Environmental Impact Statement

Long Harbour Commercial Nickel Processing Plant

Executive Summary

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April 2008

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1.0 Introduction

The Long Harbour Commercial Nickel Processing Plant (the Project) proposed by Vale Inco Newfoundland & Labrador Limited (Vale Inco NL) will be located in Long Harbour, Placentia Bay, in the Province of Newfoundland and Labrador (Figure 1.1). A general Project layout is shown in Figure 1.2.

Figure 1.1 Project Location

The Project has been exhaustively planned so that it will be a major benefit to the province, providing significant employment and business opportunities. Vale Inco NL has in place well proven policies and procedures with respect to safety, environmental protection, sustainability assurance, human resources and community relations. Through an extensive planning process, the Company has identified, and is committed to implementation of, significant environmental protection and mitigation measures that will enhance benefits and reduce or eliminate potentially negative effects. Based on its proven performance record, Vale Inco NL is confident in its ability to plan, construct, operate and eventually decommission the Project in an environmentally responsible manner. This Environmental Impact Statement details how this will be accomplished.

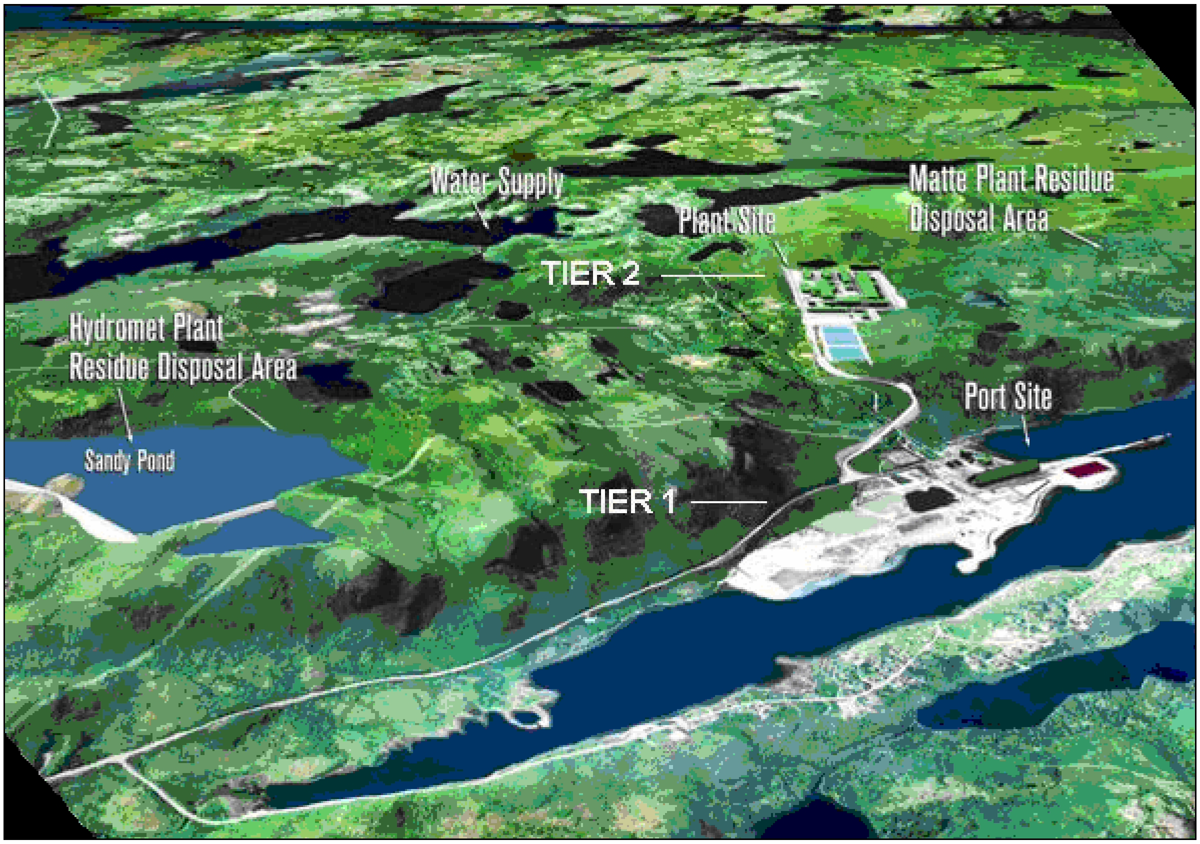

Figure 1.2 General Layout (Looking South)

The Proponent is well known in the province. Voisey's Bay Nickel Company Limited (VBNC) was established in 1995 and became a wholly-owned subsidiary of Inco Limited in 1996. On January 7, 2007, Inco Limited became a wholly-owned subsidiary of Companhia Vale do Rio Doce (CVRD) and changed its name to CVRD Inco Limited. On November 29, 2007, CVRD adopted the name Vale, and CVRD Inco Limited changed its name to Vale Inco Limited, and on the same date, VBNC adopted the name Vale Inco Newfoundland & Labrador Limited (Vale Inco NL).

Vale is the largest mining company in the Americas, and one of the three largest diversified mining companies in the world. Vale Inco Limited is the world's second largest nickel producer and has plans to build and expand the company. More information on Vale Inco Limited is available at www.valeinco.com. Additional information on Vale Inco NL can be found at www.vbnc.com.

In March 2006, VBNC submitted a Project Description and Project Registration for its proposed Commercial Processing Plant. This single document was submitted simultaneously to the Canadian Environmental Assessment Agency and the Newfoundland and Labrador Department of Environment and Conservation. On May 11, 2006, the provincial Minister of Environment and Conservation made a determination that an Environmental Impact Statement was required for the registered Undertaking. Guidelines for this Environmental Impact Statement (EIS) were issued on October 31, 2006, pursuant to the Province's *Environmental Protection Act* and the *Canadian Environmental Assessment Act* (CEAA).

On November 3, 2006, Fisheries and Oceans Canada (DFO) and Transport Canada (TC) issued a Screening Scoping Document (CEAR Reference Number 06-01-23173) in which the two departments outlined their responsibilities under the *Canadian Environmental Assessment Act* as Responsible Authorities, indicated their intention to use the EIS to complete a screening-level environmental assessment, and set out the scope of the Project for the federal environmental assessment.

This EIS meets the requirements of the Guidelines and goes beyond the factors listed in Section 16(1) of the *Canadian Environmental Assessment Act*. Additional factors considered in this EIS are consistent with a higher level of review, and include all of those factors set out in Section 16(2) of CEAA, including the purpose of the Project, alternative means of carrying out the Project, the need for follow-up programs, and the capacity of renewable resources likely to be significantly affected by the Project to meet present and future needs.

This EIS is being submitted for the purpose of assisting the Minister of Environment and Conservation to determine the acceptability of the Project. It is also being submitted to support the federal environmental assessment. The EIS provides a description of the Project that is consistent with the Scope of Project as laid out in the Guidelines and in the Screening Scoping Document. The scope of this environmental assessment is also consistent with the requirements laid out in these documents.

2.0 Sustainability

Vale Inco NL supports sustainable development, which seeks to enhance society through economic development and environmental responsibility. Vale Inco NL believes that mineral products are essential for the development of a sustainable economy, and that the protection of worker health and safety, as well as the health of surrounding communities and the environment, are essential considerations in the management of its business. These beliefs are reflected in the Vale Inco NL Health, Safety and Environment Policy (Figure 2.1).

The management of occupational hazards and environmental liabilities during all phases of the Project will conform to the Vale Inco NL corporate Health, Safety and Environmental Management System (HSEMS). This dynamic system, which applies to all Company operations and contractors and is audited by Vale Inco Limited, will evolve to address changing needs throughout the project life cycle. Key documents for the implementation of the HSEMS include:

- Environmental Protection Plan;
- Greenhouse Gas Management Plan;
- Environmental Effects Monitoring Plan;
- Occupational Health and Safety Plan;
- Vessel Traffic Management Plan;
- Fisheries and Aquaculture Compensation Program;
- Rehabilitation and Closure Plan;
- Waste Management Plan; and
- Emergency Response Plan.

Vale Inco NL believes that all accidents are preventable. Safety targets are set because excellence can be achieved only with effort and by motivating the entire workforce to make safety a top priority. Through a variety of safety initiatives and a program of continuous improvement, the Company is committed to achieve a goal of zero accidents.

All employees are responsible for accident prevention within Vale Inco NL facilities. Ten safety principles define the Company's commitment to achieving an injury-free and safe work environment:

- Everyone has the right to a safe environment.
- Safety will not take second place to any other management responsibility.
- Management is directly responsible for preventing injuries and occupational illness.
- Working safely is a condition of employment.
- All accidents can be prevented.
- All employees must be involved and supportive of the safety program.
- Training is an essential element for safe workplaces.
- Management must personally audit safety performance in the workplace.

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Health, Safety and Environmental Policy

Vale Inco Newfoundland & Labrador Limited (Vale Inco NL) is committed to carrying out its business activities in a sustainable manner. This Policy sets forth Vale Inco NL's commitment to protecting the health, safety and environment of our employees and contractors, the communities in which we operate and to the customers of our products. It also sets forth our commitment to social responsibility. The Policy applies to all Vale Inco NL activities from exploration, mining, processing, refining, marketing through decommissioning and post-closure.

To implement this Policy, Vale Inco NL will:

- Integrate sustainable development considerations into our business decision-making processes.
- Implement and maintain ethical business practices and sound systems of company governance.
- Uphold fundamental human rights and respect cultures, customs and values in dealings with employees and others who are affected by our activities.
- Actively participate in the social, economic and institutional development of the communities in which we operate.
- Provide development opportunities for employees and encourage their participation in the continual improvement of our health, safety, environment and social performance.
- Comply with regulatory requirements and company health, safety, environment and social responsibility management systems, standards, codes of practice and guidelines.
- Work together with stakeholders to:
  - improve our knowledge of the social and environmental impacts of our business activities
  - share and adopt improved technologies and best practices to prevent and minimize undesirable impacts through the life cycle of our products
  - assess risks and implement risk management strategies based on social concerns, valid data and sound science.
- Through our product stewardship commitment, facilitate and encourage responsible design, use, re-use, recycling and disposal of our products and by-products.
- Contribute to the enhancement of the environment through activities such as the protection and improvement of biodiversity and responsible land use planning.
- Engage our stakeholders through open and transparent communication and verifiable reporting.

Bob Cooper

Bob Cooper, *President*
Vale Inco Newfoundland & Labrador Limited

March 2008

Growing Together.

Figure 2.1 Vale Inco NL Health, Safety and Environment Policy

- Safe work practices should be reinforced, and all unsafe acts and unsafe conditions must be corrected promptly.
- It is essential to investigate injuries and occupational illnesses, as well as incidents with the potential for injury.

The Project has been planned to integrate environmental considerations ("designed-in" mitigation) in all aspects of the decision-making processes from pre-feasibility studies through design, construction, operation, decommissioning and closure. Key environmental principles that are considered in each phase of the Project include:

- Keeping Project boundaries as small as possible and controlling watershed use;
- Reducing the size and extent of physical disturbance;
- Increasing the amount of recycling of resources such as water;
- Reducing the number of release points (such as water discharges);
- Identifying environmentally sensitive areas and avoiding disturbance of these areas; and
- Planning all aspects of the Project for eventual closure.

The Vale Inco NL Emergency Response Plan will include a volunteer emergency response team of workers. The Company will deliver a range of safety training programs to workers, including hazardous materials handling, fall protection, first aid and advanced first aid, self-contained breathing apparatus training, safe operations of worker lifts, and aerial platforms and fire-fighting training.

Environment, Health and Safety staff will work closely with the training department to facilitate safety training programs on site, with the assistance of outside agencies as required. An Occupational Health and Safety Committee, which will include employee and management representatives, will be in place at the Plant and will work for continual improvement in the workplace.

For its success, Vale Inco NL depends primarily on the combined capabilities of its employees, technology, resources and customers. The Company believes that employees, suppliers, customers, the public and shareholders all have a common interest in this success, and that employee and company interests can and must be aligned. To that end, Human Resources management activities are guided by seven principles:

- Fostering open and honest communications;
- Conducting business with integrity;
- Providing supportive management;
- Emphasizing quality in all aspects of work, and focusing on customer service, internally and externally;
- Promoting a climate of continuous improvement;
- Endorsing the concept of the learning organization and supporting staff in it;

- Supporting diversity in the workplace; and
- Respect for the individual.

Vale Inco NL insists on a work environment that offers opportunity and strives always to be fair, inclusive and respectful. Corporate guiding principles define the Company's responsibility to attract, retain and develop employees at all levels. Vale Inco NL promises to:

- Provide pay and benefits that are competitive in the employment markets from which employees are drawn and that will reward successful performance and be internally equitable;
- Provide opportunities for individual growth and career satisfaction, and assist employees to realize their full potential by providing appropriate training, development, educational and promotional opportunities;
- Observe all laws respecting non-discrimination or harassment on the grounds of race, ancestry, national origin, colour, ethnic origin, citizenship, creed, gender, sexual orientation, disability, marital status, family status or age; and
- Provide suitable work facilities and conditions with the objective of safeguarding the health, safety and general well-being of employees.

