Q. **Reference: Reliability and Resource Adequacy Study, Volume III, Section 6.2**
Has Hydro considered mothballing part or all of the existing generation on the Avalon Peninsula as opposed to closing it down and levelling the associated site? Please provide any analyses conducted that considered this option.

A. Holyrood Thermal Generating Station ("Holyrood") is not required for base load generation once the Muskrat Falls project is deemed reliably in service. Following full in-service of the Muskrat Falls Generating Units, Newfoundland and Labrador Hydro's ("Hydro") current plan is for Holyrood to remain in standby service for one winter season. The expected end of standby service is April 1, 2021 and spending on assets with no future value would cease at that time. It should be noted that much of the Holyrood site will remain active after this date (e.g., Unit 3 synchronous condenser operation, which requires much of the building to remain intact, Holyrood Gas Turbine operation, workshops, landfill and wastewater treatment systems, water supply and treatment systems, ac switchyard, warehousing) and so levelling of the site is not planned. Following the in-service of the Muskrat Falls Generating Facility, it is Hydro's current opinion that the Holyrood plant is not a candidate for continued operation as a backup or standby facility significantly due to its lengthy start up time (at least a week when the plant is cold).

The intention of "Decommissioning and Demolition of the Holyrood Thermal Generating Station,"[1] was to meet regulatory and constructive obligations contemplated at the date of the report and defer unnecessary spending. The study did not contemplate levelling the entire site, rather it addressed the regulatory requirements to clean and remove the bunker fuel tanks and piping once abandoned, maintain the landfill and leachate processing for 25 years after generation ends, and address environmental risks from remaining

[1] "2017 General Rate Application," Exhibit 8, included as PUB-NLH-026, Attachment 1.

chemicals and oils, etc. The constructive obligations were primarily the immediate removal of the stacks and the tanker dock.

Assumptions are currently under review in 2019 as a normal part of the project planning for Holyrood transition and decommissioning. While Holyrood remains an aged asset with limitations on start-up times and age-related reliability risks, the steam generation functions of all three units could be extended, at least for a short period in the near-term, with additional capital and operating funding.

Hydro also has gas turbine generation at the Hardwoods Terminal Station on the Avalon Peninsula; this 50 MW plant also functions as a synchronous condenser. Hydro's plan for this plant has been to run out the remainder of its life. The generator has been replaced and the engines are at end of life; new direct replacements for the engines are not available thereby requiring the use of refurbished spares, which has limited long term success of reliability. Recently, the unit has experienced higher generation requirements thus drawing down the remaining engine life faster than originally expected. Hydro has been reviewing the future requirement for the Stephenville Gas Turbine and the potential to repurpose it as spares to support the extended operation of the Hardwoods Gas Turbine.

# Decommissioning and Demolition of the Holyrood Thermal Generating Station

Final Report

Stantec

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# Table of Contents

# 1.0 INTRODUCTION

Newfoundland and Labrador Hydro (NLH) operates a three-unit, 490 MW (gross), thermal generating station at Holyrood, NL which supplies electricity to the Island's grid. With the planned implementation of the Muskrat Falls Generating Facility as part of the Lower Churchill Project, the electrical generation capability of the Holyrood Thermal Generating Station (HTGS) will no longer be required and selected portions of the station will be decommissioned and demolished. In order to complete long term financial planning, NLH is required to determine the cost of decommissioning and demolition the HTGS in order that an asset retirement obligation (ARO) can be estimated. As such, NLH retained the services of Stantec Consulting Ltd. (Stantec) to assist in the preparation of the ARO and this report presents that estimate as well as the assumptions and methodology utilized in developing the estimate.

In general terms, the ARO reflects a decommissioning and demolition that:

1. Complies with current environmental regulatory requirements.

2. Meets constructive obligations made by NLH to provincial regulators and neighbours of the facility.

3. Meets NLH's long term operational strategy for the HTGS.

## 1.1 BACKGROUND

The HTGS is located in the Town of Holyrood, approximately 50 kilometers south west of St. John's, on Conception Bay. The HTGS site is approximately 40 hectares in size and as shown on SK-001 in Appendix A, includes:

1. A powerhouse that encompasses three generation units (boiler house and turbines/generators), maintenance shops, a water treatment plant and administrative offices.

2. Two, 90 meter and one 110 meter high concrete stacks.

3. A waste water treatment system.

4. Two cooling water intake pump houses.

5. Numerous ancillary buildings and structures including a guardhouse, chemical storage buildings, hydrogen storage building, materials storage warehouse, training building, combustion gas turbine building and pipe shop.

6. A switch yard.

7. A hazardous waste landfill.

8. A Bunker C tank farm (approximately 140,000 cubic meters of storage capacity) and a day tank and diesel fuel storage (approximately 230 cubic meters of storage).

9. A marine jetty and pipeline (approximately 1400 meters in length) for offloading and transporting Bunker C to the tank farm and day tank.

The plant was constructed in two stages - Units #1 and #2 were installed in 1971 and Unit #3 was completed in 1979. In 1988 and 1989, Units #1 and #2 were modified to increase their output to 170 MW, bringing the total generating capacity of the station to 490 MW (gross).

In December 2012, the Government of Newfoundland and Labrador announced official sanction of the Muskrat Falls development as part of the Lower Churchill Falls Project (LCP). Once Muskrat Falls is brought into service in or about 2019, the HTGS will no longer be required to generate electricity; however, it will continue to be used for:

1. Synchronous condensing (SC) for grid voltage control.

2. Operational support of the 123.5 MW Combustion Turbine (CT) situated southeast of the powerhouse.

## 1.2 REPORT ORGANIZATION

This report presents a Class 3 Opinion of Probable Cost (OPC), for the planned decommissioning and demolition of the HTGS that can be presented to the Public Utilities Board. The OPC or ARO is based on an anticipated operating scenario at the HTGS prescribed by NLH, and is reflective of current regulatory requirements and constructive obligations made by NLH.

Section 1 provides an introduction and a brief overview of the site as it exists today and a general timetable of operations at HTGS, as the LCP comes on line.

Section 2 describes the planned operational functions at the HTGS and the regulatory framework that influences the decommissioning and demolition requirements. The general approach to decommissioning and demolition and project schedule are also presented.

Section 3 presents the OPC and an associated cash flow projection. The costing methodology, including assumptions and exclusions are also presented.

The appendices provide supporting detail.

