading of the waste rock and application of the geofabric filter to the surface of the waste rock will have the next greatest level of health risk to be mitigated.

4.6.2 Remote Mine Area

The health hazard to workers will be greatest during the regrading of the waste rock and application of the geofabric filter to the surface of the waste rock.

4.7 Environmental and Community Health Protection Plan

Potential receptors that could be affected by the cleanup of the Deloro Mine Site include workers involved in the site cleanup, residents in the Village of Deloro, residents and cottagers along the Moira River downstream of the site, and vehicular traffic along Highway 7 near Young's Creek (in the case of impacted materials to be transported onsite from offsite Young's Creek across Highway 7). The following ECHPP identifies potential risks associated with the cleanup of the site and recommends appropriate mitigation measures. Protection of workers involved in the site cleanup was addressed in Section 4.6.

The disturbance of potentially contaminated materials during remedial activities and the possible loss of contaminants from the work area depend to a high degree on the remedial methods and related physical activities undertaken during site rehabilitation. Since the transport of contaminants is most easily controlled at the source, the remedial activities selected for the site have been chosen based on the ability to minimize and control the disturbance, spread, and loss of contaminants from the work area. Additional actions can be taken to further limit the spread and loss of contaminants from the work area and potentially offsite. These include measures to control dust, noise, odours, surface water runoff, surface water run-on, and erosion, as well as the use of appropriate equipment and

personnel decontamination procedures. Each of these measures, which are discussed briefly below, will be undertaken prior to and during implementation of the remedial activities. Odour control is not discussed since it is not expected to be of concern during implementation of remedial activities at the Deloro site.

It should be noted that this overview provides some of the key aspects associated with the mitigation and monitoring of potential offsite impacts resulting from remedial activities. The specific details and procedures will be included in the contract documents and specifications associated with the rehabilitation of the Deloro site, and the execution plans proposed by the remedial contractors who are selected to complete the cleanup work.

4.7.1 Dust Control and Air Monitoring

Effective dust control at sites undergoing remediation is best addressed via the development, establishment, implementation, and enforcement of a fugitive particulate emission control program. The development and implementation of such a program is generally the responsibility of the remedial contractor, and is required to be reviewed and approved by the owner and/or the consultant. The fugitive particulate emission control program includes a description of the procedures relating to the handling of materials, air monitoring and dust control, and is documented in the contractor's execution plan for the site remedial activities. The remedial contractor is required to take all precautions necessary to minimize and control the generation of dust, and under no circumstances will unacceptable levels of dust be permitted to be generated and/or transported offsite.

Key aspects of a fugitive particulate emission control program include:

- Carrying out remedial activities that involve disturbance of material, such as excavation, during good weather conditions in order to minimize the loss of materials by wind.
- Movement of materials directly to their designated location, rather than handling several times, in order to minimize the generation of dust (i.e. multiple handling tends to break materials into smaller and smaller pieces which are more likely to be entrained by wind).
- Ensuring adequate equipment and personnel are available at the site at all times to immediately clean up any spilled material, whether it be of a small or large amount.
- An inspection program to monitor the condition of onsite and offsite roads, materials piles, vehicles, etc.
- The use of tarps to cover materials which are likely to generate dust.
- The use of dust suppressants to control dust associated with roadways, work areas, stockpiles and other possible sources. Materials used to assist in dust suppression might include water, calcium chloride, or latex binders. The frequency of application of dust suppressants is generally on an as-needed basis.
- Regrading of unpaved roads, as required, to keep silt content below 10 percent, and the sweeping of paved roads.
- The use of tarps on trucks used to transport materials onsite and offsite.
- In the case of the Deloro site cleanup, air monitoring both upwind and downwind of the site will be carried out in order to confirm that dust control measures are effective, and to ensure that any potential offsite air quality impacts caused by remedial operations are

minimized. Monitoring should be carried out for dustfall and total suspended particulate matter (TSP). Monitoring for arsenic and other selected metals should also be considered. Although radioactive contaminants may become airborne in the handling of radioactive tailings, the expected levels will be considerably less restrictive than those for arsenic at similar TSP concentrations.

- The frequency of monitoring and location of monitoring stations at the Deloro site will be determined following the development of the final integrated cleanup plan and the review of the contractor's execution plan, the proposed remedial activities, and meteorological conditions. Typically, TSP is measured using standard high-volume samplers and a daily (24-hour) average determined. Depending on the size of the site, samplers are typically located at four upwind/downwind perimeter sites during each work day. Their location is subject to change based on the location of remedial activities, but they are generally placed at the furthest possible distance downwind of the site but within the property line. Standard dustfall jars are used to obtain dustfall measurements, which are typically determined based on a 30-day integrated measurement of dustfall loadings at four perimeter locations.
- Meteorological measurements (wind speed and direction) may also be required to be carried out in conjunction with the air monitoring program. Typically, hourly and daily average wind speed and direction at one localized site could be required during site activities.
- The MOE Ambient Air Quality Criteria (AAQC) for dustfall is 7 g/m^2 (30-day AAQC) and for TSP is 120 $\mu g/m^3$ (24-hr AAQC). The AAQC for TSP and dustfall were determined with nuisance effects being the limiting factor. Health effects are not a concern until TSP levels are several times higher than defined by the AAQC, unless elevated concentrations of arsenic and/or other metals are present in the dust. Levels in excess of these criteria, on the basis of property line monitoring results, are considered unacceptable. In instances where background or upwind concentrations exceed these criteria, additional contribution to the parameter is also normally considered unacceptable.
- Monitoring of ambient air quality prior to initiation of remedial activities at the Deloro site is recommended, and should be carried out on several occasions and under a variety of conditions in order to establish background air quality both onsite and offsite.

4.7.2 Noise Control

While noise is expected to be generated at the Deloro site during cleanup as a result of mobile sources such as truck and vehicular traffic, as well as equipment sources such as excavators, bulldozers, compactors, generators, pumps, and air compressors, conformation with regulatory requirements is not expected to be a major problem. The development and implementation of a noise monitoring and control program is generally the responsibility of the remedial contractor, and is required to be reviewed and approved by the owner and/or the consultant prior to initiation of any site work. The contractor is usually required to provide written details of the noise monitoring and control program in the execution plan to ensure that local requirements are met.