Vale Inco NL values gender diversity, in the belief that gender mix contributes to a healthy and productive workplace. The Company is working with governments, educational institutions, women's organizations and industry associations to advance gender diversity in the workplace, and to see that more women take advantage of employment opportunities in the Canadian mining industry.

Vale Inco NL has surpassed gender diversity targets for the Operations Phase at the Demonstration Plant in Argentia, where 38 per cent of the employees are women, the vast majority of whom are employed in non-traditional occupations including engineering, process operations and laboratory analysis. The Company will develop and apply a Women's Employment Plan for the Project.

Vale Inco NL is committed to encouraging and maintaining a work environment that provides employees with the opportunity to achieve their personal career goals, as well as the training and support they need to meet our business objectives.

Protection of health, safety and the environment is paramount for the Project. The Company will ensure that health, safety and environment training is provided to all workers. Training and orientation of visitors, new recruits and temporary student employees will be provided. All contractors will be required to employ qualified workers who have received health, safety and environment training prior to starting work. Workers will also be required to undertake regular training exercises in emergency response procedures.

Succession planning ensures that personnel of sufficient numbers and quality are available to fill business needs when required, and to maintain alignment between business goals and human capital needs. Effective succession and career planning also allows the organization to keep pace with changes in business, industry, and the overall marketplace.

Vale Inco NL is implementing a succession planning process that has four goals:

- To address the needs of the organization as the workforce ages and employees leave;
- To assist with preparing the organization for unexpected events;
- To ensure that Vale Inco NL has the right personnel to function at peak efficiency; and
- To enable residents of Newfoundland and Labrador to advance in the workplace.

2.1. Community

Vale Inco NL believes that collaboration, consultation and cooperation with community groups and all levels of government is essential to achieving mutual goals. Working together will help to stimulate the development of sustainable communities that will thrive well beyond the life of the Project.

Vale Inco NL is committed to providing local business opportunities, recognizing that there are benefits associated with developing a strong base of local suppliers. The Company also plans to continue its strategic investment in communities in Newfoundland and Labrador through financial contributions to, and sponsorship of, local programs. Between 40 and 50 per cent of the workforce used to construct the Demonstration Plant in Argentia came directly from the surrounding area, and almost all were recruited from Newfoundland and Labrador. Most Project workers are expected to commute from the nearby communities that form the “neighbourhood” for the Project.

Vale Inco NL will continue to work with citizens and municipal leaders to address concerns about industrial benefits, training requirements, environmental effects and other issues that may arise. In developing plans for the Project, the Company has consulted extensively with communities, interest groups, government agencies and various experts. As a result, a comprehensive listing of issues and concerns has been identified so that each can be properly addressed. Input from the public also served to support the identification of Valued Ecosystem Components (VECs), which provide the focus upon which this EIS is based.

3.0 The Project

Vale Inco NL is proposing to construct, operate and eventually decommission the Project in a safe, healthy and environmentally sound manner, and in accordance with the terms of the *Voisey's Bay Development Agreement*, the full text of which is available at http://www.nr.gov.nl.ca/voiseys/legal.htm. The Agreement requires that Vale Inco NL establish a commercial nickel processing plant using hydrometallurgical technology (the Hydromet Plant), provided that this technology can be shown to be technically and economically feasible, to process concentrate into a finished nickel product. In the event the hydrometallurgical technology is not technically or economically feasible, then another technology (Matte Plant) would be selected. In either case, the commitment to produce a finished nickel product in the province will be met.

Vale Inco Ltd. is conducting a comprehensive research and development program at a Demonstration Plant located at Argentia to establish the feasibility of hydrometallurgical processing. The Demonstration Plant has been operating for more than two years. Vale Inco has gained considerable knowledge about the optimization of the process (including effluent treatment) and the composition and behaviour of air emissions, effluent and residue produced by the Hydromet process. Vale Inco has successfully implemented an environmental management system at the Demonstration Plant.

The Matte Plant would use proven technology and would receive nickel matte from an out-of-province smelter as the feed material for production of a finished nickel product. The *Agreement* stipulates that the technology must be selected (Processing Decision) by November 15, 2008.

Should the technical and economic feasibility of the hydrometallurgical technology be established, Vale Inco NL will construct the Hydromet Plant at Long Harbour. It will have a design capacity of 50,000 tonnes per year (t/yr) of finished nickel product, together with associated cobalt and copper products. Should the Hydromet Plant not prove to be technically or economically feasible, Vale Inco NL would construct a Matte Plant.

At the time the Project was registered for Environmental Assessment, Vale Inco NL believed that the typical facility life of the Project was 20 years; following registration, however, it was determined that Project life should be linked directly to the known reserves at Voisey's Bay. In the event that the Project life is extended (e.g., if additional nickel reserves are defined at Voisey's Bay or other feed sources are secured), the environmental effects of the Project life extension will be addressed under regulatory regimes that will be in place at that time.

This EIS addresses and seeks approval for the commercial nickel processing plant, including the Hydromet Plant and the Matte Plant technologies. The Project will be located in a partially brown-field site on the south side of Long Harbour. The Project footprint will include a pipeline to supply process water from Rattling Brook Big Pond and an effluent discharge pipe and diffuser into Long Harbour. The Hydromet Plant will require a permanent storage area for potentially acid-generating residue; the

Matte Plant would require an above-ground residue storage area for gypsum residue. **Error! Reference source not found.** shows the general layout of the Project.

3.1. The Setting

The Port Site (Tier 1) and surrounding land was used as an industrial site from 1969 to 1989 by Albright and Wilson Americas (AWA) and decommissioned in the mid-1990s after undergoing an environmental impact assessment. The site is now owned in part by Rhodia Canada, Inc., and in part by the Long Harbour Development Corporation (LHDC). Selected portions of the site (e.g., the hazardous waste disposal area) are not accessible; however, many features will be useful, including the high voltage electrical substation, the dock and adjacent land areas.

Other projects and activities in the Placentia Bay region include the North Atlantic oil refinery, the Newfoundland Transshipment Terminal, the Marine Atlantic Ferry Terminal, the Port of Argentia, the Marystown Shipyard, the Cow Head Fabrication Facility, commercial fisheries (including aquaculture operations) and associated seafood processing plants. These, in combination with planned undertakings currently undergoing environmental assessment, have been incorporated into this EIS to consider cumulative effects.

A variety of tourism, cultural and commercial activities take place in the Long Harbour area. Key cultural and tourism facilities include Castle Hill National Historic Park, the O'Reilly House Museum, and active archaeological digs in Placentia. Other major sites and features of importance are the Cape St. Mary's Bird Sanctuary, about 70 km south, and nearby Ship Harbour, the site of the 1941 signing of the Atlantic Charter. Central government services, an international airport, international hotels, major cultural facilities, and shopping services are available in St. John's, about 100 km from the site.

3.2. Alternatives

The EIS is required to describe alternative methods of carrying out the Project, and the alternatives to the Project. Vale Inco NL has identified one alternative to the Project and several within-Project alternatives, including processing technologies, site locations and residue disposal options.

The sole alternative to proceeding with the Project (the "no Project" alternative) would mean that Vale Inco NL would not construct a nickel-processing facility in the province. Vale Inco NL does not consider the "no Project" alternative to be viable.

Several within-Project alternatives have been considered, including processing technologies such as pyrometallurgy and bio-leaching. Alternative sites have been examined, and residue storage alternatives have been considered in order to identify feasible, secure, and environmentally suitable sites. Each of these within-Project alternatives is presented and discussed in the EIS. Alternative routing for the effluent line, methods for marine sediment dredging, and the possibility of a floating accommodation facility have also been examined. Note that, for the purposes of this EIS, the Hydromet Plant and the

Matte Plant are not considered as separate alternatives; rather, both fall within the Project and are encompassed within the EIS.

The Hydromet process for nickel concentrate produces a potentially acid-generating residue that requires neutralization and permanent, secure underwater storage. The Matte process produces a gypsum product that can be stored above ground. Each type of residue requires environmentally acceptable long-term storage. The selection of a preferred option for residue storage from the two processing technologies involved extensive examination of the chemical and physical characteristics of the residues themselves. Candidate sites were selected and evaluated based on environmental, technical, socio-economic and financial criteria.

The Matte residue storage options, including the decisions to store the residue above ground, the use of 'wet' stacking, and the selection of a suitable site, are described in detail in the EIS. The selected site is about 1.3 km southwest of Tier 2 (Figure 3.1)

The Hydromet Plant will generate 381,000 tonnes per year (t/yr) of residue, much of which has the potential to be acid-generating; hence the need to reduce or eliminate its combination with oxygen by secure placement under water. A comprehensive search of every candidate location in the Project area was carried out to find a suitable nearby site, and natural water bodies as well as above-ground fabricated sites were considered. Twelve candidate sites were identified, assessed and compared for their ability to meet relevant criteria. Following detailed examination and comparison, one site was clearly preferred. Sandy Pond is 3.2 km from the processing plant and isolated at the top of a watershed, thus requiring no water diversion. Three earth-fill dams will be required to provide containment for the residue over the life of the Project.

The major issue related to use of Sandy Pond is the protection of fish and fish habitat under the *Fisheries Act* of Canada. The Department of Fisheries and Oceans (DFO) operates on the "No Net Loss" principle: any loss of productive fish habitat has to be offset in an acceptable manner so that there is no net loss in capacity. Fish habitat can be altered or destroyed only if authorized by the Minister of Fisheries or otherwise approved under the *Fisheries Act*. Such approval would be granted only if an acceptable Fish Habitat Compensation Plan is in place and a binding agreement reached on its implementation. Environment Canada and DFO have determined that the use of Sandy Pond as a residue storage site will require amendments to the *Metal Mining Effluent Regulations* (MMER) under the *Fisheries Act*.

The loss of fish habitat as a result of the use of Sandy Pond for storage of the residues will be balanced by habitat gains elsewhere. Vale Inco NL will quantify the extent of harmful alteration, disruption or destruction (HADD) of fish habitat and will work with DFO to develop an appropriate Fish Habitat Compensation Plan.

3.3. Project Description

The processing operation will be located at two adjacent sites, connected by road and pipelines. The Port Site (Tier 1, Figure 3.2) at the existing brown-field site will comprise:

- Wharf and laydown area for staging and storing of equipment and containers;
- Storage facilities for raw materials, reagents, wastes and finished products;
- Lime kiln to convert limestone into lime to be used for effluent neutralization;
- Concentrate and limestone grinding process building (Hydromet only);
- Conveyor systems;
- Storm-water capture system, a sewage treatment system and general port buildings;
- Sulphuric acid storage tank(s) and fuel tanks;
- Treated effluent discharge line into a diffuser in Long Harbour;
- Port administration office, lunch room and change house; and
- An existing electrical substation.

The Plant Site (Tier 2; Figure 3.3 for Hydromet, Figure 3.4 for Matte) will be located on a nearby plateau and will house the processing plant, which comprises:

- Processing complex where the feed (concentrate or matte) is pressure leached in acidic solution to separate iron and sulphur from nickel, copper and cobalt;
- Solvent extraction building to extract the nickel, copper and cobalt for refining;
- Complex for the refining of nickel, copper and cobalt;
- Oxygen plant;
- Boiler plant to provide steam for heating;
- Cooling tower to cool and recycle cooling and some process water;
- Fuel storage tanks;
- Electrical substation;
- Administration/change house, warehouse, workshops, and utility buildings;
- Analytical laboratory; and
- Control room.