# 2.0 DECOMMISSIONING AND DEMOLITION AT THE HTGS

When the LCP is brought into service in 2019, the HTGS will no longer be required to generate electricity; but it will continue to be used for SC operations and support of the CT. Based on these planned operations, NLH will have to consider: a number of federal and provincial Acts, Regulations and Guidelines; the requirements stipulated in their current Certificate of Approval (C of A) issued by the Newfoundland and Labrador Department of Environment and Conservation (NLDEC); and input from regulatory authorities, to define the exact nature, extent and requirements of decommissioning and demolition. NLH will also have to consider the constructive obligations it has made to the regulators and the public regarding the scope and timing of demolition activities. Together, the regulatory requirements and constructive obligations will shape the decommissioning and demolition plan for the HTGS.

## 2.1 REGULATORY REQUIREMENTS OF DECOMMISSIONING

Based on a review of environmental statutes it appears the legislation identified below will govern the scope and timing of demolition as there is no all-encompassing piece of legislation or policy that stipulates decommissioning and demolition requirements in the Province of Newfoundland and Labrador.

Preliminary discussions were held with representatives of the NLDEC as part of developing the regulatory framework, but it is suggested that additional input from regulators will be required as the project scope is finalized and as planning proceeds to ensure compliance and that all environmental issues are addressed in an appropriate manner.

Based on a review of federal legislation, the Canadian Environmental Assessment Act (CEAA) does not apply because of the nature and scope of the project; nor will an authorization from the federal Department of Fisheries and Oceans be required for the demolition of the marine jetty and causeway. This should be re-confirmed with the appropriate regulatory authorities when the project scope has been clearly defined and the demolition project is imminent.

The following acts/regulations apply:

***Environmental Protection Act (SNL – 2002 c E-14.2)***

*Certificate of Approval to Operate for the HTGS - AA11-085563, issued to NLH pursuant to Section 83 of the Environmental Protection Act.*

Appendix A – Part 16 requires compliance with the Storage and Handling of Gasoline and Associated Products Regulations 58/03 which, per Section 25. (3) mandates that the owner of a storage tank system to, within 30 days of abandonment, empty the system of all liquids and vapours and dismantle and remove or dispose of the tank system including the dyke and remove the impacted material to the satisfaction of the NLDEC.

Appendix A - Part 21 requires that a plan to restore areas disturbed by the operation be submitted to the NLDEC ten months before closure.

Appendix B – Provides general objectives for site decommissioning and elements to be included in the decommissioning and restoration plan. Specific clean-up criteria are not provided, but a phased environmental investigation to identify the type, extent and degree of impacts at the site is to be undertaken, and the site is to be restored to a condition acceptable to the NLDEC.

*Environmental Assessment Regulations 54/03*

Sections 34.(1) and 26 of the regulation, require that the decommissioning of an electric power generating facility be registered as an undertaking.

*Storage and Handling of Gasoline and Associated Products Regulations 58/03.*

Section 25.(3) of the regulation mandates cleaning and dismantling and disposal of the an above ground petroleum storage tank system.

***Canadian Environmental Protection Act***

*PCB Regulations SOR/2008-273*

This federal regulation dictates the management, storage and disposal of PCBs, and Section 19 stipulates that the owner of PCBs shall, within 30 days after they are no longer used; either send them for destruction or for storage at a PCB storage site.

***Canadian Navigation Protection Act***

This federal regulation requires the submission of a 'Notice of Works' to the Navigation Protection Program (Transport Canada), describing the demolition of the marine jetty and causeway. It is assumed that the work will be deemed as 'not likely to substantially interfere with navigation' and that ministerial approval will not be required.

There are a number of other acts and regulations, in addition to those described above that prescribe specific decommissioning requirements in a variety of areas – i.e. management of asbestos containing materials, or removal of halocarbons; water resource management, etc. While they are not listed, compliance with these requirements is reflected in the decommissioning methodology and the ARO presented herein.

## 2.2 COMPONENTS OF DECOMISSIONING AND DEMOLITON

In light of the plan to cease electrical generation at the HTGS after the LCP project comes on line, a two phase approach to demolition will be undertaken such that demolition can begin and planned SC and CT operations can continue in a safe manner.

Engineering and planning for Phase 1 will begin in early 2020 with most of the Phase 1 demolition occurring in 2021 and 2023. Phase 2 planning will begin once the SC and CT operations conclude. Once initiated, Phase 2 is expected to be completed within a five year period.

It is assumed that NLH will retain ownership of the entire HTGS site for the foreseeable future and the land use will be classified as 'Industrial'.

The key decommissioning and demolition components are listed below:

**Phase 1**

1. Cleaning and demolition of Bunker C Tanks #1 to #4.
2. Cleaning and demolition of the Bunker C day tank and fuel additive tank.
3. Cleaning and demolition of the Bunker C pipeline.
4. Demolition of the marine jetty and causeway.
5. Demolition of the three powerhouse stacks and breeching.
6. Demolition of the previously decommissioned 10 MW gas turbine building.
7. Cleaning and removal of seven transformers associated with Units #1 and #2.

**Phase 2**

1. Asbestos abatement and cleaning of the boilers and boiler house.
2. Demolition of the powerhouse and all internals and equipment.
3. Cleaning and removal of four Unit #3 transformers.
4. Demolition of the two cooling water pumphouses and associated piping.
5. Cleaning and demolition of the waste water treatment plant.
6. Cleaning and demolition of the equalization basins and building.
7. Capping of the hazardous waste landfill and decommissioning of the leachate pond.
8. Cleaning and demolition of the diesel fuel storage tanks serving the powerhouse.

At present there are no plans to demolish the ERT building, hydrogen storage building, shawmont (warehouse) building, chemical storage building, training center, pipe shop building,

the metershop building or the CT. Please refer to drawing SK-001 Rev K, in Appendix A depicting which components are to be demolished and when.

### 2.2.1 Requirements of the Certificate of Approval to Operate

In addition to the tasks listed above, NLH will be required, as stipulated in their current Certificate of Approval to Operate, to:

1. Complete an intrusive environmental investigation at the HTGS to identify and quantify potential contaminants of concern on the site (Phase II Environmental Site Assessment (ESA)) and to manage any impacted soils and groundwater either through remediation or risk management.

2. Prepare and submit to the NLDEC, a plan to restore areas disturbed by the HTGS operations (closure plan).

3. Register the closure of the HTGS as an undertaking as stipulated in the provincial Environmental Assessment Regulations (EA Registration).

These environmental activities are captured in the project schedule and OPC.

### 2.2.2 Project Execution

It is expected that the decommissioning and demolition will be planned, managed and overseen by NLH staff, at the plant and head office. In addition, HTGS staff will assist with selected decommissioning activities (chemical removals, sludge management, electrical disconnects/ isolation, boiler wash down, and contract administration, etc.), because experience has shown that this is the most efficient and effective way to complete these power plant related tasks.