Typical aspects of a noise monitoring and control program include:

- The contractor will be required to take all precautions necessary to minimize noise, and under no circumstances will unacceptable levels of noise be permitted to impact offsite residents/property owners.
- The contractor is to conduct all work using appropriate construction methods and equipment so that noise emanating from the site remains at acceptable levels.
- The contractor is required to obtain approval from the owner and/or consultant prior to conducting any site activities between the hours of 6:00 p.m. and 7:00 a.m.
- The contractor will be required to undertake noise monitoring if deemed necessary.
- MOE noise guidelines for landfill operations suggest that a criterion of 50 dBA during the hours of 7:00 a.m. and 7:00 p.m. should be established for the closest residential location. A similar guideline may be suitable for the cleanup activities at the Deloro site.

4.7.3 Surface Water Protection

The control of surface water is required in order to minimize the contact of water with potentially contaminated materials, and thus reduce the generation of contaminated water. This can be achieved though the control of surface water runoff from the work area, as well as the control of surface water run-on into the work area. Surface water is also required to be controlled in order to minimize erosion, and prevent the offsite transport of potentially contaminated water and sediment to Young's Creek and the Moira River. Specific details relating to the control of surface water will be dependent on the final engineering designs for the cleanup of the site.

The development and implementation of a work area surface water control program is generally the responsibility of the remedial contractor, and is required to be reviewed and approved by the owner and/or the consultant. Generally, the remedial contractor is required to take all precautions necessary to minimize the generation of sediment and potentially contaminated surface water, and may be required to collect and treat any such water.

Key aspects of a work area surface water control program include:

- The use of geotextile silt fencing, sand bags, and/or straw bales to reduce sediment transport.
- The construction of surface water diversions, comprised of swales and sumps, or clay berms, to re-direct and/or collect surface water runoff and run-on.
- The collection and treatment of all potentially contaminated water, including water used to decontaminate equipment, surface water, and water generated from the dewatering of excavations.
- In the case of the Deloro site cleanup, surface runoff characteristics (i.e. quantity, quality, and direction of flow) of the site should be assessed prior to initiation of remedial activities. Additionally, an assessment of the quality of water in existing site drainage ditches and channels, including those that result in both run-on and runoff, standing water, and natural water (i.e. any adjacent natural streams, wetland areas, and the Moira River) should be undertaken prior to remedial activities (if not addressed through current site monitoring). The water quality assessment should include the sampling and analysis of water for total suspended solids, arsenic, and metals.

- Once a decision on the activities planned for the Deloro site is made, a site-wide surface water quality monitoring program should be developed for implementation during the cleanup.

4.7.4 Decontamination Procedures

In order to prevent the transfer of contaminants from the work area, all equipment, materials, and supplies that come into contact with potentially contaminated materials must be decontaminated prior to removal from the work area. The development and implementation of equipment decontamination procedures is generally the responsibility of the remedial contractor, and is required to be reviewed and approved by the owner and/or the consultant. The remedial contractor is required to take all precautions necessary to minimize the transfer of contaminated materials from the work area. Under no circumstances is the transfer of non-decontaminated equipment and materials from the work area permitted.

The key aspects of a decontamination program include:

- Decontamination of equipment and materials that have come into contact with potentially contaminated materials, completed by the contractor prior to the removal of equipment and materials from the work area.
- Equipment decontamination using water or steam facilities to decontaminate tracks, sprockets, tires, axles, buckets, and trailers used in the transport of materials.

CH2M HILL has prepared a conceptual design for a decontamination facility to be constructed and operated by the remedial contractors.

4.7.5 Emergency Response and Preparedness

CH2M HILL will develop a site-specific emergency procedures plan, including requirements and information relating to emergency contacts; directions to the nearest hospital; spill and fire control; emergency communications, notification, and reporting; and emergency response such as for a spill, fire, or medical emergency. All site contractors will be expected to be familiar with and implement the site-specific emergency procedures plan as required. Much of this information is already contained in the GHASP (CH2M HILL, January 2002).

4.7.6 Associated Considerations and Activities

Several issues associated with the mitigation of offsite impacts include:

- CH2M HILL will develop a site TERP to outline procedures and protocols for addressing vehicular accidents and spills of hazardous and non-hazardous materials. Procedural controls will limit the speed of vehicles and determine safe routes.
- The development and implementation of specific work practices associated with contamination, decontamination, and clean work zones.
- In addition to the existing perimeter fencing, the development and implementation of a site security plan including aspects such as additional fencing of work areas, warning/caution signs, security patrols, control of site staff and visitors, etc.

- The use of a qualified environmental contractor that is experienced in similar types of projects, has a good safety and environmental record, and whose employees are experienced and qualified.

4.8 Other Operational Procedures

4.8.1 Main Mine Area

Other operational procedures are associated with the operation of the ATP in the Industrial Area. As detailed in Section 3, contaminated groundwater collected at the Tuttle Shaft (Main Mine Area) will be pumped to the equalization pond for treatment at the onsite ATP. The operational procedures associated with the ATP are contained in the Closure Plan for the Industrial Area.

No other operational procedures are anticipated.

4.8.2 Remote Mine Area

No other operational procedures are anticipated.

5. Operation and Maintenance Requirements

Operations and maintenance efforts under the recommended alternative would be associated primarily with the groundwater collection, pumping, and conveyance system at the Tuttle Shaft, periodic maintenance of the earth caps and the reconstructed riverbank (if applicable) to repair any erosion damage and areas of vegetative stress, and perimeter fence maintenance. In addition, infilling of the surface of previously sealed mine workings may be required if subsidence is found.

A detailed operations and maintenance plan should be established for the Mine Area following implementation. Operations and maintenance of the control measures will be required to ensure that they remain in good working order.

5.1 Groundwater Collection, Pumping, and Conveyance System

OMM efforts for the groundwater collection, pumping, and conveyance system at the Tuttle Shaft include the following:

- Pump inspection and maintenance on a routine basis as recommended by the pump manufacturer (e.g. routine seals replacement)
- Pump flow capacity testing
- Flow meter calibration annually
- Pipe integrity testing (pressure testing)
- The monitoring of pump operations and pipe integrity, including pressure testing may be as frequent as weekly if no alarms are in place, and could be monthly if alarms are in place and tested regularly
- OMM related to the ATP are covered in the Closure Plan for the Industrial Area.