Nine auxiliary components of the facility extend beyond the primary sites:

- Water supply and pipeline from Rattling Brook Big Pond;
- Residue storage area (underwater at Sandy Pond for Hydromet; above-ground storage for Matte);
- Pipelines to and from the residue storage area;
- Access road network;
- Electric power distribution lines between the substation and the sites;
- Pipeline utilidor and pipe racks between Tier 1 and Tier 2;

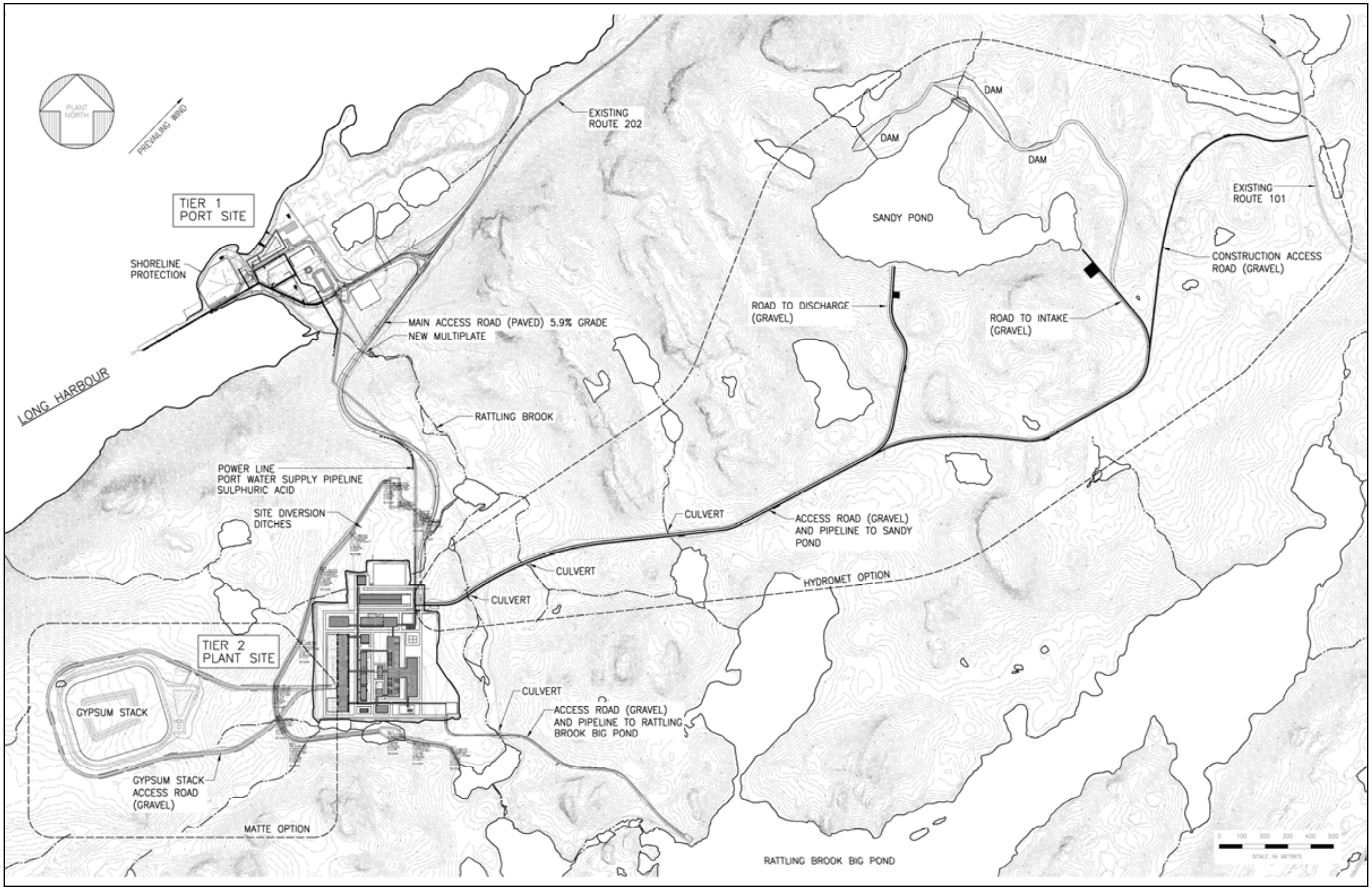

Figure 3.1 General Site Plan

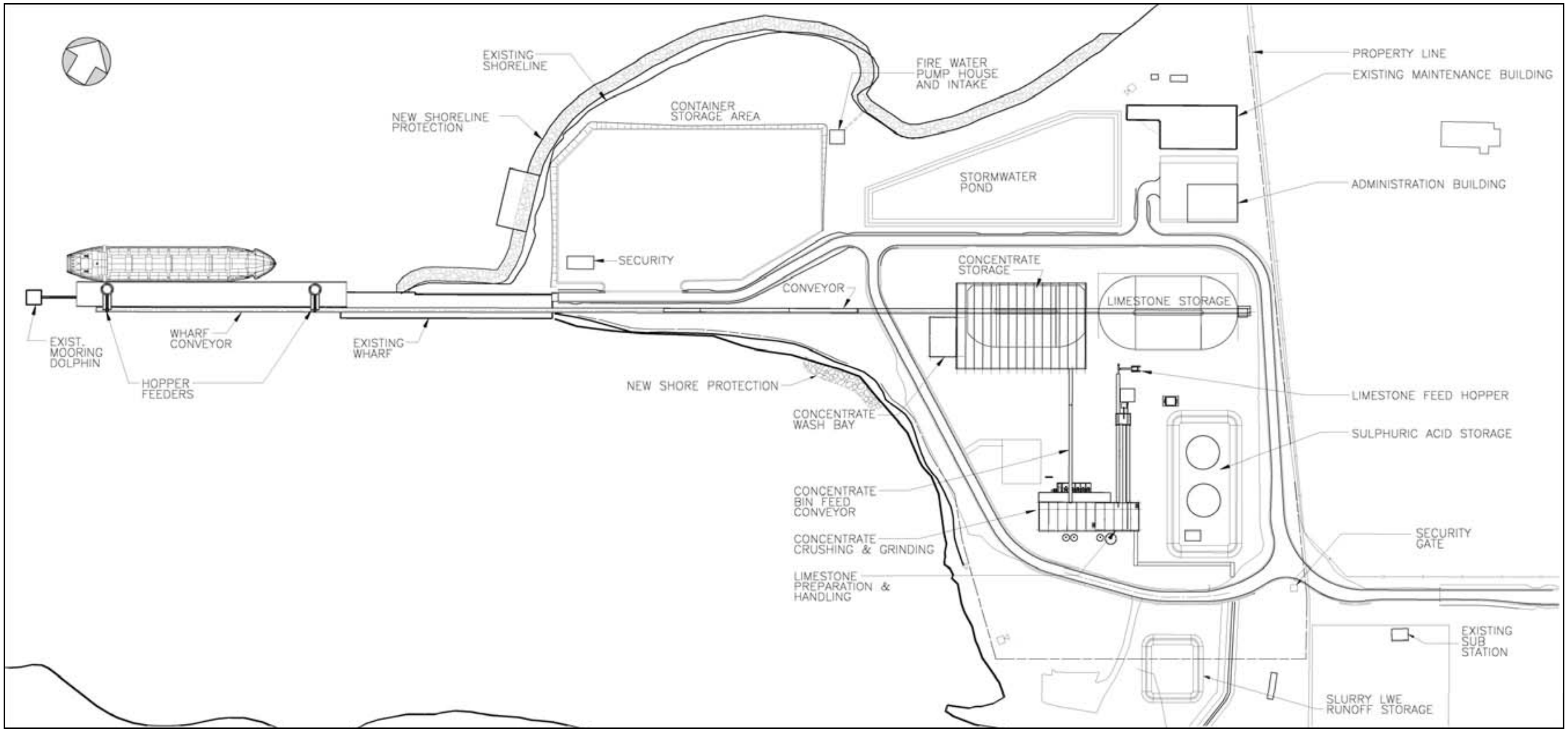

Figure 3.2 Port Site – Hydromet

- Other site infrastructure – parking, water tank and pump houses, water distribution system, effluent treatment plant, sewage treatment plant, surface water drainage system, security;
- Constructed storm-water pond and effluent discharge polishing/cooling ponds; and
- Standby diesel generators.

Tiers 1 and 2 will occupy a total area of about 65 ha. For the Hydromet Plant, a further 85 ha will comprise the residue pond and pipeline. Above-ground residue storage (Matte Plant) would occupy an additional 40 ha.

Process water will be obtained directly from Rattling Brook Big Pond, 2 km southeast of the site. A pumphouse and pipeline will be constructed to pump the water to Plant, which will be at approximately the same elevation as the pond. A low dam will be constructed on Rattling Brook Big Pond to provide the flows required for fish habitat maintenance in Rattling Brook.

Treated effluent will be discharged through a 6-km pipeline to a diffused outfall at a depth of 50 to 70 m near the mouth of Long Harbour. Runoff from the two sites will be collected in fabricated storm-water ponds.

For the Hydromet Plant, 3.8 km of pipeline will be constructed to convey neutralized slurry residue to Sandy Pond and return clarified water to the processing facility. Three dams will be constructed to ensure the pond has sufficient capacity to contain all settled residue, and decant water will be pumped back to the Plant Site on Tier 2 and treated as required.

In the case of the Matte Plant, waste gypsum slurry would be transported by a pipeline to a storage site about 1.3 km west of the Plant Site. The storage site would be surrounded by a 4-m high containment berm, and excess water would be collected and returned to the Plant for treatment and discharge.

The wharf will be repaired and upgraded to accommodate vessels up to approximately 30,000 DWT. The road to the Port Site will be upgraded and extended, and new local access and driveways will be constructed as necessary. A 3-km road will connect Tier 1 to Tier 2.

Most of the existing buildings at Tier 1 will be demolished and replaced as required. Materials will be reused in the construction of the proposed facility to the extent possible; any unusable material will be removed and disposed of by licensed third-party contractors.

Electrical power will be connected from the existing substation. Electricity (about 94 MW for the Hydromet Plant and about 74 MW for the Matte Plant) will be supplied from the provincial grid.