It is also assumed that NLH will retain the services of an engineering consultant to assist with: project planning, preparing an EA registration and closure plan, conducting a Phase II ESA and remedial action plan, preparing decommissioning and demolition tender packages and periodic construction monitoring and support.

The demolition (including fuel tank decommissioning and asbestos abatement) will be carried out by a suitably qualified demolition contractor with a documented safety record and expertise in the required demolition components. It is also assumed that inert construction debris generated from the decommissioning and demolition work will be disposed of in a properly constructed and duly permitted on-site facility in the area of the former Bunker C tank farm.

The project task responsibilities are described in Section 2.3.

### 2.2.3 Demolition Risk

Based on discussions with an experienced demolition contractor, it is recommended that NLH consider the implications of Phase 1 demolition of the three stacks on planned SC and CT operations. While believed to be relatively small, there is a risk that the Phase 1 stack demolition could negatively affect SC operations. The risk can be mitigated by delaying the demolition until the end of SC operations or employing an alternate stack demolition method. This is discussed in further detail in Section 3.

## 2.3 PHASING OF DECOMMISSIONING AND DEMOLITION

The general sequence of events is presented below and a detailed schedule, including activity durations, is provided in Appendix B. Demolition methodology is provided in Appendix C.

### 2.3.1 Phase 1

Phase 1 will be conducted over a four year period and will include engineering and planning, a Phase II ESA and remediation/risk assessment, registration of the project for an environmental assessment and execution of decommissioning and demolition tasks by NLH staff and suitably qualified contractors retained through a competitive bidding process. It is envisioned that three separate tenders will be issued to complete the demolition and associated tasks in Phase 1. The majority of the demolition in Phase 1 will be completed by mechanical means with the exception of the three stacks which will be dropped using a controlled, explosive method.

**2020**

Engineering and planning will be initiated in 2020 and will include preparation of decommissioning and demolition tenders and submission of an environmental assessment registration and closure plan to the NLDEC.

**2021**

A tender will be awarded for selected demolition work and NLH staff will begin decommissioning activities including removal of:

1. Bulk surplus chemicals remaining in the powerhouse (returned to the supplier or disposed of) in accordance with regulations.

2. Surplus recoverable Bunker C and other hydrocarbons (returned to supplier or disposed of) in accordance with regulations. It is assumed that NLH will manage their fuel inventory such that only one tank will contain fuel at the lowest possible level.

3. Miscellaneous small volumes of chemicals in the powerhouse for disposal in accordance with environmental or hazardous waste regulations, as appropriate.

Once the chemicals and hydrocarbons are removed, the demolition contractor will:

1. Initiate sludge removal, cleaning and demolition of the four Bunker C tanks, the day tank and the fuel additive tank. The tank foundations shall be cleaned, but will remain in place. It is assumed that the demolition contractor will retain the services of a local, licensed petroleum contractor to complete this work.

2. Clean and dispose of the day tank enclosure (above grade knee wall), but the enclosure foundations below grade shall remain.

3. Drain and clean the Bunker C piping system from the marine jetty to the burner fronts of all three boilers.

4. Demolish the cleaned pipeline from the marine jetty to the South wall of the powerhouse and cut and remove the pipeline supports at ground level. The support foundations will remain in place.

5. Demolish and remove the previously decommissioned gas turbine building leaving the floor slab and foundation in place.

6. Drain and remove the seven transformers - including T1, UST-1, RT1, T9, T2, UST 2 and RT2 associated with Units #1 and #2.

As the demolition concludes in the fall of 2021, NLH will complete an intrusive Phase II ESA. All areas of the site that are to be decommissioned or demolished, excluding the diesel oil fuel storage tank area near the pipeline and the transformer area, will be assessed, although focus will be upon Bunker C tank farm, pipeline and area north of the powerhouse. The excluded areas will be assessed at a later date.

Impacted soils and groundwater identified in the Phase II ESA will be managed either through remediation and/or risk management.

At the same time as the intrusive investigations, NLH will also complete a hazardous building materials assessment. This will identify the extent and type of existing hazardous materials and will confirm that debris can be safely disposed of in an on-site facility. It is possible that some material identified in the hazardous building materials assessment may require special disposal at an off-site hazardous waste landfill.

Permitting for the on-site construction and debris (C&D) disposal facility will also be completed in 2021.

**2022**

As remediation requirements are currently unknown and will not be determined until late 2021 with the completion of a Phase II ESA, no active demolition is planned for 2022. Required soils

and groundwater remediation will be conducted at that time. However, if it is determined that soil and/or groundwater impacts can be successfully managed through risk assessment and/or minimal remedial work, it is possible that the demolition scheduled for 2023 could occur in 2022.

It is also assumed that a tender for the construction of a C&D site in the area of the former Bunker C tank farm, to permit the cost effective on-site management of inert debris, will be awarded and the facility constructed.

**2023**

In 2023, the final tender of Phase 1 will be awarded for the remaining demolition. This will include:

1. The marine jetty, causeway to the jetty, associated components (shed, lights, electrical, etc.) and the supports. The supports (concrete filled steel tubes) shall be cut at the seabed and the sub-seabed foundations shall remain. Demolition will follow best practices to minimize any environmental impacts on the marine environment, including the use of a silt curtain and debris will be placed in the on-site C&D facility.

2. The three stacks and breeching exterior to the plant. The concrete from the stacks shall be crushed to 6" minus and disposed of in the on-site C&D facility. The openings in the north end of the boiler house created by the removal of the breeching shall be re-sided and the building made weather tight.

Following the placement of debris in the C&D facility, it shall be covered to limit infiltration of precipitation and snow melt. The closure of the C&D facility will conclude Phase 1 activities.

### 2.3.2 Phase 2

Phase 2 will be conducted over a five year period and will include engineering and planning, environmental site assessment and remediation/risk assessment, and execution of decommissioning and demolition tasks by NLH staff and suitably qualified contractors retained through a competitive bidding process. It is envisioned that a single contract will be called for the demolition work described herein. Similar to Phase 1, most of the demolition work will be completed by mechanical means, but the boiler house and boilers will be dropped using explosives. A separate contract will be called, as required, for environmental remedial work.

**Year 1**

Engineering and planning will be initiated in year 1 and will include preparation of a decommissioning and demolition tender.

**Year 2**

A tender will be awarded for decommissioning and demolition and NLH staff will begin decommissioning activities in the turbine hall and balance of the powerhouse, including removal of:

1. Surplus chemicals (returned to the supplier or disposed of) in accordance with regulations.

2. Surplus recoverable diesel fuel (returned to supplier or disposed of) in accordance with regulations.

3. Miscellaneous small volumes of chemicals and ozone depleting substances for disposal in accordance with environmental or hazardous waste regulations, as appropriate.