5.2 Cap/Cover and Riverbank

Maintenance efforts will include periodic maintenance of the earth caps and reconstructed riverbank (if applicable) to repair any erosion damage and areas of vegetative stress. In the short-term of the first three years, this will include watering of the planted areas, plant growth monitoring, plant replacement as required, and checking for tree health and addressing rodent activity (beaver and vole controls). If trees are planted, mowing between tree rows will help reduce competition from grasses and expose rodents to predators. These activities will help to reduce the mortality rate of the freshly vegetated areas, and to improve the likelihood that the vegetation density increases to the required level.

As the trees mature, occasional sampling of the leaf and bark tissue for contaminants of concern may be required if subsurface soil conditions warrant. The long-term monitoring will be less frequent than the short-term monitoring. Plant growth monitoring will be used

to determine seasonal trends, and ascertain whether replacement is required. Monitoring for beaver and vole activities, and implementing controls will be required if the plantation integrity may be compromised.

5.3 Perimeter Fencing

A maintenance program to inspect and maintain the integrity of the perimeter fence will address the following activities on a semi-annual basis in spring and fall:

- Removal of dead trees that may otherwise collapse and damage the perimeter fence
- Removal of beaver dams which are creating surface water control problems, including follow-up inspections to ensure they are not reconstructed
- Routine inspections to identify any other problems with the fence integrity, such as missing or damaged signs

The MNR should be contacted in the event large mammals become trapped inside the perimeter fence, to determine a suitable course of action.

5.4 Mine Workings

As noted in Section 3.6, the mine workings in the Main Mine Area and the Remote Mine Area were closed in three phases from 1992 to 1995. Generally, all mine and surface workings have been sealed, and no further work is required for closure with the exception of continued periodic observation of the surface for evidence of subsidence. If subsidence is detected, some infilling of the surface of the former mine workings may be required.

6. Monitoring Program

A comprehensive monitoring plan will be required to evaluate the effectiveness of the remediation measures and controls, and to identify the need for maintenance tasks discussed in Section 5.

The current site-wide monitoring program (surface water, groundwater, pumping system, ATP inlet and outlet) will be extended to monitor site conditions and the effectiveness of the site rehabilitation measures. This will include the existing monitoring wells, the surface water sampling stations, and the operational sampling stations, as well as time domain reflectometry (TDR) measurements of the cover and cap elements. Provided that the monitoring confirms the effectiveness of the closure measures in reducing the flux of arsenic reaching the Moira River, the frequency of the sampling may be gradually reduced.

Periodic monitoring is anticipated to be required during the following two phases:

- Phase 1: Post-Construction Performance Assessment – to assess the effectiveness of the cleanup measures and controls, and to evaluate the remaining potential exposure pathways and whether or not these are significant
- Phase 2: Long-Term Monitoring and Maintenance – repairs to covers, maintenance of Tuttle Shaft groundwater collection and conveyance system, cover vegetation care, etc.

Monitoring programs that will likely be prescribed for the Mine Area are summarized in Table 6.1.

TABLE 6.1
MONITORING PROGRAM

Type of Monitoring	Description	Duration	Frequency
Physical Stability	Visual inspection of surface of sealed mine workings, vegetative cover, erosion problems, tension cracks, seeps	Indefinitely following capping (Note: Inspection of surface of sealed mine workings for subsidence is ongoing, following closure of mine workings during 1992 to 1995)	Semi-annual for Years 0 to 3 Annual after Year 3
Water Quality	Sampling and analysis of surface water at key selected locations	During the excavation stage of the project	Daily during excavation
Water Quality	Sampling and analysis of surface water at key selected locations	Indefinitely following capping	Semi-annual for Years 0 to 5 Annual after Year 5
Leachate Quality	Sampling and analysis of leachate at Tuttle Shaft	Indefinitely following capping	Semi-annual for Years 0 to 5 Annual after Year 5
Pumping and Conveyance	Visual inspections and pressure testing	Throughout the pumping period	Monthly (with alarms in place)
Biomonitoring	Vegetation tissue sampling, soil moisture monitoring, visual observations	Indefinitely following capping	Annually for Years 0 to 5 Once every five years for the next 20 years Once every 10 years thereafter
ATP Influent/ Effluent Quality	Sampling and analysis of influent/effluent from the ATP	Refer to the Closure Plan for the Industrial Area	Refer to the Closure Plan for the Industrial Area

The results of monitoring during closure activities should be documented in annual monitoring reports. During the post-closure period, annual reports should be prepared that document the results of monitoring activities for that year, discuss past trends in the data, and forecast trends for the future. The overall effectiveness of the cleanup measures and controls should be examined.

The various components associated with the monitoring program are described in detail below.

6.1 Physical Stability

During construction of the clay covers/caps, compaction testing will be undertaken to verify compliance with the compaction standards described in the specifications, in order to reduce infiltration potential. After construction has been completed, the covers/caps will be inspected for erosion and slumping.

Long-term monitoring of the physical stability of the earth caps will be required. Physical monitoring of the covers/caps will include evaluation of surface water erosion damage, vegetative stress, tension cracks at the crest of slopes, and seepage along the side slopes. Semi-annual physical stability monitoring is recommended for the first three years after the vegetative covers have been planted. When the vegetative covers have become well established, annual monitoring is recommended.

As noted in Section 3.6, all mine workings at the site were previously identified and sealed in the Main Mine Area and Remote Mine Area. Periodic observation of the surface of these former mine workings will be required for evidence of subsidence.

6.2 Chemical Stability and Water Quality

An extensive program is in place to monitor surface water and groundwater quality at the Deloro site. The program includes the monitoring of the ATP influent and effluent, and the groundwater pumping stations in the Industrial Area. Two monitoring networks on the Moira River and Young's Creek provide information on surface water quality, and a series of monitoring wells on the site property assess groundwater levels and quality.

Future chemical stability and water quality monitoring efforts will be focussed on the monitoring of the ATP influent and effluent, surface water, groundwater, and possibly sediment quality at selected locations to evaluate the effectiveness of the recommended alternative following implementation.

Some of the existing monitoring wells in the Mine Area may need to be decommissioned prior to construction. New groundwater monitoring wells may need to be installed at selected locations to undertake post-remediation groundwater monitoring.