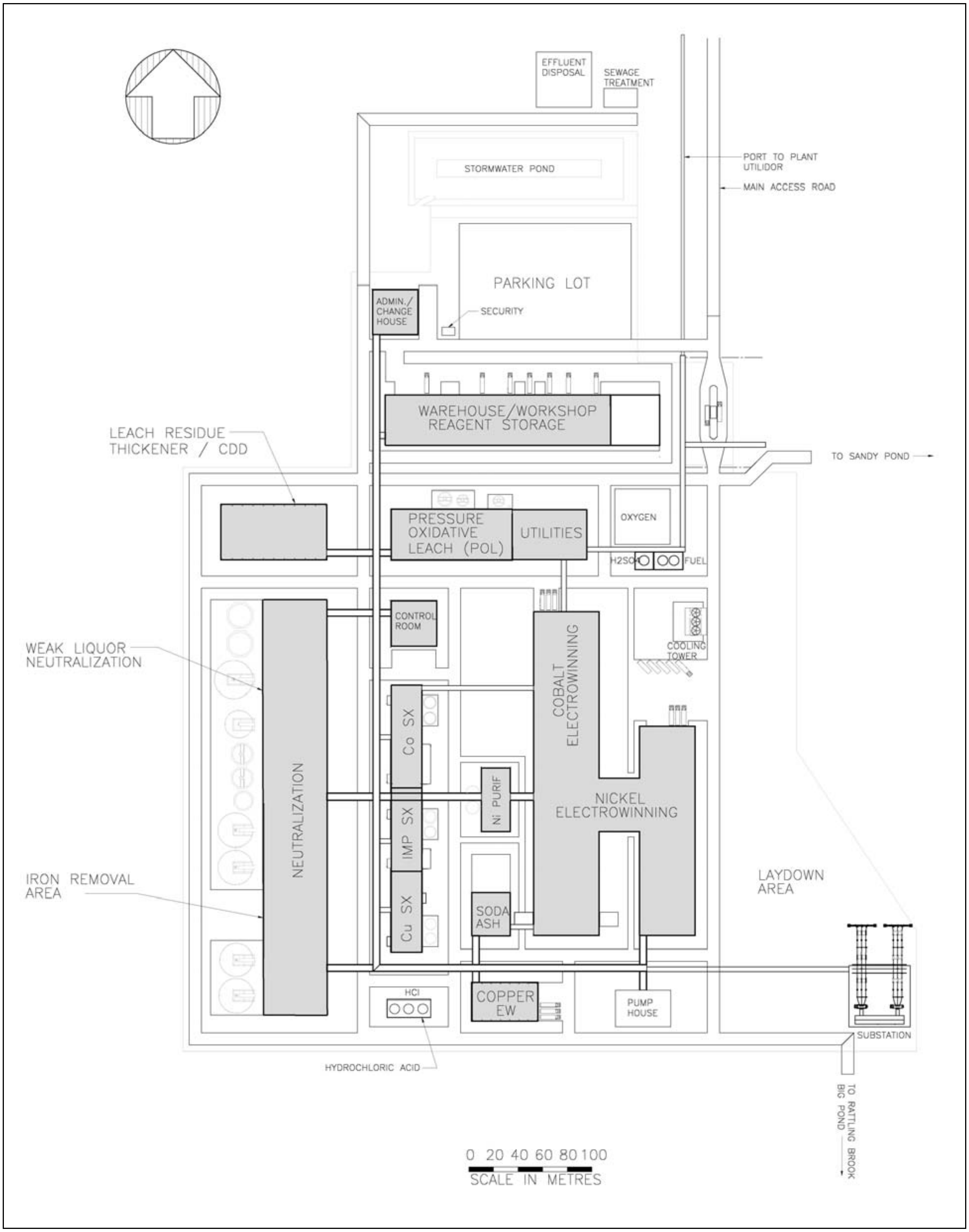

Figure 3.3 Tier 2 Site Plan – Hydromet Plant

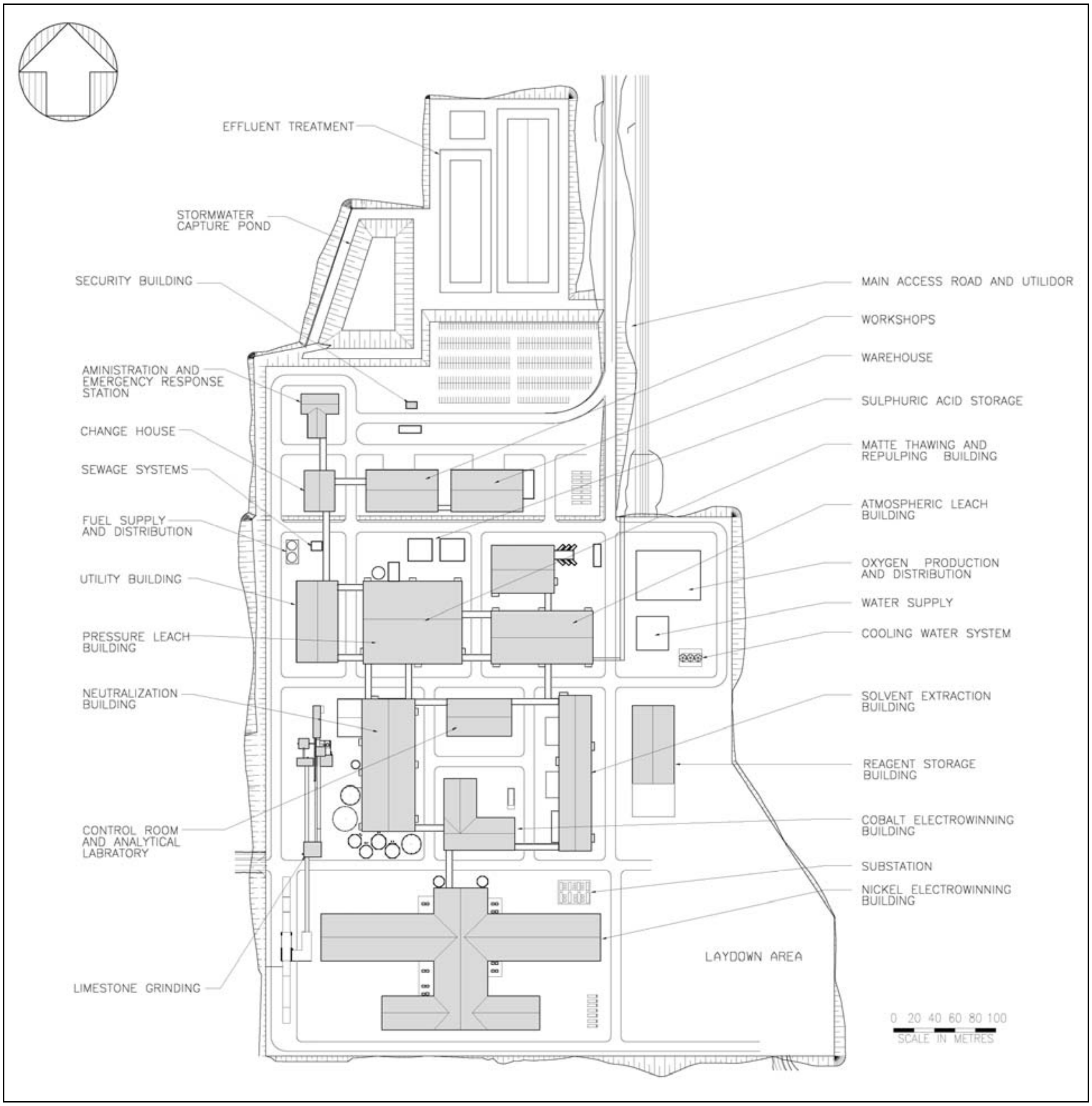

Figure 3.4 Tier 2 Site Plan – Matte Plant

4.0 Application of Environmental Best Practices

The Project has been planned to apply environmental principles reflective of a designed-in mitigation approach to environmental management. Listed below by Project Phase are examples of specific mitigation measures which demonstrate the application of these principles.

Site Selection

- Long Harbour was selected to minimize the environmental footprint, i.e., short pipelines, access roads and electric transmission lines.
- Residues are combined from the Hydromet Plant to minimize the environmental footprint.
- Residue storage locations for the Hydromet Plant and Matte Plant were selected to reduce environmental impact.

Design

- Underwater storage of combined residues was selected for the Hydromet Plant to avoid sulphur acidification of residue.
- Recirculation and recycling of process and effluent streams will be undertaken to the greatest extent possible, to recover valuable metals and to reduce the demand for reagents and water.
- Air pollution control systems include:
  - Baghouses for hygienic dust control – used predominantly at concentrate and limestone transfer and handling locations;
  - Scrubbers for venting gas streams and copper electrowinning cells – used to reduce aerosol mists and particulate carryover entering the environment;
  - Adequate building ventilation to ensure acceptable in-plant air quality; and
  - Water-spray dust suppression, as required, for roads and for the Matte Plant residue storage site.
- Instrumentation and monitoring equipment will be provided for measuring air quality and effluent characteristics.
- Access road and facilities drainage will be designed to direct runoff away from the Site.

Construction

- Construction practices will minimize stockpiling of materials to reduce fugitive dust emissions.
- Buffer zones will be established and flagged prior to any disturbance activities.
- Natural vegetation will be left in place wherever possible.
- A dedicated survey will be completed to identify trees that host the boreal felt lichen. Wherever possible, trees will be left in place; alternatively, specimens will be relocated and monitored.

- Temporary diesel generators and other equipment required during construction will be muffled to control noise.
- Fuel storage and distribution areas will be centralized and graded to direct storm-water runoff to an oil-water separator before being sent to a storm-water management pond.
- Drainage from areas of exposed fill will be controlled by grade or ditching and directed away from natural watercourses wherever possible. Surface water will be directed away from work areas by ditching. Runoff from these areas will have silt removed by settling, filtration, or other suitable methods. The requirement for ditch blocks/check dams or sediment traps to intercept runoff will be established during design and confirmed during construction, and appropriate action taken.
- Preventative measures such as silt curtains will be in place to reduce suspended sediment entry and dispersion in water bodies.
- Regular monitoring of construction activities will be undertaken for leaks and spills.
- Stream crossings will be protected according to terms and conditions of provincial permits as well as guidelines issued by DFO. Construction of stream crossings will follow accepted engineering and construction practices, and culverts will be sized to handle a 25-year return period flood and installed in accordance with known best practices so that there is minimal disruption to substrate or flow characteristics.
- Dams will be designed and constructed to prevent their failure.

Production Operations

- Adequately sized impermeable secondary containment will be provided for all outdoor storage of petroleum products, reagents and chemicals.
- Process equipment will be located indoors (other than surge tanks, storage tanks, heat exchangers and thickeners) with provision for adequate containment (berms or concrete curbs) and sumps.
- Exhausts from operating equipment will be routed through air pollution control devices prior to release.
- Conveyors will be covered and transfer points vented through air cleaning prior to release.
- Dust collection systems will be in place at all material transfer points; material will be moved between locations in covered conveyors.
- Air emissions will be monitored for compliance with regulations.
- Environmental control equipment will be monitored for comparison to design performance.
- Precautions will be in place to monitor and prevent the release of chlorine gas associated with the Hydromet process. Alarm systems and emergency safety procedures will be established to properly manage any accidental event involving chlorine.
- Liquid effluents will be monitored for regulatory compliance.
- Effluent treatment systems will include:
    - Sewage treatment plant;
    - Spill containment and treatment to ensure site runoff is not contaminated;
    - Storm-water management pond (solids settling);

- Polishing pond (solids settling, pH adjustment and effluent cooling);
- Sand filters and pH adjustment (as required for treatment of polishing pond, Sandy Pond and/or storm-water management pond);
- Instrumentation and monitoring equipment for measuring applicable (regulated) effluent parameters; and
- Storm-water (within the boundaries of Tiers 1 and 2) collection and treatment as necessary before discharge.

- All effluent will be treated, tested, monitored, and then discharged through a common pipe and diffuser located to maximize dispersion by mixing.
- There will be no discharge to freshwater bodies other than parking lot drainage that has gone through an oil/debris separator.
- Solid-waste sludge from the sewage treatment plant will be collected by a certified sludge disposal company for disposal at an off-site, properly licensed commercial facility.
- Contingency plans will be in place to ensure an adequate level of emergency preparedness.

Decommissioning

A Rehabilitation and Closure Plan will be developed to accomplish three objectives:

- Restore affected landscapes to a stable and safe condition that will protect public health and safety;
- Re-establish conditions that will allow productive use of the land and natural resources of the area, similar to their original use; and
- Reduce the need for long-term monitoring and maintenance by establishing, as quickly as practical, effective physical and chemical stability of disturbed areas.

5.0 Project Phases

The Project has four phases: Planning, Construction, Operation and Decommissioning. The construction schedule is shown in Figure 5.1.

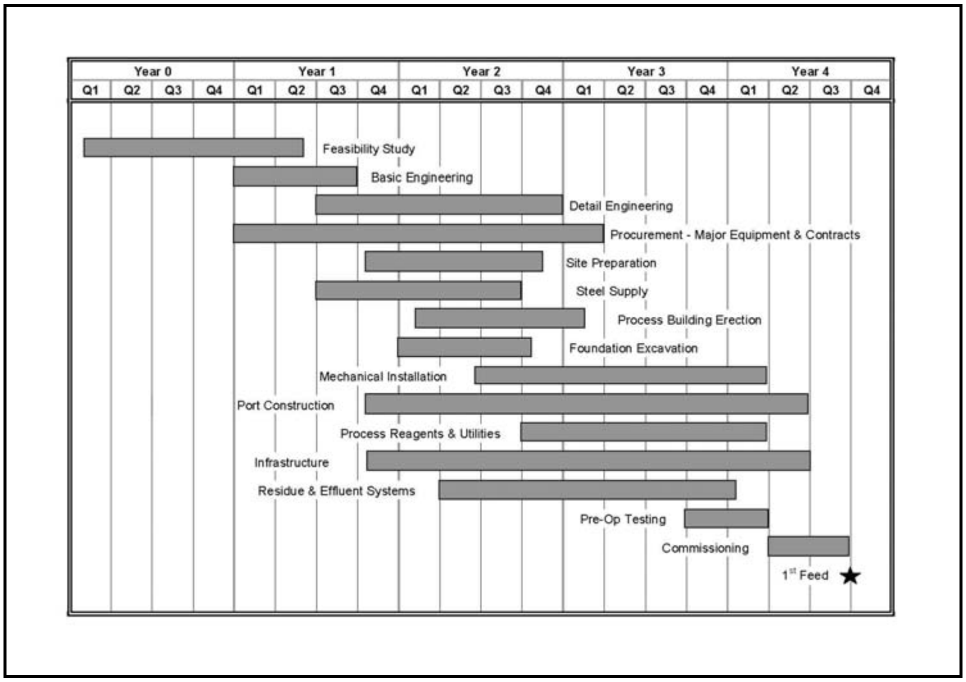

Figure 5.1 Summary Construction Schedule

Planning, including environmental assessment, is now under way. Construction will begin following Project release in 2008 and be completed in 2011. Operations, scheduled to continue for 15 years, will commence by fall 2011, and Decommissioning and Closure will take two to five years.

Operations are scheduled to continue for 15 years to match the existing known reserves of the Voisey's Bay mine, and in conformance with the *Agreement*. The duration of operations beyond 15 years will depend on either defining additional reserves at Voisey's Bay or securing additional feed from other sources. An extended operating life could be achieved, although such a possibility is not within the scope of this environmental assessment. Any such plans, if and when developed, would be subject to all applicable approval processes in place at that time.

5.1. Construction

Construction and site development will include nine components:

- Preparing Construction accommodations;

- Enlarging the existing wharf, dredging the berthing area, and demolishing non-essential buildings and infrastructure at Tier 1;
- Pre-stripping, clearing, excavation, site grading and levelling;
- Building access roads;
- Preparing drainage works;
- Constructing Plant buildings and other facilities;
- Constructing roads, storm-water, water and sewage systems, and residue and raw material pipelines;
- Constructing dams for water supply and for underwater residue storage; and
- Installing a marine outfall.

Construction accommodations will house workers who do not commute from nearby communities and will provide an attractive high-quality facility located near (but not at) the site.

At the Port Site, dredging will provide adequate water depth for the concentrate carrier and other vessels. The wharf will be widened and expanded to accommodate conveyor systems (Figure 5.2).

Much of the Site preparation and infrastructure establishment will involve conventional heavy civil construction activities, all of which will be carried out in accordance with a Construction Environmental Protection Plan.

The Construction Phase will create approximately 3,000 person-years of employment. See Table 5.1 for a summary of the estimated total labour demand by year, starting in 2008. Vale Inco NL will work closely with contractors and trade unions to identify a qualified skilled workforce from within the province.

5.2. Production Operations

Hydrometallurgical process technology for the recovery of pure base metals has been used commercially for many years to process zinc and copper concentrates and nickel mattes (nickel that has been processed through a smelter).

The Hydromet Plant will be designed to process approximately 260,000 t/yr of nickel concentrate to recover 50,000 t of nickel, 3,710 t of copper and 2,450 t of cobalt. For comparison, a Matte Plant would be designed to process approximately 91,000 t/yr of nickel-bearing matte; it would produce 50,000 t of nickel, about 24,700 t of copper sulphide and about 400 t of cobalt.