Once the chemicals and hydrocarbons are removed by NLH, the contractor will complete environmental decommissioning and asbestos abatement tasks. During the removal of asbestos containing materials (ACM), NLH will engage the services of a specialized contractor to monitor the abatement to ensure worker safety and regulatory compliance. They will also sample suspected ACM as discovered during the demolition.

The contractor will:

1. Clean and demolish the two above ground, horizontal diesel fuel oil storage tanks and associated piping near the Bunker C tank farm. The foundations shall be cleaned, but remain in place.

2. Drain and remove the four remaining transformers T3, UST-3, SST1-2 and SST 3-4 for disposal at an approved facility.

3. Remove and dispose of mercury containing devices and lights for off-site disposal.

4. Drill low points and drain residual product, flush and clean the lines of all other oil and chemical systems previously drained in Phase 1.

5. Remove by hand, friable ACM that may be contaminated with ash (heavy metals) and could have a very low pH. The contractor will follow Type 3 removal procedures, including the off-site disposal of cladding and insulation from Boilers 1 and 2. Boiler 3 cladding and insulation is not assumed to be ACM, but must be removed as Type 3 and disposed of as ACM, due to ash contamination.

6. Manage ACMs that are discovered as demolition proceeds.

NLH staff will wash down Boilers #1 and #2 and the building interior in year 2 after asbestos abatement procedures are carried out by the contractor. Boiler #3 wash down will occur in year 3 as the ACM abatement for that particular unit will not be completed until late in year 2.

NLH will also engage a consultant to complete an intrusive Phase II ESA in the area of the diesel oil fuel storage tanks near the pipeline and in the transformer area. Impacted soils and groundwater will be managed either through remediation and/or risk management.

**Year 3**

NLH staff will complete the wash down of Boiler #3 and plug the floor drains/trenches in the powerhouse at grade level, and the contractor will continue to prepare for the demolition of the powerhouse. The contractor will:

1. Remove the non-friable Galbestos siding on the powerhouse. It is assumed that mechanical removal of non-friable Galbestos will be permitted and it will be disposed of in the on-site C&D site.

2. Mechanically demolish the turbine hall and equipment and equipment foundations within. The equipment footings/foundations will be removed to permit the boilers to drop to grade to facilitate their demolition. The floor slab will remain.

3. Drop the boiler building using explosives and then complete the demolition by mechanical means. The floor slab of the boiler building and equipment foundations shall remain. Concrete from demolition of the powerhouse will be crushed to 6" minus and will be placed in the on-site C&D site.

**Year 4**

Continuing under the same contract, the demolition contractor will clean the trenches and sumps in the power house and then move to the ancillary buildings and infrastructure situated north of the powerhouse. Specifically, the two cooling water pumphouses, the equalization basin building, and the waste water treatment building will be demolished.

NLH staff will be responsible for removing any sludge remaining in the waste water treatment and equalization basin buildings and leachate pond in advance of demolition.

The contractor will:

1. Steam clean or power wash trenches and sumps in the powerhouse.

2. Remove the non-friable Galbestos siding on cooling water pumphouse 2, for on-site disposal.

3. Demolish both cooling water pumphouses. The floor slabs, wet wells and sub surface foundations shall remain, but the wet wells and intakes will be backfilled.

4. Demolish the equalization basins and building, and the waste water treatment equipment and building. The floor slab, foundations and equipment foundations shall remain.

5. Dewater and backfill the leachate lagoon.

6. Cap and close the hazardous waste landfill.

7. Excavate, open and backfill all piping greater than 24" in diameter, including the seal pits, utilidors, oil/water separators and the wet wells.

8. Place concrete caps in the CW inlets and outlet piping. The rip rap breakwater shall remain intact.

9. Cap and close C&D facility.

Once the buildings north of the powerhouse are removed, NLH will conduct an intrusive Phase II ESA in this area.

**Year 5**

Any impacted soils and groundwater identified in the Phase II ESA will be managed either through remediation and/or risk management. If required, the hazardous waste landfill will be temporarily reopened for the economical on-site disposal of impacted soils and then recapped.

Final closure reporting will also be completed in year 5.

As stated earlier, based upon current assumptions, the Holyrood site is expected to remain an industrial site. As a result, at this time there are no legal or constructive requirements to remove the remaining assets in Phase 2. However, the scope of the required decommissioning could change based upon changes in assumptions, updates in regulations or directions from governing agencies such as the NLDEC. It is recommended that as the assumptions and requirements of the environmental regulators become known, the estimate be further refined for Phase 2.

# 3.0 OPINION OF PROBABLE COST

Section 3 presents the opinion of probable cost (OPC) of the planned decommissioning and demolition and an associated cash flow projection based upon the proposed long term operational objectives and the legislative and constructive obligations as described in Section 2. The costing methodology, including assumptions and exclusions are also presented.

## 3.1 METHODOLOGY

The OPC was developed by first defining the operational requirements of NLH and the legislative and constructive constraints governing decommissioning and demolition. Once these were established, an approach and schedule for the demolition was developed and budget pricing from a nationally based contractor with recent experience in demolishing two similarly sized thermal generating stations in Atlantic Canada and a 2400 MW plant in Ontario was sought. In addition to budget pricing from the demolition contractor, the OPC was developed using budget pricing from local suppliers and contractors, salary and labour burden data from NLH, and in house experience with demolition pricing.

The OPC was sub-divided into 5 groupings and the methodology for the development of the OPC within each group is presented below.

**Environmental Compliance and Studies**

Environmental Compliance and Studies includes those tasks to be completed to ensure the appropriate environmental permits, studies and assessments are completed, including hazardous materials surveys, asbestos monitoring, ESAs, environmental remediation, EA registration, landfill permitting and closure reporting. This grouping also includes an allowance for future studies.

Development of environmental compliance costs were based upon in house experience with similar type projects in NL, DELC requirements, and local laboratory and equipment rental costs.

No intrusive environmental studies were conducted as part of this cost estimate and only limited consultation with environmental regulators has been conducted to date. It is possible that requirements beyond those identified in current legislation may be imposed upon the project. Nevertheless, allowances to register the project under provincial environmental assessment legislation; complete Phase II ESAs, remediation and risk assessments; and to comply with existing regulatory requirements are carried in the OPC. A cost to complete a full environmental assessment is not included, as it is not known if this will be required.

**Environmental Decommissioning**

Environmental decommissioning includes chemical and fuel removals, tank and pipeline cleaning, asbestos abatement, development of a C&D landfill, hazardous waste management/disposal and closure of the landfills.