The surface water sampling locations associated with the Mine Area will be selected as part of a site-wide monitoring program to evaluate the improvement in water quality in the Moira River. The post-remediation surface water sampling locations are anticipated to be similar to the existing monitoring network on the Moira River. This will allow comparison of post-remediation water quality data with (historical) data currently being collected by OCWA.

Testing of groundwater from the Tuttle Shaft groundwater collection well (i.e. sample collection, analysis, recording, plotting), recording of flow rates, groundwater level monitoring, and alarm testing will be required to track changes in each of these components over time, and to predict their impact on the ATP.

During the rehabilitation stage, monitoring will be required for surface water and sediment quality to assess the impacts on surface water quality during excavation and consolidation activities. The purpose of the surface water quality monitoring will be to assess the effectiveness of surface water quality protective measures that are implemented during excavation activities. During periods of active excavation work onsite, surface water samples should be collected on a daily basis, and analyzed for arsenic, metals, and suspended solids. As a minimum, samples should be collected at sampling station #9, the New Westerly Creek Station at the Moira River, and at any stormwater retention ponds used to settle suspended solids. The results should be compared to historical pre-excavation concentrations as well as PWQOs.

Monitoring of surface water and sediment quality will be required prior to, and following riverbank reconstruction activities (if required) to confirm whether reconstruction activities have affected the Moira River surface water or sediment quality. Samples will be analyzed for arsenic and metals of concern including cobalt, copper, and nickel.

Semi-annual monitoring of surface water quality at the selected locations is recommended initially for the first five years following completion of the Mine Area rehabilitation activities. Provided that the results do not indicate any adverse impacts on surface water quality, the monitoring frequency would be reduced to annually following the initial five years.

6.3 Seepage and Groundwater Collection, Pumping, and Conveyance System

The monitoring of the Tuttle Shaft groundwater pumping operations will be necessary to ensure that the required pumping rate and the pipe integrity are maintained. Monitoring will include pressure testing that may be as frequent as weekly if no alarms are in place, and could be monthly if alarms are in place and tested regularly.

6.4 Biomonitoring

Biomonitoring will be undertaken in areas where natural environmental restoration measures are planned. This includes the revegetation of the capped and covered areas within the Main and Remote Mine Areas. The biomonitoring program will be undertaken during the first growing season following the construction of each remediated area, and annually thereafter for a total of five years. Biomonitoring will then be conducted once every five years over a 20-year period, and every 10 years thereafter.

Qualified field personnel will evaluate the success of herbaceous vegetation such as grasses, wildflowers, seeding, and woody plantings in the remediated areas. Plant health will be monitored, and woody planted materials, such as shrubs and trees, that are inadequate or dead will be replaced. Native colonizing species of shrubs and trees that germinate and grow in these areas will also be documented.

To further support the goals and objectives of the Mine Area Closure Plan, the monitoring program may include the collection of plants (leaves and/or stems) from the capped and covered areas during the growing season and prior to senescence. The concentration of metals of concern in the plant tissues could be chemically determined. Trends could be identified, and comparisons to benchmark, toxicological, and site data could be conducted to ensure that the goals of the Mine Area Closure Plan are being met.

Wildlife use, including direct sightings or signs such as tracks, burrows, dens, nests, and scat, in the Mine Area should be documented and recorded on a site map, as one of the goals of the Mine Area Closure Plan is to increase the quantity and quality of wildlife habitat and wildlife diversity. Wildlife observations could be documented by qualified field personnel while undertaking the other investigations, and thus would be completed with the same frequency and over the same period of time as noted above.

6.5 Site Management

It is anticipated that the following site management actions will be implemented or maintained:

- Fencing exists on the perimeter of the Deloro Mine Site and access is restricted to authorized personnel.
- Signage exists on the perimeter fence as well as at the north and south approaches along the Moira River.
- The MOE will retain ownership and control of the site for the foreseeable future.
- Site conditions will be registered on title at the conclusion of the cleanup coincident with the issuance of a Record of Site Condition (RSC).

7. Malfunctions, Accidents, and Mitigation Measures

During the implementation and operation of the rehabilitative measures at the site, there is a potential that malfunctions (i.e. in design, construction, or commissioning) or accidents (i.e. due to acts of nature) could occur. These malfunctions and accidents can adversely affect remediation activities, and OMM activities, resulting in delays and costly mitigation measures. These events must be considered, and mitigation measures must be developed, to ensure environmental impacts are minimal and acceptable.

Table 7.1 identifies mitigation measures for potential malfunctions and accidents that have a reasonable probability of occurring at the site during three time frames:

- Short-term: Preparation activities
- Mid-term: Remediation activities
- Long-term: OMM activities

Table 7.1 documents potential malfunctions and accidents, as well as mitigation measures and responses.

TABLE 7.1
MALFUNCTIONS, ACCIDENTS, AND MITIGATION MEASURES IN THE MINE AREA

Malfunction (M) or Accident (A)	Mitigation Measures
Short-term: Preparation Activities	
A – Spill of contaminated soil from construction equipment/ vehicle fuel	Construction contractors and other site personnel should be trained to respond to spills. Spill would be isolated and transferred to waste consolidation area, or to an acceptable waste receiver if spill occurs offsite.
Mid-term: Remediation Activities	
M/A – During excavation and consolidation activities, severe storm events could expose contaminants, or transport contaminants via wind or stormwater	Contain stormwater (if possible) and ensure that sediment controls are in place. Implement contingency plan to dewater ponded water in excavations. Sedimentation catchments will be in place during construction activities. Excavation should be staged such that contaminated sediments cannot be washed into clean areas. These design measures should be sufficient during normal storm events. Sequence work to avoid areas subject to erosion during severe storm events.
M/A – During cap/cover construction, soil and vegetation could wash away	Placing straw onto sloped areas that are freshly planted, and planting with annual rye or wheat will help stabilize the soil. If soil is washed away, then replace the soil, and replant.
A – Damage to existing Tuttle Shaft collection system during construction activities	Repair or replace damaged components.
M/A – Perpetual disruptive forces (MNDM, 1995)	The recommended alternative for the rehabilitation of the Mine Area incorporates measures to mitigate perpetual disruptive forces. Further refinements will be addressed during detailed design.
A – Spill of contaminated soil from construction	Construction contractors and other site personnel should be trained to