Operations staffing for the purposes of environmental impact assessment has been estimated at 450 personnel.

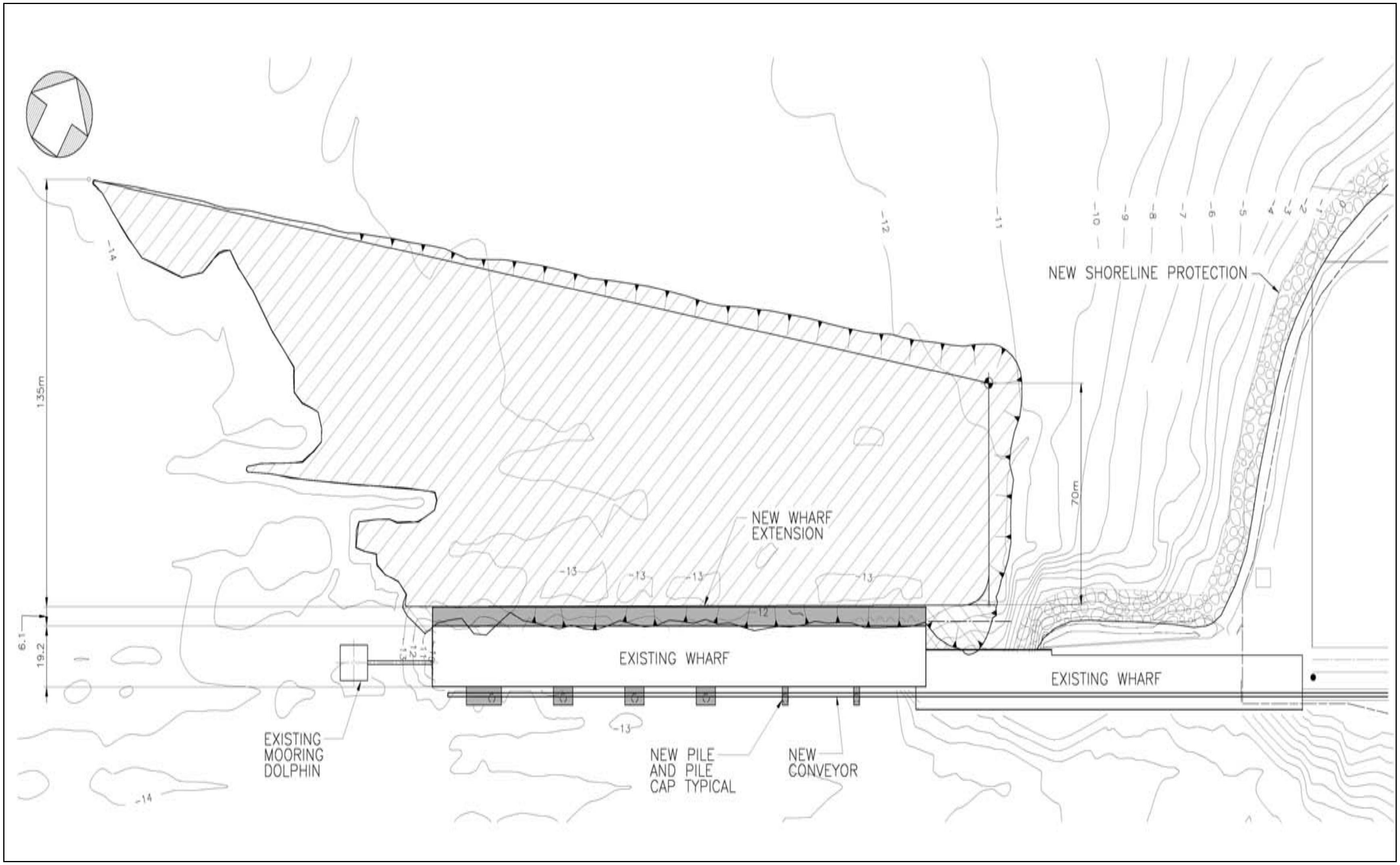

Figure 5.2 Marine Works

Table 5.1 Construction Labour Estimates

Trades	NOC Code	Person-Years			
		Yr 1	Yr 2	Yr 3	Yr 4
Direct Trades					
Bricklayers	7281	n/r	10	20	4
Iron workers	7264	80	140	120	50
Plumbers and pipefitters	7251	35	75	150	125
Electricians	7241	40	80	130	100
Labourers	7611	60	125	125	100
Carpenters	7271	60	125	80	50
Millwrights	7311	10	50	80	60
Operating engineers	7421	60	70	60	40
Boilermakers	7292	15	60	80	70
Insulators	7293	n/r	n/r	10	6
Painters	7294	n/r	5	5	5
Sheet metal workers	7261	n/r	50	50	20
Instrument technicians	2243	n/r	n/r	80	60
Total Direct Trades		**360**	**790**	**990**	**690**
Indirect Trades					
Bussing	7412	6	12	16	11
Janitorial/Outhouse	6663	5	14	14	14
Bulks	7611	3	10	13	10
Water supply/Delivery	7611	2	5	5	5
Waste management	7611	1	3	4	4
Perm. plant maintenance	7445	n/r	2	5	3
Medical	3152	1	2	2	2
Security		12	17	17	17
Total Indirect Trades		**30**	**65**	**76**	**66**
Total Direct and Indirect Trades		**390**	**855**	**1,066**	**756**
EPCM		**265**	**350**	**300**	**108**
Owners		**80**	**103**	**99**	**84**
Operations		**0**	**0**	**215**	**410**
Total		**735**	**1,308**	**1,680**	**1,358**

Notes:
Initial operations employment overlaps last two years of the Construction Phase.
There will be similar employment by occupational group for the Matte Plant within ± 5 per cent.
Subtotals and Totals rounded to full numbers.
EPMC= Engineering, Procurement and Construction Management

Because the feed for the Hydromet Plant (concentrate) is less refined than the feed for a Matte Plant, a higher input volume is required in order to produce the same volume of product. Similarly, the waste products from hydrometallurgical processing are greater than would be produced by a Matte Plant, simply because the latter process represents a smaller portion of the full processing cycle from mined ore to finished product.

The concentrate feed in the Hydromet Plant will contain a significant amount of iron, which is almost entirely removed when the concentrate is smelted for the production of matte. Thus, while the Hydromet Plant generates a residue containing a significant amount of iron oxides, the Matte Plant would contain very little.

.
The two plants also have some differences in processing techniques. The Hydromet Plant process uses a chloride-sulphate medium while the Matte Plant process would use an entirely sulphate medium to extract the desired metals. The finished products from the two process plants are, however, similar market-quality nickel, copper and cobalt.

Hydromet Process

The use of pressure oxidative leaching to separate metals within concentrate is at the core of the hydrometallurgical process. A series of purification steps lead to the generation of nickel, cobalt and copper streams, from which the metals are recovered by electro-winning. Iron and sulphur are removed as a residue during leaching. A gypsum residue is also generated during one of the impurity removal steps. The complete cycle applicable to the proposed Long Harbour facility is illustrated in Figure 5.3.

The estimated quantities of materials and energy needed to support operations at the Hydromet Plant are indicated in Table 5.2; the outputs are in Table 5.3.

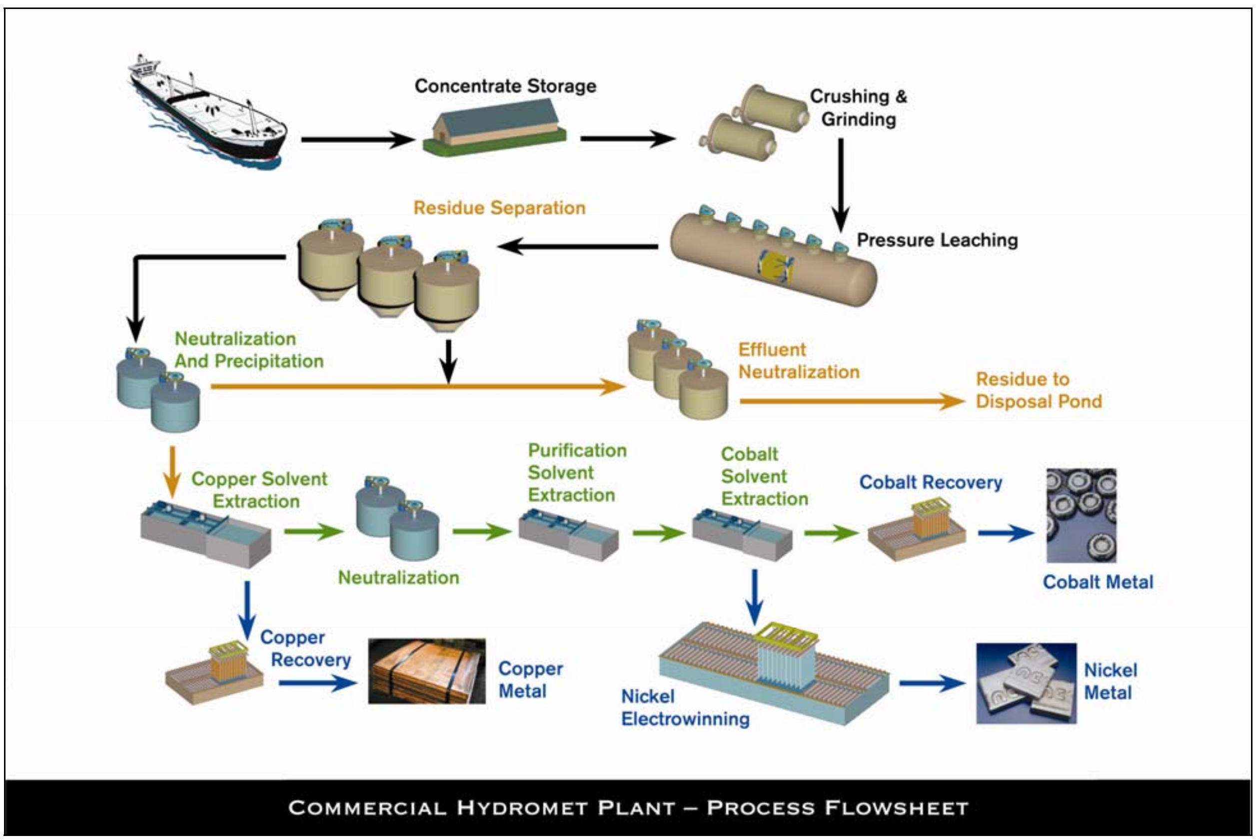

Figure 5.3 The Hydromet Process

Table 5.2 Estimated Hydromet Plant Material, Water and Energy Inputs

Input	Quantity Per Year (tonnes except as noted)	
Nickel concentrate (containing approximately 19% Nickel, 42% Iron, 2% Copper , <1% Cobalt)	269,000	
Oxygen	154,000	
Sulphuric acid (98 wt% H_2SO_4)	35,000	
Hydrochloric acid (36 wt% HCl)	8700	
Sodium carbonate (99 wt% Na_2CO_3)	11,400	
Coarse limestone (98 wt% $CaCO_3$)	121,000	
Boric acid (99 wt% H_3BO_4)	260	
Caustic soda (50 wt% NaOH)	539	
Sodium chloride	971	
Sodium hydrosulphide	1,100	
Sodium metabusulphite	906	
Sodium lignosuphonate	6,472	
Sodium laurel sulphate	5.1	
Flocculant	315	
Lewat TP 214	12.21	
LIX 84	34.8	
DEPHA	10.5	
Cyanex 272	3	
SX Diluent (Escaid 110; type of kerosene)	265,000	litres
Water	4,366,710	m^3
Electrical power	642,000	MWh (94 MW)
Diesel	472,500	litres
#2 Fuel oil	25,500	

Table 5.3 Estimated Quantities of Main Outputs from the Hydromet Plant

Output	Quantity per Year (tonnes except as noted)	
Nickel product	50,000	
Copper product	3,710	
Cobalt product	2,450	
Mixed residue	381,000	
Treated effluent to Long Harbour	7,220,000	m^3
Air Emissions		
Carbon dioxide	75,400	
Nickel	9,950	kg
Copper	1,790	kg
Cobalt	520	kg
Iron	4,690	kg
Limestone	15,070	kg
Calcium hydroxide	10,320	kg
Sodium carbonate	10,320	kg
Calcium oxide	2,780	kg
Total particulate	95,770	kg
Nitrogen oxides	93,700	kg
Sulphur dioxide	211,610	kg
Chlorine	40	kg
Hydrogen chloride	15,370	kg
Sulphuric acid	7,410	kg
Manganese	200	kg
Lead	70	kg
Escaid	0.3	kg

Matte Process

The Matte refining process involves treatment of finely ground nickel matte using a combination of atmospheric leaching, oxidative pressure leaching, and pressure leaching with copper solution to dissolve the nickel and copper, leaving behind a copper sulphide leach residue that will be treated at another facility. The processing steps lead to purified nickel and cobalt streams, from which the metals are recovered by electrolysis. Selenium and tellurium contained in the matte are recovered as a by-product residue. The iron originally in the matte is contained in the copper sulphide product and the sulphur is contained in the gypsum residue. The estimated quantities of the main materials and energy that would be needed for the Matte Plant are indicated in Table 5.4; outputs are given in Table 5.5.