Development of decommissioning costs were based on the demolition contractor's experience, local contractor pricing, and estimated time and salary and labour burden costs for NLH staff to support and/or complete in plant tasks. Decommissioning includes ACM abatement, cleaning of petroleum storage tanks and removal of transformers, etc.

NLH time to support the decommissioning was also included and was based on Stantec experience with similar type demolition projects in Atlantic Canada. The following on-site staffing compliment is anticipated: shift supervisors/operators, chemical technicians/environmental management system coordinators, electricians, and utility/laborers. Staff responsible for contract administration will be full time, others will be part time. Further details on the required site support times are provided in Appendix D.

**Demolition**

Demolition includes the dismantling of site infrastructure for off-site recycling or disposal or on site landfilling. The infrastructure to be demolished is illustrated in SK-001 in Appendix A.

In order to develop the demolition cost, an experienced contractor visited the HTGS site and was provided with facility drawings, material quantities and photographs. The contractor pricing was supplemented by in house experience with demolition and components of the contractor's pricing were cross checked with budget pricing from local environmental and hazardous waste contractors. All sub-contractors to the general demolition contractor were assumed to be marked up at 15%, per the industry standard.

In addition, quantities and unit rates for civil works during demolition were developed, including: the C&D landfill and landfill and leachate pond capping, excavation and backfilling of voids (equalization basis, utilidors, seal pits, cooling water pumphouses buried piping) and installation of concrete caps on the cooling water intakes and discharges.

**Owner's Management and Engineering Costs**

Owner's management and engineering costs include direct and indirect, on site and head office project management and engineering fees associated with preparation of tender documents for the decommissioning and demolition, assistance during tendering, bid review, project planning assistance, and support during construction.

Development of Owner's costs for direct, on-site and head office project management and indirect project management were based on input from NLH and current NLH salary and labour burden costs. The direct project management staffing from site is assumed to include: a site

supervisor, administrative assistant, a safety specialist and two plant engineers. Head office direct project management staffing includes: a project manager, two project engineers, an environmental specialist, a safety hygienist, communications personnel and a scheduler, none of whom are dedicated to the project on a full time basis.

Indirect, head office, project management staff includes legal support, safety, human resources and procurement assistance at an assumed percentage of the overall project costs.

Further details on the required project management support time for direct Head Office and on-site staff is provided in Appendices D and E respectively.

Engineering costs of 15% of project costs were based on in house experience with similar decommissioning and demolition projects in New Brunswick. Full time, on-site engineering support during construction is not included in the estimate.

**Contingencies**

Contingencies are included in the OPC as monies that will be expended during the course of the project, but are currently unidentified. Contingencies have been added to the OPC presented herein and vary in each grouping with the degree of confidence in the estimate, the lower the contingency, the higher the anticipated accuracy.

**Scrap Metal and Salvage**

As directed by NLH, the OPC did not capture any value for remaining equipment or scrap. Given the current project planning horizon and the volatility in scrap metal pricing, it is believed that this is a most prudent costing approach.

## 3.2 OPC ASSUMPTIONS, QUALIFICATIONS AND EXCLUSIONS

The OPC presented herein is based upon the following assumptions, exclusions and/or qualifications:

1. Environmental assessment and remediation costs are based on an assumed level of effort and that on-site management of impacted soils will be permitted.

2. Environmental assessment and remediation of areas outside of the HTGS have not been included.

3. Decommissioning of the air quality monitoring stations associated with the HTGS has not been included.

4. Remaining equipment has no salvage value.

5. Metals recovered in the demolition have no assigned scrap value in the estimate.

6. NLH will capture the sunk cost of the unusable Bunker C fuel, as a write off within their internal accounting systems. The disposal cost of unusable fuel is included in the OPC.

7. All costs are presented in 2016 dollars (no escalation).

8. Union rates for labour, with no room and board allowance are used for NLH and contractor staffing.

9. Taxes are not included.

10. Maintenance and/or modifications to the water treatment, circulating cooling water system, and waste water treatment systems and equalization basins are not included.

## 3.3 OPC FOR THE HTGS

The OPC for the Phase 1 decommissioning and demolition of the HGTS is $15,237,000 and a breakdown of the cost is provided in Table 1 below.

**Table 1: Summary of Phase 1 Decommissioning and Demolition Costs**

| OPC Components | Phase 1 | % of Total |
|---|---|---|
| Environmental Compliance and Studies | $1,377,000 | 9 |
| Environmental Decommissioning | $2,988,000 | 20 |
| Demolition | $4,400,000 | 29 |
| Owner's Management and Engineering | $4,563,000 | 30 |
| Contingency | $1,909,000 | 12 |
| **Total** | **$15,237,000** | **100** |

Detailed breakdowns are provided in Section 3.3.2.

The OPC for the Phase 2 decommissioning and demolition of the HGTS is $25,839,000 and a breakdown of the cost is provided in Table 2 below.

It is noted however that, because the scope of Phase 2 activities could change based upon changes in assumptions, updates in regulations or directions from governing agencies such as the NLDEC, the Phase 2 costs are provided for information and comparative purposes only; and will not be included in the ARO submitted to the PUB.

**Table 2: Summary of Phase 2 Decommissioning and Demolition Costs**

| OPC Components | Phase 2 | % of Total |
|---|---|---|
| Environmental Compliance and Studies | $ 367,000 | 4 |
| Environmental Decommissioning | $5,879,000 | 22 |
| Demolition | $9,143,000 | 33 |
| Owner's Management and Engineering | $7,368,000 | 29 |
| Contingency | $3,082,000 | 12 |
| **Total** | **$25,839,000** | **100** |

Detailed breakdowns are provided in Section 3.3.2.

### 3.3.1 Demolition Risk

As noted in Section 2, there is a risk that the powerhouse could be damaged and SC and CT operations be impacted should the three stacks be demolished in Phase 1 as opposed to a later time at the planned end of SC operations. This is because of the potential for flying debris to damage the roof and equipment within the adjacent powerhouse. There is also a risk that the controlled explosive demolition could fail and the stacks would remain standing but in a weakened and unsafe state.

The risk of damage or failure could be mitigated by delaying the demolition until the end of SC operations or by employing an alternate stack demolition procedure utilizing specialized wall climbing scaffolding for the upper portions of the stack. It is also anticipated that windy conditions would require many starts and stops to the operations, increasing standby times and the duration of the work.

### 3.3.2 OPC Details

This section provides a detailed breakdown of decommissioning and demolition costs by phase and illustrates contractor and NLH costs. Table 3 provides a detailed breakdown of the Phase 1 and Table 4 provides the breakdown for Phase 2.