TABLE 7.1
MALFUNCTIONS, ACCIDENTS, AND MITIGATION MEASURES IN THE MINE AREA

Malfunction (M) or Accident (A)	Mitigation Measures
equipment/vehicle fuel	respond to spills. Spill would be isolated and transferred to waste consolidation area, or to an acceptable waste receiver if spill occurs offsite.
M – Breach of cover/cap	Although the thickness of the covers/caps is designed to prevent penetration from tree roots and burrowing animals, there is a remote possibility that this can happen. Ongoing monitoring program will identify need for repairs to covers and caps. The site OMM manual will provide cap/cover repair procedures and protocols.
M – Riverbank erosion	Ongoing monitoring program will identify need for repairs to riverbank. The site OMM manual will provide riverbank repair procedures and protocols.
M – Tree mortality due to soil conditions, contaminants, rodents, etc.	Install raptor perches to encourage hawks and owls to prey on rodents. Routinely monitor the health of the trees. Mulch trees, keep grass mowed to reduce potential for rodent damage. If mortality occurs, determine cause of mortality (soil conditions, contaminants, rodents) and rectify, then replace trees.
M – Tuttle Shaft transfer pump failure	Use standby pump. Routine monitoring of pump performance.
M – Tuttle Shaft transfer pump or conveyance system capacity insufficient	Purchase appropriate pump and replace original pump, or increase pipe capacity by replacing with increased diameter piping or adding a parallel pipeline.
M – Flow meter producing no or erroneous signal	Repair flow meter and/or check the pump integrity.
M – Piping failure	Install auto shutoff that is triggered if back pressure is too low. Routinely monitor the pipe integrity.
M – Piping frozen	Shut down pump and thaw line. Check heat tracing integrity. Routinely monitor that the collected water is flowing.
M – Electrical short circuiting in pump control/flow meter panel	Troubleshoot and repair. If due to rain/moisture, ensure waterproof features are in place.
Long-term: Operation, Maintenance, and Monitoring Activities	
M/A – Perpetual disruptive forces (MNDM, 1995)	The recommended alternative for the rehabilitation of the Mine Area incorporates measures to mitigate perpetual disruptive forces. Further refinements will be addressed during detailed design.
M – Cover Failure due to flooding	Since the majority of the cover is from 7 to 12 m above the floodplain of the 100-year flood, the possibility of severe flooding that could potentially compromise the integrity of the cover and lead to the release of some of the contained contaminants is considered remote.
A – Seismic occurrences	Design long-term structures at the Deloro site to the appropriate Seismic Zone. The probability of an earthquake of sufficient magnitude to breach the covers is very small given the stability of the region (Zone 1, low risk of earthquake). Any damaged areas during such an event would be identified and rectified using defined maintenance procedures.

Notes: Perpetual disruptive forces are defined in MNDM (1995) to include wind erosion; water erosion due to flooding, sheeting, rilling, and gulleying; sedimentation and debris accumulation; annual ice accumulation; seasonal frost penetration; soil restructuring; and physical and chemical weathering. Biological activities include root penetration, burrowing, intrusion, and actions by animals and man.

8. Expected Post-Closure Conditions and Uses

This section provides an assessment and description of the expected conditions and uses following closure activities.

8.1 Land Use

The final intended use of the site will be specified as a component of the federal EA. It is anticipated that access to the site will continue to be restricted, and the fence that currently surrounds the site will be maintained for the foreseeable future.

8.2 Topography

The revised topography in the Mine Area (Main Mine and Remote Mine Areas) will be heavily dependent on:

- The amount of highly leachable wastes/soils excavated from areas
- The final grade of the land, which will be suitable for stormwater runoff yet allow minimal stormwater erosion
- The thickness of the earth cap applied to the remediated areas

It is anticipated that the earth cap will rise to an elevation of about 215 metres above sea level (masl) in the area north of the Gatling Shaft. The maximum elevation difference is approximately 1.5 m higher than the current grade in the Main Mine Area and about 0.65 m in the Remote Mine Area. These are well below the localized topographic high points of other locations within the Mine Area.

Public visual impacts associated with the Mine Area closure are anticipated to be minimal, principally due to the remote location and the restriction of access to the site by the public. Tree removal in the Main Mine Area may have the greatest visual impact for canoeists travelling along the Moira River during the limited high water periods.

8.3 Water Resources

It is anticipated that the implementation of the recommended rehabilitation alternative for the Main Mine Area will result in a marked improvement to the Moira River water quality, and support the overall closure objective of a 90 percent reduction in arsenic discharge to the Moira River, thus achieving PWQOs at the intersection of the Moira River and Highway 7 (CG&S, October 1998).

8.4 Plant and Animal Life

As noted in Section 2.1.2, the post-closure risks to ecological receptors from the draft SLERA are not conclusive given information that is currently available. Additional site information is being collected and further risk evaluation is underway.

9. Approval Requirements

The primary site-wide regulatory approvals that must be applied for and issued by the appropriate government agencies are outlined in this section of the Closure Plan.

9.1 Site-Specific Risk Assessment

SSRA is the remedial approach selected from the options available in the *Guideline for Use at Contaminated Sites in Ontario* (MOE, 1997). There are a number of steps to approval of an SSRA to ensure that public health and the environment are protected. First, an SSRA is reviewed by an independent third party peer reviewer who is qualified and experienced in conducting SSRAs. Once the peer reviewer's comments have been incorporated, the SSRA is submitted to the Standards Development Branch (SDB) of the MOE, which undertakes a review of both technical and policy issues. Other prerequisites for acceptance of the SSRA include community-based public communication and dialogue with the municipality regarding the SSRA. Once these steps have been completed, the cleanup can proceed.

As confirmation that the actual cleanup is completed according to the SSRA, a Record of Site Condition (RSC) will be prepared and filed to document the cleanup. The RSC is completed jointly be the proponent, MOE, as well as the consultant overseeing the cleanup. The SSRA is a Level 2 Risk Management involving the use of engineered controls (i.e. engineered covers, groundwater pumping/treatment systems). A Level 2 Risk Management requires Registration on Title for the property to document the conditions of the land in the public domain. Registration on Title will be accomplished through filing a Certificate of Prohibition.