Table 5.4 Estimated Matte Plant Material, Water and Energy Inputs

Input	Quantity per Year (tonnes except as noted)	
Nickel matte (approximately 54% nickel, 19% copper, 1% cobalt with the balance mainly iron and sulphur)	92,000	
Oxygen	53,000	
Sulphuric acid (98 wt% H_2SO_4)	58,100	
Hydrochloric acid (36 wt % HCl)	4,500	
Boric acid (99 wt% H3BO4)	194	
Soda ash (99 wt% Na_2CO_3)	9,900	
Caustic soda (50 wt% NaOH)	168	
Coarse limestone (98 wt% $CaCO_3$)	123,000	
Sulphur dioxide	1,100	
Flocculant	50	
DEPHA	9	
Cyanex 272	3	
Solvent extraction diluent	220,000	litres
Water	2,450,000	m^3
Electrical power	478,000	MWh (74 MW)
Diesel	472,500	litres
Fuel Oil #2 (steam generation)	30,500	

Table 5.5 Estimated Main Outputs from Matte Plant

Output	Quantity per Year (tonnes except as noted)	
Nickel	50,000	
Copper sulphide	24,700	dry basis
Cobalt rounds	400	
Gypsum residue	175, 000	dry basis
Selenium/tellurium residue	535	dry basis
Residue from impurity strip solution neutralization	127	dry basis
Treated liquid effluent	2,585,000	m^3
Air Emissions		
Carbon dioxide		
Nickel	10,790	kg
Copper	1,620	kg
Cobalt	390	kg
Iron	2,650	kg
Calcium hydroxide	16,520	kg
Sodium carbonate	16,520	kg
Calcium oxide	3,740	kg
Total Particulate	74,110	kg
Nitrogen oxides	56,930	kg
Sulphur dioxide	205,200	kg
Hydrochloric acid	5,230	kg
Sulphuric acid	1,240	kg
Manganese	100	kg
Lead	30	kg
Escaid	0.4	kg

Residue Storage and Management

The Hydromet process residues are combined as a neutralized slurry that will be pumped to Sandy Pond by pipeline. The residue will be deposited at designated locations as a 35 per cent solids slurry, using floating pipelines. Because of its low permeability, the initial deposit will be placed against the underwater face of the dams to provide a seepage seal for the containment area. When Operations cease, the residue will be stored permanently underwater to prevent acidification. Figure 5.4 shows the pattern of residue disposal for Years 1 and 5. Decant water from Sandy Pond will be pumped back to the Plant and into the Process Effluent Neutralization system, where it will be mixed with the other effluent and treated as necessary.

Sandy Pond dams have been designed to be able to expand its storage capacity. One of the design criteria is that “Dam alignment and design must take into consideration the possibility of future dam rising.” The storage capacity can be doubled by raising the dam height by about 8 m.

The Matte Plant gypsum residue would be stored at a 20-ha site about 2 km southeast of the processing facilities on Tier 2. The stack would include a storm-water surge pond, a perimeter containment dyk, and a double liner system at the base.

Water Management

Water supply for the Plant will be drawn from Rattling Brook Big Pond at an average rate of 0.17 m^3/s. The flow regime in Rattling Brook will be maintained at a level adequate to protect fish habitat. The Hydromet Plant will require about 4.4 million m^3 of water per year; the Matte Plant about 2.45 million m^3. No water diversions are planned, other than for capture of runoff around Tier 1 and Tier 2.

Process Effluents

All process effluent will be neutralized and treated in a constructed polishing pond, then monitored prior to discharge. A marine outfall will be constructed to discharge towards the mouth of Long Harbour through a diffuser array at a depth of 50 to 70 m (Figure 5.5). Effluent from the sewage treatment plant, decant water from the potable water sludge handling system, and discharge from the plant storm-water capture pond will also be directed to this discharge. In addition to treating the effluent from the cooling/ polishing ponds, the filters can also be used to treat water from the storm-water capture pond. Should liquids from the cooling/polishing pond not meet discharge criteria, they will be recycled to Sandy Pond.

Waste Management

All domestic solid waste will be collected, properly stored, removed, and disposed of in a government-approved site. A 3-R program of waste reduction, reuse and recycling will be implemented at all site facilities.

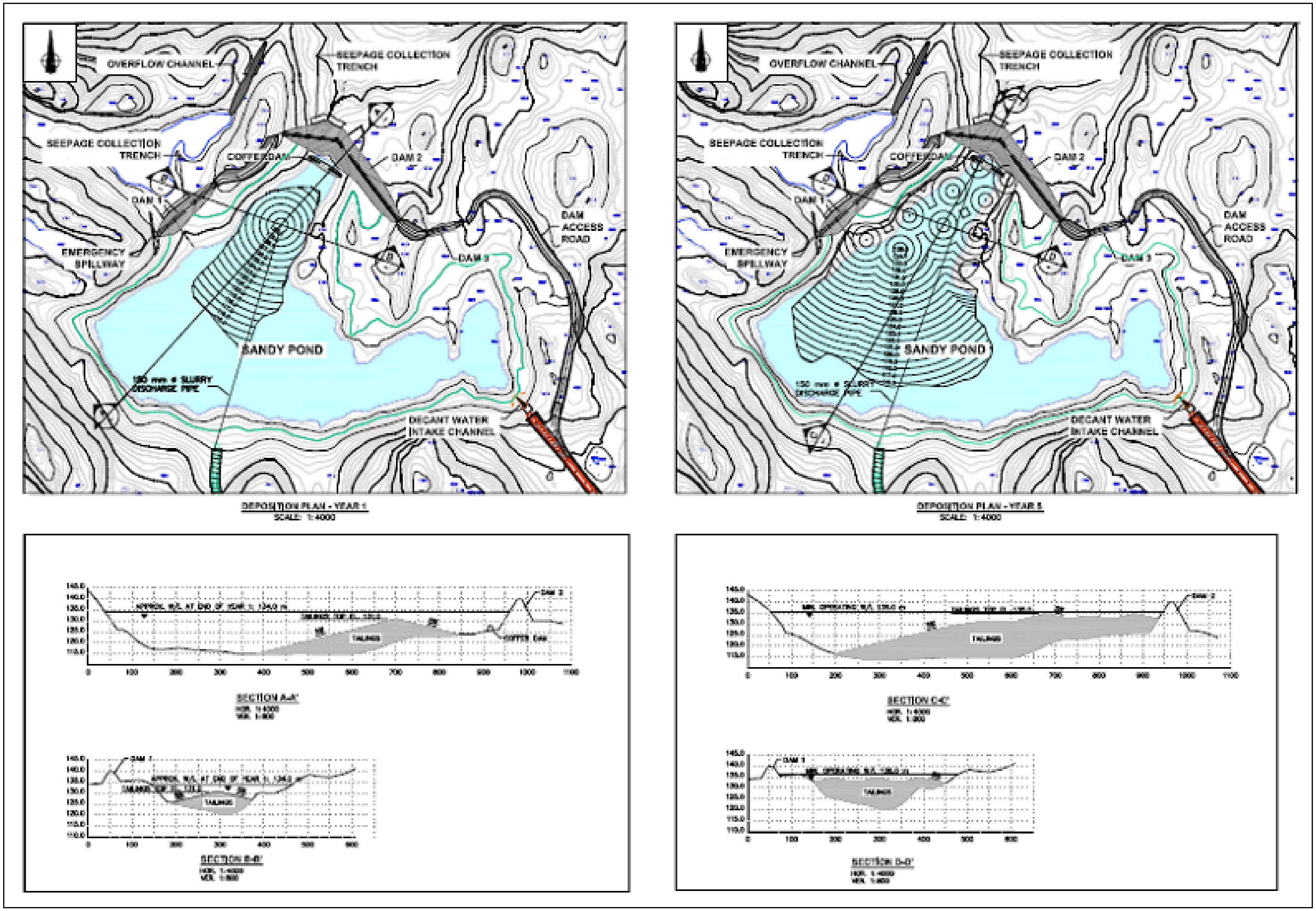

Figure 5.4 Residue Disposal Year 1, Year 5

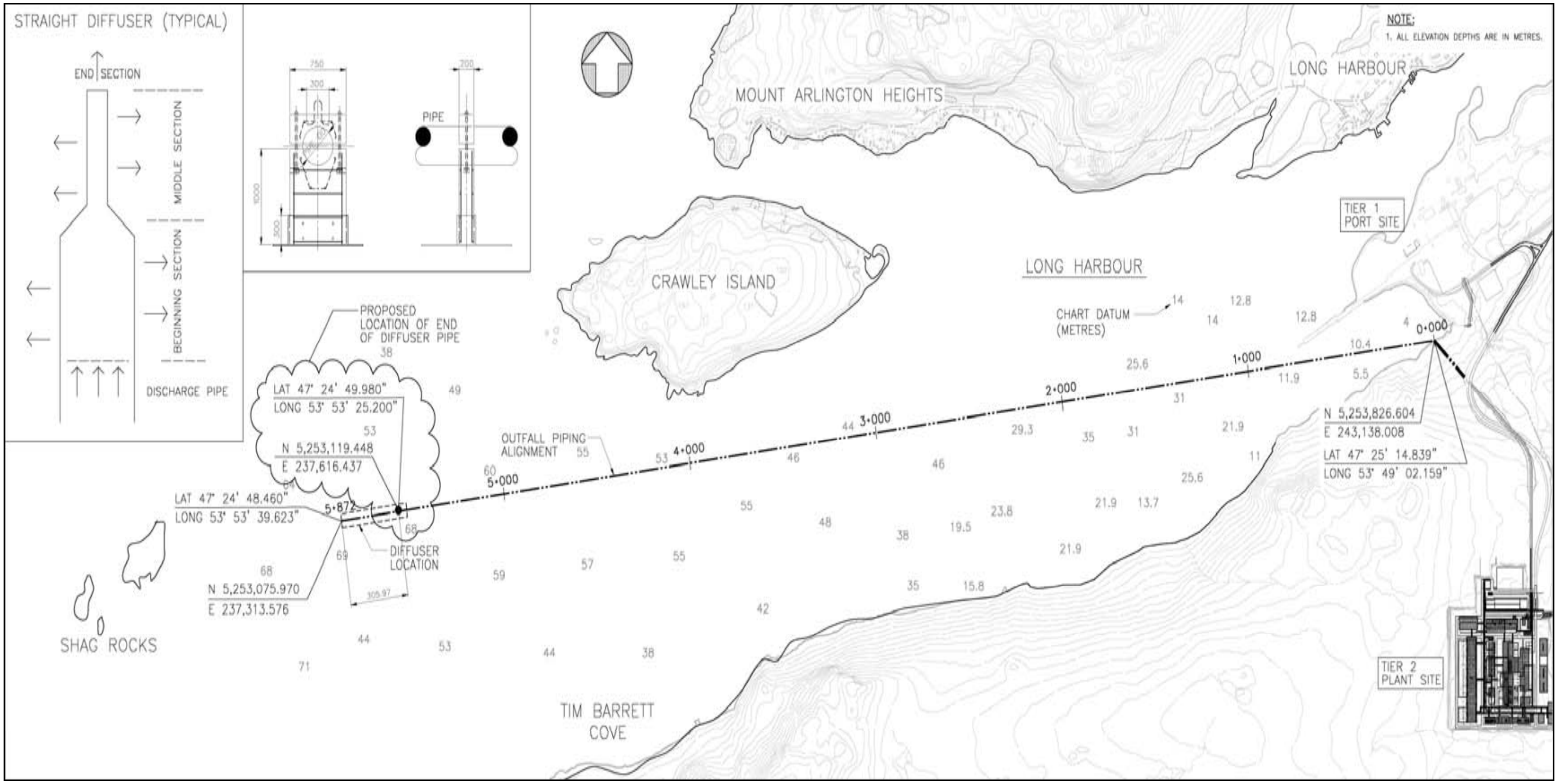

Figure 5.5 Outfall Pipe and Typical Details

All process waste solids (strip solution treatment for the Matte and Hydromet Plants and selenium/ tellurium for the Matte Plant) will be removed by approved waste-disposal contractors for appropriate disposal.

Sewage sludge from the treatment plant will be removed by an approved waste-disposal contractor for appropriate disposal.

5.3. Decommissioning

Once the operating life of the facility is over, it will be properly closed and rehabilitation measures taken to return the site and surrounding area to an environmentally appropriate condition. The residue storage facility and associated infrastructure will remain in place and will be subject to long-term monitoring, inspection and maintenance. The length of the monitoring period will be determined following an assessment of the site at Decommissioning, in consultation with the appropriate regulatory authorities.

The Vale Inco NL approach is to integrate rehabilitation into all phases of the Project. Rehabilitation planning will begin prior to construction, when considerations such as delineating and limiting the area of disturbance are incorporated into construction planning. Progressive rehabilitation is implemented as components or phases of the Project are completed.