**Table 3: Phase 1 Decommissioning and Demolition Costs**

| | **Phase 1 - 2020 -2023** | |
|---|---|---|
| 1 | **A. Environmental Compliance and Studies** | **Total** |
| 2 | Hazardous Building Materials Survey | $ 30,000 |
| 3 | Permitting - EA Registration, Closure Plan and C&D Landfill Permitting | $ 60,000 |
| 4 | Phase II Environmental Site Assessment | $ 239,000 |
| 5 | Environmental Risk Assessment and Remediation | $ 698,000 |
| 6 | Future Studies | $ 350,000 |
| 7 | Sub-total | $ 1,377,000 |
| 8 | **B. Environmental Decommissioning** | **Total** |
| 9 | Cleaning of Bunker C, day and additive tanks and associated pipeline | $ 2,400,000 |
| # | Bulk, small volume chemical removal and sweep | $ 173,515 |
| # | NLH staff support, electrical disconnects/isolation activities, contract admin | $ 116,370 |
| # | Drain 7 transformers and dispose of oils and carcasses | $ 85,293 |
| # | Develop C&D disposal site and parital cap | $ 180,040 |
| # | Prep of stack fall area | $ 32,903 |
| # | Sub-total | $ 2,988,121 |
| # | **C. Demolition** | **Total** |
| # | Mobilization and demobilization | $ 75,000 |
| # | Demolish Bunker C tanks, day and fuel additive tanks and pipeline | $ 810,000 |
| # | Demolish marine jetty and access bridge | $ 1,650,000 |
| # | Demolish stacks, breeching and protection of powerhouse/ancillary bldgs | $ 1,830,000 |
| # | Repair, install new siding in boiler house wall at breeching locations | $ 9,900 |
| # | Demolish decommissioned gas turbine building | $ 25,000 |
| # | Sub-total | $ 4,399,900 |
| # | **D. Owner's Management and Engineering Costs** | **Total** |
| # | On Site Project Management Team | $ 1,352,743 |
| # | Head Office Project Management Team | $ 1,369,218 |
| # | Head Office (legal, safety, HR, procurement at 6% A, B and C) | $ 525,901 |
| # | Engineering Support (15% of A, B and C) | $ 1,314,753 |
| # | Sub-Total | $ 4,562,615 |
| # | **E. Contingency** | **Total** |
| # | Environmental Planning Contingency @ 25% | $ 344,250 |
| # | Decommissioning Contingency @ 15% | $ 448,218 |
| # | Demolition Contingency @ 15% | $ 659,985 |
| # | Owner's Costs Contingency @10% | $ 456,262 |
| # | Sub-total | $ 1,908,715 |
| # | **Phase 1 TOTAL DECOMMISSIONING AND DEMOLITION COST** | **$ 15,236,351** |

**Table 4: Phase 2 Decommissioning and Demolition Costs**

| # | **Phase 2** | |
|---|---|---|
| # | **A. Environmental Compliance and Studies** | **Total** |
| # | Environmental Liasion | $ 50,000 |
| # | Asbestos abatement monitoring and sampling | $ 100,000 |
| # | Phase II Environmental Site Assessment | $ 50,000 |
| # | Environmental Risk Assessment and Remediation | $ 117,380 |
| # | Post closure reporting | $ 50,000 |
| # | Sub-total | $ 367,380 |
| # | **B. Environmental Decommissioning** | **Total** |
| # | Diesel fuel recovery (Credit for fuel = cost of removal) | $ - |
| # | Cleaning of diesel fuel tanks | $ 7,100 |
| # | Chemical/sludge removal, drain oils, plug drains,clean oily water separators | $ 112,615 |
| # | Washdown of boilers and building | $ 110,400 |
| # | NLH staff support, electrical disconnects, chem techs and contract admin | $ 1,898,341 |
| # | Drain 4 transformers and dispose of oils and carcasses | $ 48,739 |
| # | Drilling lines, removal of chemicals and mercury containing items and lights | $ 486,736 |
| # | Abatement of asbestos containing materials (boilers and boiler cladding) | $ 2,259,009 |
| # | Abatement of asbestos containing materials (defined during demolition) | $ 100,000 |
| # | Management of lead and/or zinc impacted paint | $ 50,000 |
| # | Close C&D disposal site | $ 327,533 |
| # | Close hazardous waste landfill and backfill lagoon | $ 478,710 |
| # | Sub-total | $ 5,879,183 |
| # | **C. Demolition** | **Total** |
| # | Contractor mobilization and demobilization | $ 306,605 |
| # | Demolish diesel fuel tanks | $ 10,000 |
| # | Demolish turbine hall and T/G units | $ 1,737,000 |
| # | Demolish boiler house and units | $ 6,103,042 |
| # | Demolish cooling water pumphouses | $ 167,000 |
| # | Demolish WWT and equilzation basin buildings | $ 95,139 |
| # | Backfill voids, trenches, cap cooling water intake/outlets and wetwells | $ 723,805 |
| # | Sub-total | $ 9,142,591 |
| # | **D. Owner's Management and Engineering Costs** | **Total** |
| # | On Site Project Management Team | $ 2,246,400 |
| # | Head Office Project Management Team | $ 1,890,000 |
| # | Head Office (legal, safety, HR, procurement at 6% A, B and C) | $ 923,349 |
| # | Engineering Support (15% of A, B and C) | $ 2,308,373 |
| # | Sub-Total | $ 7,368,122 |
| # | **E. Contingency** | **Total** |
| # | Environmental Planning Contingency @ 25% | $ 91,845 |
| # | Decommissioning Contingency 15% | $ 881,877 |
| # | Demolition Contingency @ 15% | $ 1,371,389 |
| # | Owner's Costs Contingency @10% | $ 736,812 |
| # | Sub-total | $ 3,081,923 |
| # | **Phase 2 TOTAL DECOMMISSIONING AND DEMOLITION COST** | **$ 25,839,200** |

## 3.4 PROJECTED CASH FLOW

The projected cash flow for the two project phases is provided in Tables 4 and 5 below. The contingency is distributed across the duration of the project on a weighted basis.