As a result of the different land ownership between the Deloro Mine Site and the Young's Creek Area south of Highway 7, a separate SSRA report has been prepared for each of these two land parcels (see Section 2.1) following the process described in this section.

The current process for completing SSRAs, outlined above, was developed in 1997 and has been in place since that time. New legislation has been passed that is anticipated to modify this process once the enabling regulations are finalized. The new legislation, the *Brownfield Law Statutes Amendment Act*, received Royal Assent on November 21, 2001. The public comment period for the regulations ended on April 29, 2003. Final regulations, which are expected to be released through 2003, may change the SSRA process from a guideline-driven to a regulatory-driven process. The draft regulations do not suggest significant change in the technical approach to SSRAs, but they do indicate some changes in the administrative aspects. The Deloro Mine Site SSRA will be adapted, if needed, to meet the new regulatory requirements.

9.2 MOE Authorizations

Under the *Environmental Protection Act* (EPA) and the *Ontario Water Resources Act* (OWRA), approval is required from the MOE for processes that emit to the environment, or for waste management activities. The primary means of approval is through issuance of a Certificate

of Approval (C of A) for air or water emissions, or a Provisional Certificate of Approval (PC of A) for waste related activities. A Permit to Take Water (PTTW) is required for water extraction above 50,000 L/day. Generator Registration is required for ongoing waste generation, such as the ferric arsenate sludge, which is generated by the onsite ATP.

A number of MOE authorizations already exist at the Deloro Mine Site as a result of environmental mitigation actions implemented to date. This includes extraction and pumping of impacted groundwater, treatment of water in the Arsenic Treatment Plant (ATP), discharge of the treated effluent, and storage/dewatering of sludge from the treatment process. A listing of the MOE authorizations currently in place at the Deloro Mine Site is provided in Table 9.1.

The Closure Plans will result in changes to the currently authorized systems, plus the addition of new systems. Changes to the current systems will require modifications to the existing MOE authorizations, most likely through an amendment (i.e. C of A Amendment). New systems will require new authorizations to be developed.

Certificate of Approval – Sewage

Amendment to the existing C of A for the ATP, sludge storage lagoon, pumping stations, and forcemains may be required to accommodate modifications to these systems as a result of the Closure Plans.

Certificate of Approval – Air

There is no anticipated requirement for modification of the existing C of As, or for new C of As as a result of the Closure Plans.

Permit to Take Water

The existing PTTW for the Tuttle Shaft and pumping station will require amendment to account for installation of a permanent forcemain, and the increase in pumping to a year-round operation. Other PTTWs for the other pumping stations may also require some modifications.

In the Industrial Area, a new PTTW will be required to authorize the construction and operation of a groundwater interceptor system at the western property line. Similarly, a new PTTW will be needed in the Tailings Area for groundwater pumping from wells located in the vicinity of the tailings dams walls.

Provisional Certificate of Approval – Waste Disposal

The site cleanup is following the SSRA process (outlined above) where existing residuals and by-products will be managed onsite through a Level 2 Risk Management involving isolation and containment. Although the legacy materials being managed have been in place for several decades and are not the result of ongoing waste production, and many of the materials are the result of mining activities (i.e. mill tailings from a mine) that are exempt from Ontario's Waste Management Regulation, the MOE has committed to seeking a PC of A for the proposed waste management facilities under Part V of the EPA. The development of Closure Plans for the Deloro site has drawn on landfill design standards, as well as mine closure and other guidelines, as general guidance and best management practices to ensure that the site is engineered and maintained to be safe and secure for hundreds of years.

TABLE 9.1
EXISTING MOE AUTHORIZATIONS FOR THE DELORO MINE SITE

Authorization	Type	Number	Date	Description
Certificate of Approval	Sewage	4-036-82-006	28 Jul 1982	Collection/storage/treatment system
Certificate of Approval	Air	8-4042-82-006	8 Sep 1982	Lime silo venting and fume hood exhaust
Certificate of Approval	Sewage	4-053-83-006	18 Jul 1983	Pumping station and forcemain
Provisional Certificate of Approval	Waste Disposal Site	A362106	6 Sep 1983	Temporary storage processed sludge
Permit	Permit to Take Water	85-P-4006	26 Apr 1985	Tuttle shaft and pumping station #5
Certificate of Approval	Sewage	4-041-85-006	25 Jul 1985	Sludge drying lagoon
Permit	Permit to Take Water	85-P-4038	16 Aug 1985	Moira River
Certificate of Approval	Sewage	4-067-85-006	16 Sep 1985	Manhole rehabilitation
Certificate of Approval	Air	8-4069-86-006	17 Nov 1986	Plant exhaust system
Certificate of Approval	Sewage	4-116-86-876	8 Jul 1987	Tuttle shaft pump and forcemain
Certificate of Approval	Sewage	4-0155-87-006	20 Nov 1987	Sludge testing lagoon
Certificate of Approval	Air	8-4120-88-006	12 Dec 1988	Lab equipment exhaust
Generator Registration	Waste Streams	ONO199886	23 Jan 1989	Arsenic compounds and oils
Certificate of Approval	Air	8-4128-89-006	4 Dec 1989	Lab fume hood exhaust
Permit Amendment	Permit to Take Water	83-P-4010	6 Jun 1990	Pumping station #3
Permit Amendment	Permit to Take Water	82-P-4035	6 Jun 1990	Pumping stations #1, #2, and #4
Certificate of Approval Amendment	Industrial Sewage	4-041-85-006	27 Nov 1992	Sludge storage lagoon expansion
Permit Amendment	Permit to Take Water	85-P-4006	21 Feb 1996	Tuttle shaft and pumping station #5
Certificate of Approval Amendment	Industrial Sewage Works	4-036-82-006	20 Apr 2000	Decontamination facilities
Generator Re-registration (HWIN)	Waste Streams	ONO199886	Jan 2002	Ferric arsenate sludge
Provisional Certificate of Approval	Waste Disposal Site	2668-5DHJEW	30 Aug 2002	Temporary storage contaminated soil
Provisional Certificate of Approval Amendment	Waste Disposal Site	2668-5DHJEW	12 Nov 2002	Contingency plan

The Deloro Mine Site Cleanup Project is being carried out under an exemption to the provincial *Environmental Assessment Act* (EAA). Ontario Regulation 577/98 (O. Reg 577/98) exempts the Deloro Mine Site Cleanup Project from a mandatory hearing under Part V of the EPA (Sections 30 and 32).