The cessation of operations of the facility will bring change to the workers, their families, and the residents and businesses in nearby local communities. Six months in advance of Closure, Vale Inco NL will provide affected employees with available alternate work opportunities, outplacement services and counselling.

6.0 Environmental Assessment

The Project was registered in 2006 with the federal and provincial governments and consequently received formal Guidelines that set out the information requirements for a provincial Environmental Impact Statement and a federal Environmental Screening. The requirements included the identification of issues and concerns to be addressed, a definition of information needs, and a determination of the required analyses of Valued Ecosystem Components (VECs).

A wide variety of databases and existing information (including past EIS reports) were used in this EIS. Vale Inco NL also commissioned an extensive series of baseline and supporting studies:

- Atmospheric Environment – SENES (2007a,b);
- Terrestrial Environment – JWL (2007a);
- Freshwater Environment – AMEC (2007a);
- Marine Environment – LGL (2007a);
- Ecological Risk Assessment - Intrinsik (2007);
- Historic Resources – GPAL (2006);
- Socio-economics – JWL (2007b); and
- Health Status – HRU (2007).

Air emissions were modelled for the Construction and Operations Phases by SENES (2007a) using the CALMET/CALPUFF modelling system. Airborne noise was also modelled by SENES (2007b).

Marine effluent discharge and dilution modelling was conducted by Oceans (2006). Equilibrium modelling (PHREEQC) and sediment modelling (BBLTv7 and SEDTRANS96) were conducted by AMEC (2007b, c).

A formal ecological risk assessment (ERA) and a Human Health Risk Assessment were conducted by Intrinsik (2007). The ERA analysed a number of potential ecological vectors for a suite of metals, including nickel.

An economic model was applied by Wade Locke Economic Consulting (2007) to examine the effects of each phase of the Project on the local, regional and provincial economies.

A variety of “reasonable worst-case” accidents were developed by AMEC, SENES and SGE-Hatch for accidental events such as concentrate, fuel and acid spills, dam or berm failures, and chlorine release.

Vale Inco NL carried out in-house studies, including a detailed evaluation of Hydromet Residue Storage Options (Vale Inco NL 2008).

The information available, including original data collection by Vale Inco NL, provided an adequate information base for the environmental assessment, including the prediction of effects and the design of appropriate monitoring programs.

6.1. Valued Ecosystem Components

The Guidelines identified a set of issues and concerns from regulators, resource managers and the public. Vale Inco NL conducted extensive public consultation in support of planning for the Project, and these efforts confirmed the set of study subjects that comprise this EIS. Study subjects have been organized and presented in the EIS as the following Valued Ecosystem Components (VECs).

Air Quality. Air emissions form a key pathway for affecting air quality during operations, and airborne noise from the Project can affect sound levels in the area during construction.

Freshwater Resources - Water Quality and Quantity (including wetlands). Water resources will be required for a variety of uses. Extractions can reduce the quantity of water (especially fresh water) available for consumptive and non-consumptive uses. Processes can alter water quality upon discharge to the environment, either through regulated discharge or accidental event. Key pathways for effects on water include surface runoff around the sites and air emissions from processing operations.

Freshwater Fish and Fish Habitat. Freshwater fish and their habitat, with brook trout as the key indicator species, is an important VEC providing recreation and food for humans, as well as forage for certain birds and mammals. Where relevant, the freshwater stages of anadromous (sea-run) fish are also considered. There is potential for effects on fish and fish habitat from residue storage, water withdrawals and changes in water quality.

Marine Fish and Fish Habitat. Marine fish habitat is very broadly defined to include components such as water and sediment quality, plankton, and benthos. Fish VECs are of prime concern from public and scientific perspectives, locally, nationally and internationally. Individual species were selected to represent this VEC, as in most cases species can be grouped according to life history and habitat use. Flounder and blue mussel species are most likely to be affected by the Project, and as such provide a conservative basis for the EIS. There is potential for effects from marine effluent, shipping, and accidental events.

Avifauna. Newfoundland supports some of the largest seabird colonies in the world, hosting very large populations during all seasons. Shorebirds, waterfowl and raptors (Bald Eagle and Osprey) are abundant at certain places and times. They are important socially, culturally, economically, aesthetically, ecologically and scientifically. Seabirds are a key component near the top of the food chain and are an important resource for bird-watching (one of the fastest growing outdoor activities in North America), tourism, local hunting, and scientific study. This VEC is more sensitive to contaminants in or on water than other VECs and is of prime concern from both a public and a scientific perspective, locally, nationally and internationally. There is potential for effects on the marine-related avifauna (represented in the EIS by Bald Eagle and cormorant) from marine effluents and shipping and unloading/loading accidents.

Otter. River otter is a focal species, as it pursues a marine lifestyle in Placentia Bay and is a top-level predator. These mammals are of prime concern from both a public and a scientific perspective, locally, nationally and internationally. The main pathways for potential effects include disturbance (e.g., from noise) and exposure to contaminants, especially potential for biomagnification in the food chain.

Species at Risk. This group has become a mandatory VEC in Canadian environmental assessments. The legally-defined "species at risk" are those listed as endangered, threatened, or of special concern on Schedule I of the *Species at Risk Act* (*SARA*) (e.g., wolffishes) and/or the provincial *Endangered Species Act* (e.g., boreal felt lichen and Red Crossbill). Consideration was also given to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) listings, as some of those species may be up-listed to *SARA* during the life of the Project. (COSEWIC nominates species for listing under *SARA*.) Some species in Newfoundland and Labrador are captured in the VECs listed above; however, they are also discussed separately because of their special status.

Economy, Business, Training and Employment. This socio-economic VEC encompasses aspects of the human environment that are important to all citizens, some of whom will benefit directly or indirectly from Project employment skills and experience. New industrial projects generally benefit the surrounding area as some people are directly employed, and as employee and business spending generate indirect effects throughout the local economy. Some effects, however, can be negative; for example, wage inflation caused by the Project may adversely affect local businesses, while an increase in the cost of living may adversely affect those on fixed incomes. All citizens and the economy as a whole will benefit from the taxes and royalties that the Project and employees will pay to different levels of government.

Services and Infrastructure. This is an important VEC, as citizens value its components for their contribution to the quality of life. Employment stemming from the Project may result in higher incomes or lifestyle changes, or encourage in-migration, leading to increased demands on services and infrastructure and thus reducing the overall quality of services if capacity is exceeded. Where services and infrastructure are underused, increased demand may have either no effect or a positive one, through user-pay and greater efficiency of use.

Recreational Activities. These activities contribute to the physical and mental well-being of a broad range of individuals. Hunting, trapping, fishing, berry-picking, cutting firewood, and other activities can also contribute to their economic well-being. Parks, trails, and historic resources are important to local tourism and the local economy.

Commercial Fisheries and Aquaculture. The commercial fishery forms an important element in the economic societal, cultural and aesthetic environment of Newfoundland and Labrador. This VEC is of prime concern from both a public and a scientific perspective, locally, nationally and internationally. Aquaculture is considered here because of its growing presence in Placentia Bay. Marine activities including shipping, shoreline and wharf construction, and effluent discharges have the potential to interact with nearby commercial fishing and aquaculture operations.

6.2. Study Areas

The areas studied varied in accordance with the anticipated zone of influence of the Project and the nature of the study subject (Figure 6.1). The Project Area was considered to be the physical "footprint" associated with the developed site. Marine studies, including oceanography, marine life, and resource harvesting, encompassed Placentia Bay, with special focus on Long Harbour. Freshwater and terrestrial studies focused on an area of approximately 10 km surrounding the Project footprint, while socio-economic studies covered a larger region that included communities that might interact with the Project.

6.3. Environmental Assessment Methods

The systematic assessment of the potential effects of the Project involved the following major steps:

- Identification of all potential interactions between Project activities and each VEC;
- Evaluation of each interaction, consideration of mitigation measures and predictions of likely effects; and
- Description and evaluation of the residual effects, including consideration of cumulative effects.

Matrix tables were prepared to identify all possible Project activities that could interact with each VEC, listing activities by phase and identifying potential interactions. Each interaction was evaluated for its potential to cause effects. Where the potential was deemed unlikely or incidental it was not considered further; in this way the assessment focused on key issues and substantive environmental effects.

An interaction was considered to have a potential effect if it could change the abundance or distribution of a VEC directly or indirectly. The potential for an effect was assessed by considering the following factors:

- Location and duration of the interaction;
- Existence of any pathways between the project activity and the receiving environment;
- Modelling exercises;
- Existing literature on similar interactions and associated effects, including previous environmental assessments;
- Consultation with experts; and
- Results of monitoring done in other areas.

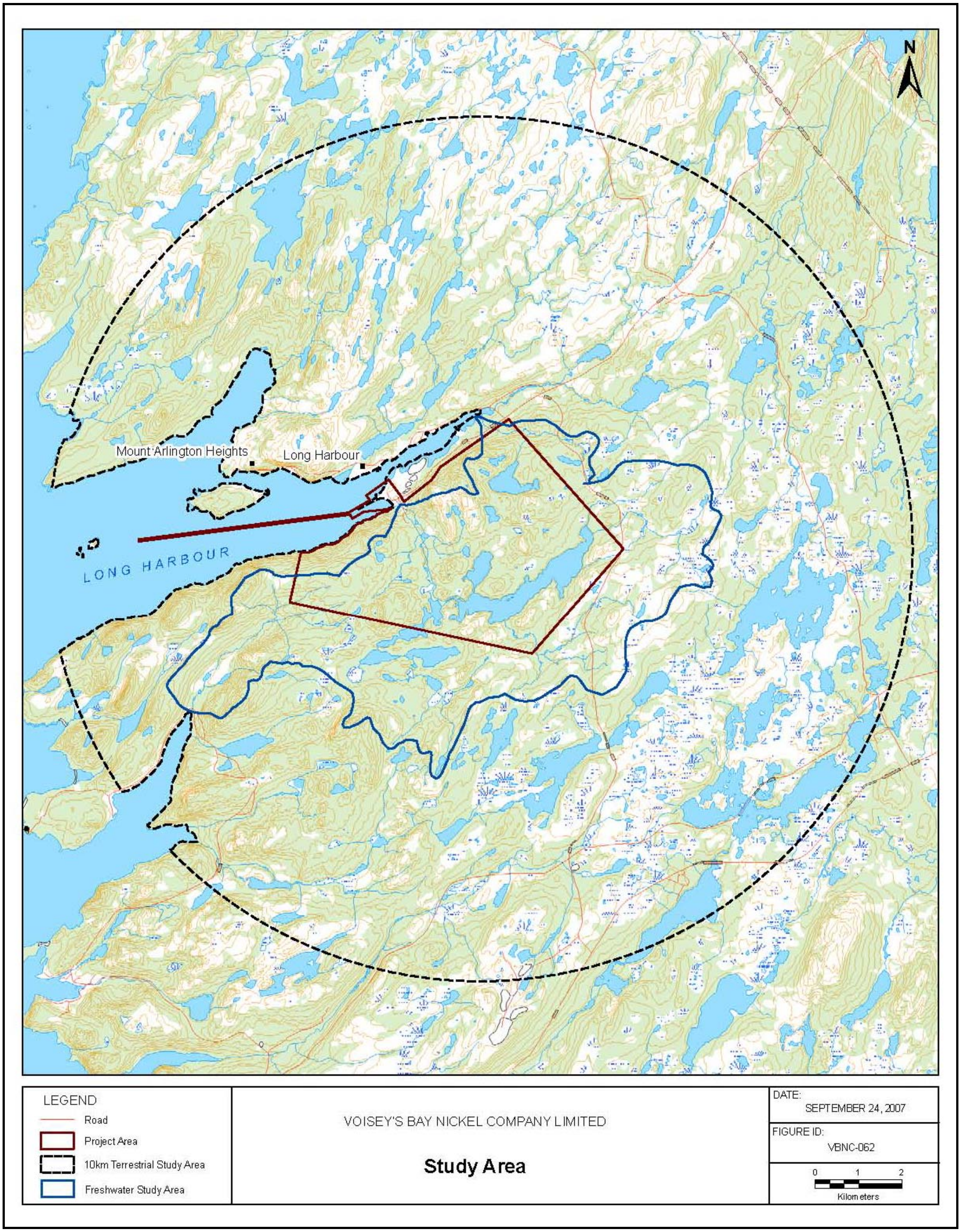

Figure 6.1 Study Areas

When data were insufficient to allow certain or precise effects evaluations, predictions were based on professional judgement. In most cases, the potential effects of coastal developments are reasonably well known. The EIS includes many mitigation measures that are mandatory or have become standard operating procedure in the industry.

The characterization of effects included the consideration of key factors used in determining adverse environmental effects, as provided for in CEA guidelines (CEA Agency 1994b):

- Negative effects on the health of biota;
- Loss of rare or endangered species;
- Reductions in biological diversity;
- Loss or avoidance of critical/productive habitat;
- Fragmentation of habitat or interruption of movement corridors and migration routes;
- Transformation of natural landscapes;
- Discharge of persistent and/or toxic chemicals;
- Toxicity effects on human health;
- Loss of, or detrimental change in, current use of lands and resources for traditional purposes;
- Foreclosure of future resource use or production; and
- Negative effects on human health or well-being.