**Table 5: Phase 1 Cash Flow – 2020-2023**

| Year | Total |
|---|---|
| 1 | $1,554,000 |
| 2 | $5,759,000 |
| 3 | $2,255,000 |
| 4 | $5,668,000 |
| **TOTAL** | **$15,236,000** |

**Table 6: Phase 2 Cash Flow**

| Year | Total |
|---|---|
| 1 | $2,300,000 |
| 2 | $6,227,000 |
| 3 | $10,956,000 |
| 4 | $4,237,000 |
| 5 | $2,119,000 |
| **TOTAL** | **$25,839,000** |

# 4.0 APPENDICES

Appendix A Demolition Plan – SK-001 Rev K

Appendix B Decommissioning and Demolition Schedule

Appendix C Decommissioning and Demolition Methodology

Appendix D Site Project Management Staffing

Appendix E Head Office Project Management Staffing

# APPENDIX A

Demolition Plan – SK-001 Rev. K

PUMPHOUSE #2

INDIAN POND

WASTE WATER TREATMENT EQUALIZATION BASINS

DAY TANK

ABANDONED SEPTIC FIELD

PUMPHOUSE #1

NEW SEPTIC SYSTEM

WASTE WATER TREATMENT PLANT

CHEMICAL STORAGE BUILDING

BOILERHOUSE TURBINE/ GENERATORS

#1 #2 #3

MAINTENANCE BUILDINGS

BOILER STACKS

1 SK-001

SEE DETAIL 1 FOR TRANSFORMER DECOMMISSIONING

TRAINING CENTER

COOLING WATER DISCHARGE

ROADWAY

HYDROGEN STORAGE BUILDING

SHAWMONT BUILDING (WAREHOUSE)

ERT BUILDING

CTG

DECOMMISSIONED GAS TURBINE

BUNKER 'C' LINE BETWEEN TANK FARM AND DAY TANK

BLACK START GENERATORS

DIESEL FUEL TANKS

SWITCH YARD

TANK #1

CONCEPTION BAY

TANK FARM

16"ø BUNKER 'C' PIPELINE FROM JETTY

HAZARDOUS WASTE LANDFILL (RETAIN & CAP)

LEACHATE HOLDING POND

N

RT1 RT2

UST1 T9 UST2 SST12 UST3 SST34

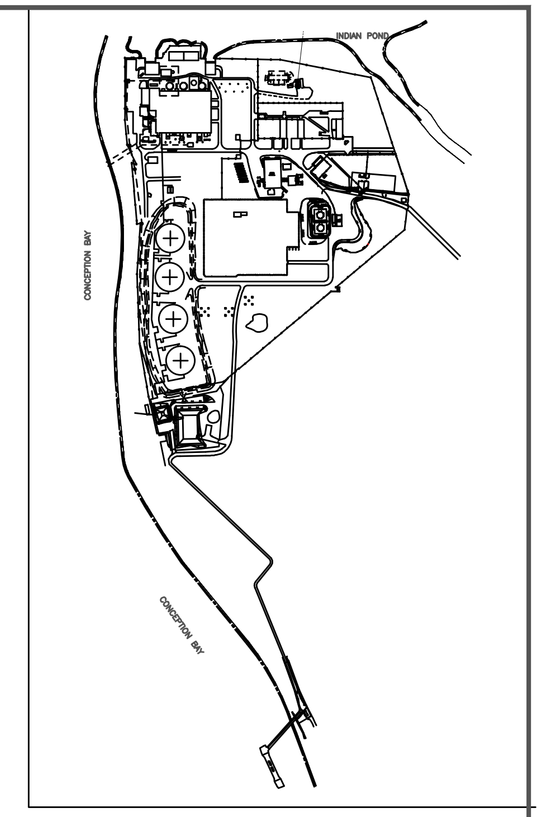
T1 T2 T3

ROADWAY

DETAIL 1

SCALE: NTS SK-001

TRANSFORMER DECOMMISSIONING




KEY PLAN

16"ø BUNKER 'C' PIPELINE

CAUSEWAY

JETTY HEAD

LEGEND

- DEMOLISH AND/OR DECOMMISSION BUILDINGS AND EQUIPMENT ~PHASE 1
- DEMOLISH AND/OR DECOMMISSION BUILDINGS AND EQUIPMENT ~PHASE 2
- TO REMAIN
- MANAGED BY OTHERS TRANSMISSION ASSET

PRELIMINARY
FOR INFORMATION ONLY

| DWG.NO. | TITLE |
|---|---|
| REFERENCE DRAWINGS | |

| NO. | DATE | DESCRIPTION | DWN. | DESIGN. | CHK. | APP'D |
|---|---|---|---|---|---|---|
| J | 2016-06-23 | GENERAL REVISION | MEO | | | |
| H | 2016-06-03 | GENERAL REVISION | JRC | | | |
| G | 2016-05-06 | GENERAL REVISION | JRL | | | |
| F | 2016-05-04 | GENERAL REVISION | JRL | | | |
| E | 2016-04-21 | GENERAL REVISION | JJB | | | |
| D | 2016-04-14 | GENERAL REVISION | JJB | | | |

REVISIONS

Stantec | P.M. MEM | P.T. | JOB No. | DWG. No.



newfoundland labrador hydro a nalcor energy company

**Newfoundland and Labrador Hydro**

| | |
|---|---|
| ELECT. | |
| CIVIL | |
| TRANS. | |
| MECH. | |
| P&C | |
| TELC. | |
| SCALE: | NTS |
| DESIGNED: | MDV |
| DRAWN: | JJB |
| DATE: | 2016-04-04 |
| CHECKED: | |
| APPROVED: | |

# HOLYROOD THERMAL GENERATING STATION DEMOLITION PLAN

W.O. NO.

DWG. NO. SK-001

REV. K

Jul 25, 2016 2:14pm jcrawford C.A.D.