9.3 Conservation Authority

Through the Fill, Construction, and Alteration to Waterways Regulation, which is administered in support of Section 28 of the *Conservation Authorities Act* of Ontario, the Conservation Authority regulates and may prohibit work taking place within valley, river, stream, and watercourse corridors as well as along lake waterfronts.

Fill regulations allow the Authority to prohibit or regulate the placing, excavation, grading, or dumping of fill of any kind for projects such as pools, ponds, roads, and driveways. These regulations are applied when, in the opinion of the Authority, the control of flooding, pollution, or the conservation of land within its jurisdiction may be affected by the placing or dumping of fill.

Construction regulations allow the Conservation Authority to regulate construction structure in or on a wetland or floodplain, or in any area susceptible to flooding during a regional storm. In this regulation, construction refers to new buildings, additions to existing buildings, stormwater outfalls, culverts, and bridges.

The alteration to waterways regulation allows the Conservation Authority to prohibit or regulate the straightening, changing, diverting, or interfering with the existing channel of a river, creek, stream, or watercourse.

Based on the remedial works that are proposed along the west bank of the Moira River (reconstruction) as well as within Young's Creek (sediment removal and wetland rehabilitation), it is anticipated that a permit "To Construct, Place Fill, or Alter a Waterway" will be required from the Moira River Conservation Authority (MRCA) c/o Quinte Conservation (QC).

9.4 Ministry of Natural Resources

Of note within the Deloro Mine Site property and in the Young's Creek Offsite Area is a Provincially Significant Wetland (PSW), the Deloro Wetland Complex. The Deloro Wetland Complex, including the area along Young's Creek south of Highway 7, was evaluated during the summer of 2000 using the 3rd Edition of the wetland evaluation manual (Snider's Ecological Services, 2000). The wetland received a total score of 688 and was evaluated as a Class 2 PSW.

The management of Ontario wetlands and lands adjacent to them is implemented through the *Wetlands Policy Statement,* which falls under the jurisdiction of the *Planning Act*. The MNR and the Minister of Municipal Affairs jointly issued the *Wetlands Policy Statement*. The policy requires that all planning jurisdictions protect PSWs such that development is not permitted in PSWs that are located within the Great Lakes—St. Lawrence Region. Development and alteration may be permitted on lands adjacent to PSWs only if it does not result in:

- Loss of wetland function
- Subsequent demand for future development that will negatively impact existing wetland functions
- Conflict with existing site-specific management practices
- Loss of wetland area

An Environmental Impact Study (EIS) would have to be prepared in order to permit development on these adjacent lands.

Consultation is required with the MNR, and possibly the Minister of Municipal Affairs, to determine whether any of the project components, such as construction of the Young's Creek Area onsite containment cell and dredging, constitutes wetland "development" and whether the project can be permitted. Also, the MNR would need to determine whether an EIS would need to be completed.

The MNR is also responsible for issuing Work Permits under the authority and provisions of several different Provincial Acts. If the project is allowed to proceed, the Provincial Acts that apply to this project would have to be determined in consultation with the MNR. The following Provincial Acts and their regulations are considered in the application for a Work Permit.

Forest Fire Prevention Act*:* The MNR administers this Act. A Work Permit is required to authorize any work on Crown land, and to ensure that adequate forest fire precautions and equipment are in place.

Lakes and Rivers Improvement Act: The purpose of this Act is to manage the use of the lakes and rivers in Ontario, and to regulate improvements to them. The Act provides for the preservation of public rights in or over water; protection of the interests of riparian owners; management of fish, wildlife, and other natural resources dependent on such waters; preservation of natural amenities; and suitability of the location and nature of improvements. The *Lakes and Rivers Improvement Act* gives the MNR the mandate to manage water-related activities, particularly in the areas outside the jurisdiction of Conservation Authorities.

Public Lands Act*:* This Act, which is administered by the MNR, authorizes the construction of roads on Crown lands, sets out Crown cost-sharing of company roads, limitations on liability and tenure for private forest roads and camp areas, and defines the applicability of the *Highway Traffic Act* on access roads.

As part of the application for a Work Permit, each project proponent must complete and apply for "Parts" of the permit. The determination of which Parts (i.e. A through F) are applicable to the project is conducted in consultation with the MNR. The Parts that must be taken into consideration when applying for a Work Permit are briefly described below:

- *Part A*: Fire Prevention and Suppression/Logging Activities
- *Part B*: Mineral Exploration Activities
- *Part C*: Building Construction
- *Part D*: Application to do Work on Shore Lands
- *Part E*: Roads, Trails, or Water Crossings
- *Part F*: Works Within a Waterbody

Based on the work proposed at the Deloro Mine Site, a Work Permit will be required from the MNR. Several Parts to the application will have to be completed possibly including, but not limited to, Parts A, D, and F. It is anticipated that the MNR will include conditions pertaining to work in the PSW with those issued as part of the Work Permit.

9.5 Department of Fisheries and Oceans/ Canadan Coast Guard

9.5.1 Navigable Waters Protection Act (NWPA)

The purpose of the NWPA is to protect the public right to marine navigation, and to ensure unobstructed passage of vessels in Canadian waters. Any construction, modification, or repair of a work that will interfere with navigable waterways must be approved, or concurrence provided by the Department of Fisheries and Oceans (DFO), and is administered by the Canadian Coast Guard (CCG). The removal of obstructions to navigation, and the provision and maintenance of lights and markers required for safe navigation are also covered under this Act. Although the section of the Moira River that passes through the site has limited use for boating, many parts of the Moira River are navigable and the CCG should be consulted on the final cleanup plan for the site.

9.5.2 Fisheries Act

The federal Minister of Fisheries and Oceans has the legislative responsibility for the administration and enforcement of the federal *Fisheries Act*. The *Fisheries Act* protects and conserves fish and fish habitats, and has the power to deal with damage to fish habitat, destruction of fish, obstruction of fish passage, necessary flow requirements for fish, and the control of deleterious substances. Section 35(1) of the federal *Fisheries Act* states that "no person shall carry on any work or undertaking that results in the harmful alteration, disruption, or destruction (HADD) of fish habitat". Any proposed works and activities that are likely to alter or damage fish habitat must be reviewed and authorized by the DFO. The Conservation Authorities have agreements with the DFO in the evaluation and processing of applications, and therefore would also have to be consulted.