Many potential effects can be moderated, reduced or eliminated through the application of mitigation measures. In some cases, project or interaction–specific measures are developed, including changes in equipment or procedures, or in timing of activities. As an important stage of effects prediction, mitigation measures are identified and committed to, and their effectiveness is taken into account in considering the residual (remaining) potential effects of Project activities. Many of these mitigation measures have been incorporated into the Project Design, often as a consequence of the Demonstration Plant experience, which provided a unique opportunity to test the effectiveness of such measures. The designed-in approach to mitigation means that most of these measures are described in the Project Description (Volume 1) and already committed to by Vale Inco NL.

Significant social and economic effects may be positive, negative, or both. Benefits may be enhanced through an industrial benefits plan. Where they are relevant, positive effects and proposed enhancement measures are noted. For negative effects, optimization measures are indicated, but where these may be beyond the capacity or mandate of the Company, this is indicated. Predicted residual effects are based on the assumption that appropriate mitigation measures are applied and are effective.

Evaluation Criteria

The criteria taken into account when evaluating the nature and extent of environmental effects include magnitude, geographic extent, duration and frequency, reversibility, and ecological, socio-cultural and economic context.

Cumulative Effects

Cumulative effects were assessed for within-project activities as well as for external projects. The other projects and activities within Placentia Bay that were considered in the cumulative effects assessments were:

- Port of Argentia;
- Oil transshipment terminal;
- North Atlantic oil refinery;
- Proposed oil refinery;
- Proposed LNG terminal;
- Marystown shipyard and Cow Head;
- Commercial fisheries;
- Marine transportation (cargo ships, tugs, naval vessels, fishing vessels, recreational vessels);
- Hunting activities; and
- Forestry (wood harvesting) activities.

Effects assessment by VEC incorporated the consideration of cumulative effects.

Accidental Events

Accidental events can lead to damage to the biophysical environment as well as direct or indirect effects on the socio-economic environment and human health and safety. The severity of effects depends on the magnitude, location and time of year. Accidental events can be generally categorized as unplanned releases to the environment of materials such as fuel, hazardous materials, concentrate, or wastewater.

The potential for major accidents was modelled for extent of effects. The results are approximations, indicating the order of magnitude of the potential events. The accidental event scenarios were examined and refined to indicate scenarios for catastrophic events. Extensive measures will be taken to prevent such occurrences, and a high level of emergency preparedness will be in place. For the purposes of effects assessment, the following scenarios were identified:

- Accidental release of sulphuric acid into the marine environment;
- Accidental release of ships' fuel into the marine environment;
- Accidental release of chlorine gas into the atmosphere;
- Failure of a dam at the residue storage site; and
- Accidental loss of concentrate into the marine environment.

The identified malfunctions and accidents ("plausible worst-case scenarios") were assessed separately by VEC.

6.4. Environmental Effects

The EIS provides a comprehensive prediction of effects for the Construction, Operations and Decommissioning Phases of the Project. The effects of potential accidents are also addressed, as are the cumulative effects of the Project in combination with other planned and ongoing activities.

The quantities and scenarios selected are those expected to create the largest effect reasonably expected. A conservative approach was used, in that the assessment was based on the larger potential effect from the two applicable Project technologies (Hydromet or Matte) such as the larger footprint, larger volume of water consumption, and the like.

Particular attention has been paid to accidental events because of their potential to result in significant effects. The corporate target is to achieve zero unplanned discharges to the environment. Vale Inco NL has employed dispersion modeling as a valuable means to identify patterns and provide feedback to ongoing design.

Air Quality

Modeling has demonstrated that compliance will be achieved for air quality standards throughout all Project phases. With respect to accidental events, it was determined that a large-scale chlorine release could have the greatest effect on air quality; however, emergency procedures and the short-term nature of the event would prevent any lasting significant effects.

Water Resources

All phases of the Project have the potential to affect water quality. Mitigation measures, including due care and control over drainages, recycling where possible, and centralizing discharge locations, will serve to reduce potential negative effects. Any plausible accidental events that could affect water resources can be quickly controlled, given the site layout. There will be no significant effects on water quality or quantity. This prediction will be verified by additional modeling and possible effects monitoring of groundwater seepage from Sandy Pond and air emissions in the Project Area.

Freshwater Fish and Fish Habitat

The Project will affect some of the local streams and ponds in the Project Area, mostly through direct habitat loss. Mitigation measures will be applied to reduce effects. Residual harmful habitat alteration or destruction will be compensated by a Habitat Compensation Plan being developed in consultation with DFO. Any plausible accidental events that could affect freshwater fish or their habitat can be controlled given the site layout and through effective emergency response planning. There will be no significant effects on freshwater fish or their habitat.

Marine Fish and Fish Habitat

Marine fish and fish habitat within very limited areas proximate to the outfall and adjacent to the wharf will be affected and disturbed during the Construction Phase. Wharf expansion activities will result in some habitat changes through removal of debris and potentially contaminated sediment at wharf-side, and by placing riprap on eroding banks. Mitigation measures (e.g., to control suspended sediment) will be applied to reduce effects, and any residual harmful habitat alteration or destruction will be compensated by a Habitat Compensation Plan approved by DFO. The main effect during Operations will be from marine effluent. Modeling exercises predict that any effect on water quality or sediments from the treated effluent will be localized and will not accumulate in the food chain to significant levels. This prediction will be verified by effects monitoring. Decommissioning should have no effect on the marine environment. There will be no significant effects from routine activities.

Large-scale accidental events such as a dam failure, oil spill or concentrated sulphuric acid spill all have the potential for negative effects on marine fish habitat in Long Harbour. Prevention and emergency response can mitigate these effects, all of which would be reversible over time.

Avifauna

Terrestrial avifauna in the Project Area may be disturbed, especially during construction, and some individuals may be displaced from the Tier 2 area. However, because the Project is to be partially located at a brown-field site, and because there does not appear to be any shortage of habitat for terrestrial birds, this component of avifauna was not assessed further.

Marine-associated avifauna were determined to be at risk from Project activities. The Bald Eagle, a resident top-level predator, and the cormorant, a resident fish-eater, were used as focal species to assess effects. Construction and routine activities will disturb (and potentially displace) these species from the Project Area. While these effects are negative, they are small-scale and reversible. There is uncertainty regarding effects on Bald Eagles feeding in spring, but they are known to adapt to human presence. Effects on prey species (marine fish) were predicted to be of low magnitude, small geographic extent and reversible, and thus not significant. Given the small zone of influence involved at the effluent marine outfall and the lack of evidence of cormorant feeding at depths where the discharge will occur, bioaccumulation of metals in cormorants is unlikely. There will be no significant effect on cormorants or their food supplies from routine activities and, by inference, on marine avifauna in general.

A large-scale accident, particularly one that releases persistent contaminants, has the potential to affect Bald Eagles. Cormorants are more susceptible to oil spills at the water surface, because they spend much more time in or on the water.

Otter

River otters were used as a focal species for marine mammals as they are resident in the area, potentially sensitive to Project activities and mostly marine in lifestyle. The main effects are those associated with noise disturbance. Some otters will be negatively affected and may be displaced, but any effects will be reversible. Effects of routine activities were assessed as not significant, but potential exists for negative effects from a large oil or acid spill. It is likely, however, that unless neighboring populations are eliminated, the otter would re-populate, as the Long Harbour area offers excellent habitat.

Species at Risk

Species at Risk that may be negatively affected are the boreal felt lichen, the Red Crossbill and wolffishes (three species). All are expected to be rare in and near the Project Area, where no critical habitat has been identified for any of these species. Wolffish and the Red Crossbill are highly mobile and have no critical or limiting habitats in the Project area; consequently, any effect on these species will be limited in magnitude and geographic extent, and not significant. All predicted effects on these species are reversible. Boreal felt lichen is present in and adjacent to the Project Area (Tier 2). Vale Inco NL will institute mitigation measures including additional analyses to determine specific numbers in the area, avoidance of clusters, and transplantation where avoidance is not possible. Effects are not predicted to be significant.

Economy, Business Training and Employment

The Project will create positive effects for the economy of the Study Area and the province through Construction and Operations employment, and through the development of business relationships. A series of optimization measures will enhance the potential benefits, especially for those living closest to the Project.

Services and Infrastructure

The Project will have a significant positive effect on regional services and infrastructure including health care, education, transportation, municipal governance, and housing. The demographic trend toward lower population in the Study Area may be reduced or even reversed as a consequence of employment, which in turn may help to fill some of the actual and anticipated excess capacity in the area.

Recreation

The Project may have a minor, not significant effect on recreation opportunities within the Project area, but will likely have a neutral or even positive effect through indirect links, such as increased employment and income.

Commercial Fisheries and Aquaculture

The primary concerns associated with fisheries and aquaculture are effects on the marine environment and site or gear loss. There are few, if any, viable fishing locations in the Project Area, although there may be some temporary fishing-berth loss if safety zones exclude fishers during Construction. The main concern is gear loss from vessel traffic, which can be compensated for in cases directly attributable to Project activities. A fishery and aquaculture Compensation Program will be developed to address Project effects on these sectors. Vale Inco NL vessel traffic is within historical levels and would contribute less than 10 per cent to current and anticipated total vessel traffic in Placentia Bay.

7.0 Conclusion

The preparation of this Environmental Impact Statement represents the culmination of an exhaustive planning process that involved the collection of an extensive series of baseline descriptions of the existing environment and the comprehensive modelling of an array of physical and ecological processes. The presence of a Demonstration Plant has enabled Vale Inco NL to develop a suitable technology, to characterize the discharges associated with the processing of nickel concentrate, and to develop appropriate pollution controls. Thus, Vale Inco NL has a level of knowledge about the proximate biophysical and human environment that is comprehensive and more than adequate for the purposes of impact assessment.

By taking a designed-in approach, Vale Inco NL has incorporated gained knowledge into the planning and design for this facility. As a consequence, the Company has been able to present a well designed Project that will avoid many potentially negative effects, apply effective mitigation measures to those that remain, and optimize the many benefits that will accrue to the area and to the province.

The important waste streams include residue, effluents and airborne contaminants. There are few airborne contaminant issues because of limited releases and the control technologies that will apply. The residue will be acid-generating and needs secure underwater storage. The Project Area provides several possible disposal sites; all have been screened and then investigated thoroughly, with the result that an optimum site has been selected at Sandy Pond. In recognition of the fisheries/fish habitat resource present, a Fish Habitat Compensation Plan will be developed to ensure there is no net loss of productive fish habitat.

Water-borne releases have been addressed through a combination of treatment technology and discharge location studies. The application of treatment technologies will result in an effluent that meets or exceeds regulatory standards. Through a program of data collection and modelling, an outfall location has been identified near the mouth of Long Harbour where the combination of a diffused outfall and existing current patterns will achieve optimum discharge conditions. The application of an Ecological Risk Assessment has provided a conservative modelling of contaminant uptake through the food chain, and provides guidance in terms of monitoring for suitable parameters to act as early warning indicators of change.

The Demonstration Plant has provided a template for local employment and business opportunities, with the development of a qualified and competent workforce that has exceeded expectations related to important factors such as gender equity. As a result, Vale Inco NL is confident that socio-economic effects will be dominantly positive for the area and the province.

Marine vessel traffic will be a short-term concern associated with a Construction zone near the wharf; however, traffic during operations will be modest. Nevertheless, there are other major anticipated increases in overall marine traffic in Placentia Bay. Vale Inco NL will participate actively in efforts to reduce potential congestion and improve marine safety.

Species at Risk represent a major concern, even where minimal interactions are anticipated. The terrestrial habitat of the Project Site is not unique; however, one organism of concern, the boreal felt lichen, has been found in the area and elsewhere on the Island of Newfoundland. In fact, the research funded by Vale Inco NL has dramatically improved knowledge about the status of this organism, which is found on a small number of trees in and near the Project footprint. Special measures will be taken to ensure that no disruption of these host trees occurs; alternatively, organisms will be transplanted.

Accidental events show the greatest potential for negative environmental effects; hence Vale Inco NL has placed great emphasis on prevention and preparedness. Nevertheless, for the identified "probable worst-case" scenarios, the environmental effects are generally of short duration and limited geographic extent. These considerations confirm the suitability of the site selected, while reinforcing the need for constant vigilance.

This EIS, along with the required suite of Component Studies, and supported by a series of technical reports, represents a comprehensive compilation of information, analysis and forecasting. The predicted environmental effects at all phases of the operation, including the cumulative effects of the Project in combination with other activities, and the effects of unplanned events, have been examined thoroughly and in accordance with available guidance. The factors considered include those identified by provincial and federal authorities, ensuring that a complete assessment has been conducted. Vale Inco NL is confident that the Project can be built, operated and decommissioned in an environmentally sound manner.