It is important to note that DFO has also developed a Policy for the Management of Fish Habitat which includes a No Net Loss guiding principle. This principle is applied to any proposed development that would result in a loss of productive fish habitat. The regulatory agency would review the measures to determine if they meet not only the No Net Loss of fish habitat, but also the DFO's long-term policy objective of achieving an overall net gain of the productive capacity of fish habitats. Therefore, works requiring an authorization from the DFO typically include a Fisheries Compensation Plan which describes the measures taken to realize an overall net gain in the productive capacity of fish habitats as a result of the project.

A section of the west bank of the Moira River in the Industrial Area will be reconstructed, and a significant amount of work is proposed within Young's Creek including the excavation of contaminated sediments/soils and wetland rehabilitation. As this will affect fish habitat, a Fisheries Act authorization will be required, and a Fisheries Compensation Plan may have to be prepared. In addition, application for a blasting permit may be required to address "destruction of fish by any other means" (under the *Fisheries Act*), since a portion of the onsite containment cell will be located in Young's Creek.

9.6 Environmental Assessment and CNSC Licensing

The *Nuclear Safety and Control Act* (NSCA) mandates the Canadian Nuclear Safety Commission (CNSC) to regulate all aspects of the nuclear industry in Canada, including the management and isolation of nuclear wastes. Paragraph 26 of the NSCA states that:

> "Subject to the regulations, no person shall, except in accordance with a licence,…possess…manage, store, or dispose of a nuclear substance. . ."

It is with respect to this paragraph that the MOE seeks to obtain a licence to manage and store, at various locations on the Deloro Mine Site, the radioactive wastes present on the site. Conceptual waste isolation scenarios are presented in Section 3.4 of this and other Closure Plans for radioactive (and non-radioactive) materials.

CNSC's authorization of the project would be provided through the issuance of a Waste Nuclear Substance Licence (WNSL) for the possession, management, and storage of nuclear substances, pursuant to subsection 24(2) of NSCA.

As previously noted, because nuclear waste management and storage is a physical activity listed in the "Inclusion List Regulation" of the CEAA, the proposed project is subject to the federal EA process. Therefore, the licencing and the federal EA processes are closely linked, as explained below.

The screening level EA process being followed for this project is outlined in Section 2.2. At the completion of the EA study, the proponent must summarize the process and the results of the EA into a report that is submitted to the RA for its review. Once the RA is satisfied that the EA has met the initial scope, the report is then submitted to the members of the CNSC for its approval. A hearing in which the proponent presents the project and where the public is invited to voice its concerns or support may be required.

Following the approval of the results of the EA by the CNSC, an application for a WNSL must be formally submitted by the proponent in accordance with the General Nuclear Safety and Control Regulations, and Nuclear Substance and Radiation Devices Regulations of the NSCA. A WNSL is applicable, as opposed to a Class Ib Nuclear Facility Licence, because mainly chemical wastes are being managed with the presence of some radioactive materials.

As part of the application for a WNSL, safety analyses must be conducted to ensure radiation exposures to both workers and the public are acceptable during normal and abnormal conditions at the site.

Some applicable portions of the General Nuclear Safety and Control Regulations which must be addressed in the application are as follows:

> 3 (1) (*e*) the proposed measures to ensure compliance with the *Radiation Protection Regulations* and the *Nuclear Security Regulations*;
> (*f*) any proposed action level for the purpose of section 6 of the *Radiation Protection Regulations*;
> (*g*) the proposed measures to control access to the site of the activity to be licensed and the nuclear substance, prescribed equipment or prescribed information;
> (*h*) the proposed measures to prevent loss or illegal use, possession or removal of the nuclear substance, prescribed equipment or prescribed information;

> (*i*) a description and the results of any test, analysis or calculation performed to substantiate the information included in the application;
> (*j*) the name, quantity, form, origin and volume of any radioactive waste or hazardous waste that may result from the activity to be licensed, including waste that may be stored, managed, processed or disposed of at the site of the activity to be licensed, and the proposed method for managing and disposing of that waste;

Some applicable sections of the Nuclear Substance and Radiation Devices Regulations are as follows:

> **3.** (1) An application for a licence in respect of a nuclear substance or a radiation device, other than a licence to service a radiation device, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations*:
> (*a*) the methods, procedures and equipment that will be used to carry on the activity to be licensed;
> (*b*) the methods, procedures and equipment that will be used while carrying on the activity to be licensed, or during and following an accident, to
> (i) monitor the release of any radioactive nuclear substance from the site of the activity to be licensed,
> (ii) detect the presence of and record the radiation dose rate and quantity in becquerels of radioactive nuclear substances at the site of the activity to be licensed,
> (iii) limit the spread of radioactive contamination within and from the site of the activity to be licensed, and
> (iv) decontaminate any person, site or equipment contaminated as a result of the activity to be licensed;
> (*c*) a description of the circumstances in which the decontamination referred to in subparagraph (*b*)(iv) will be carried out;

Following submission of the application, and any clarifications and/or additional materials required by CNSC staff, a draft licence is then prepared by CNSC staff, discussed with the proponent, and ultimately presented to the members of the CNSC for approval. A hearing in which the proponent presents its application, and where the public is invited to voice its concerns or support may be required. Upon acceptance, a WNSL is issued and remedial work can begin under the conditions of the Licence.

9.7 Mining Act

The regulatory considerations relevant to the Deloro project were examined early in the project, and have been refined as the project has progressed. The document entitled *Deloro Mine Rehabilitation Project – Development of Closure Criteria, Final Report* (CG&S, October 1998) summarized the application of the *Mining Act* to the Deloro project. Even though the Crown (i.e. the Provincial Government) is exempt from the requirements of the *Mining Act,* the Closure Plans have been developed to satisfy, in general, the requirements of the document entitled *Rehabilitation of Mines, Guidelines for Proponents* (MNDM, 1995). MNDM has agreed to review the Closure Plans relative to accepted standards for closure and rehabilitation of mines in Ontario, although a specific approval will not be issued.

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