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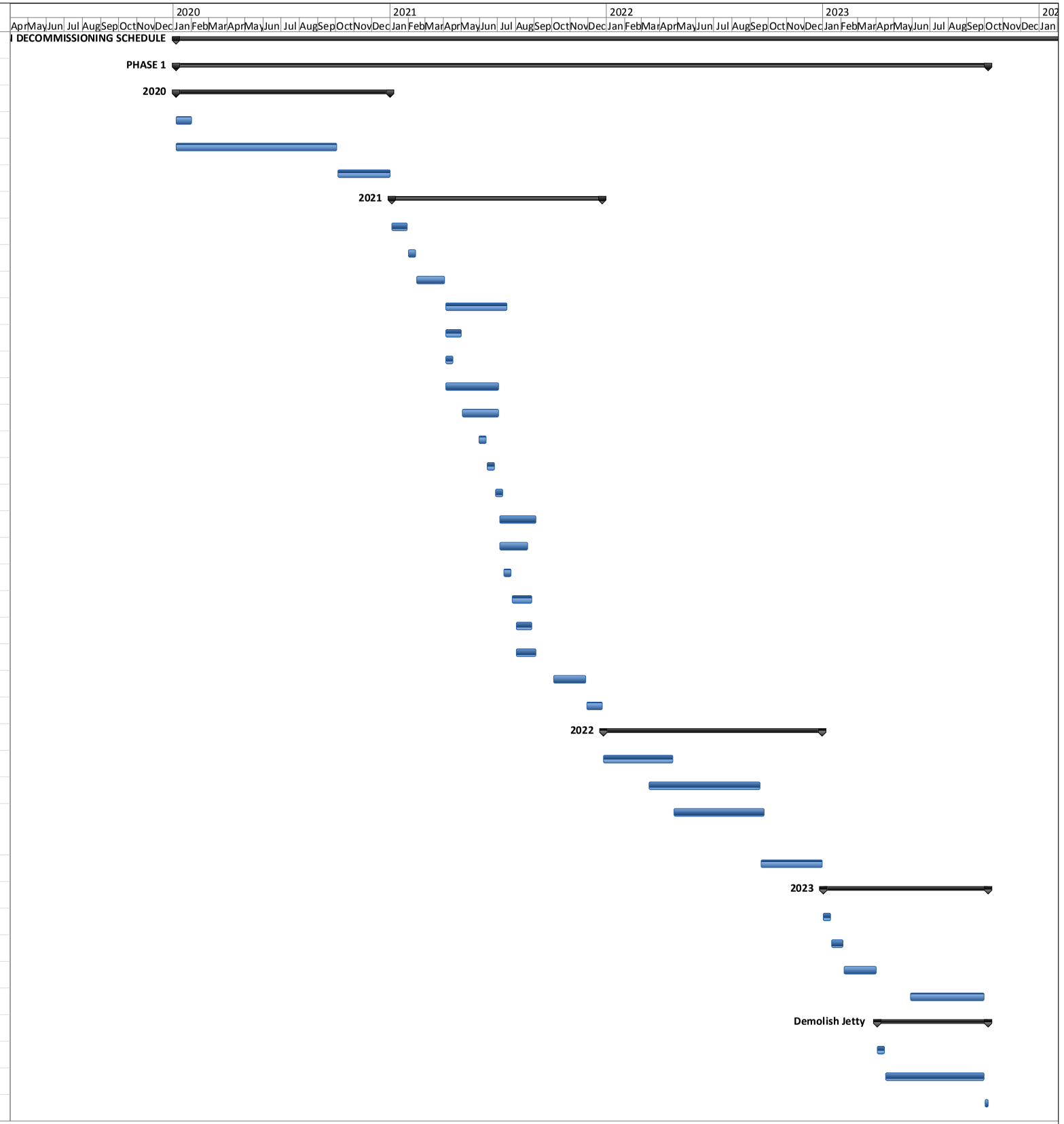
# APPENDIX B

Decommissioning and Demolition Schedule

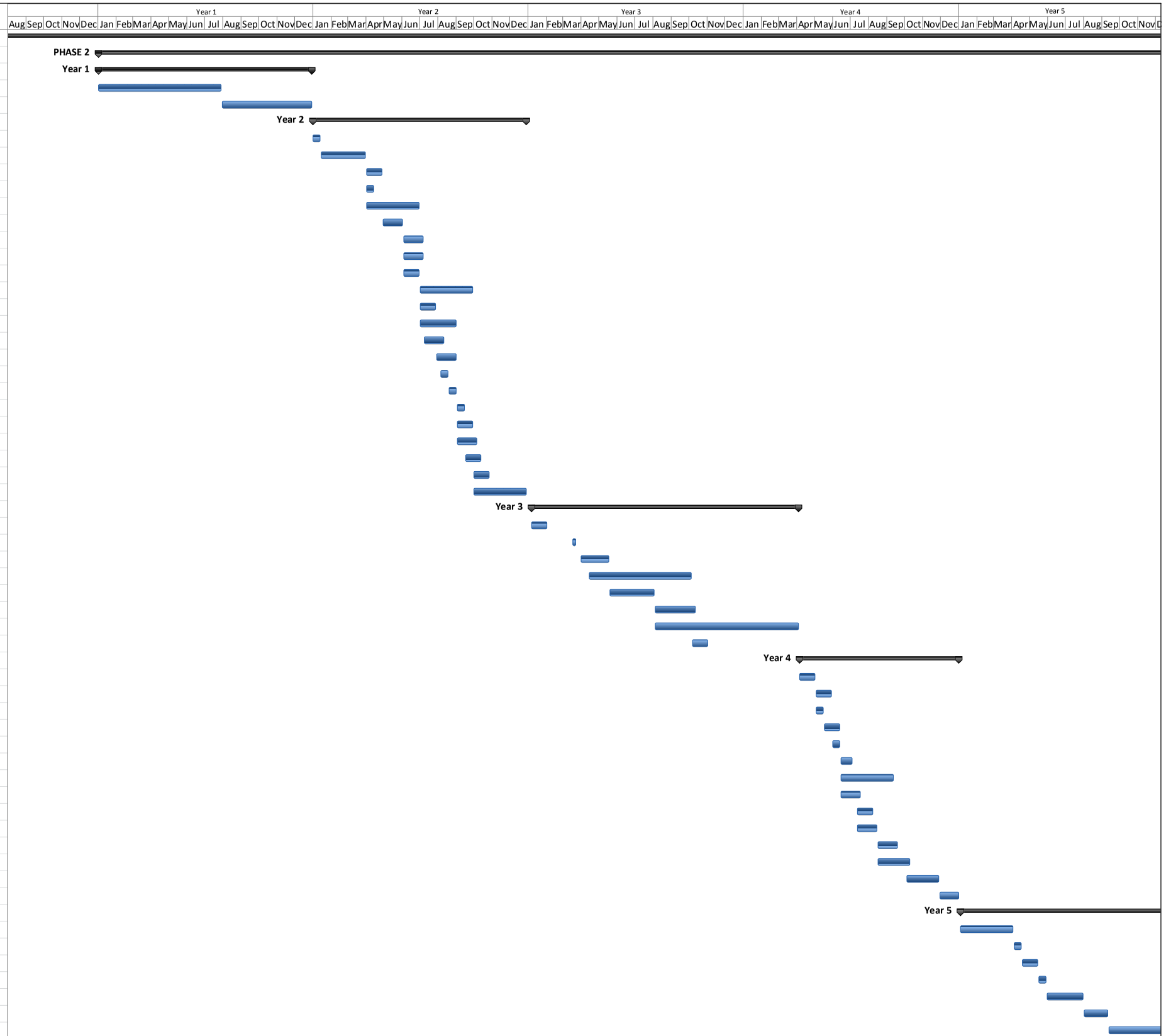
| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1 | **HOLYROOD THERMAL GENERATING STATION DECOMMISSIONING SCHEDULE** | **7825 days** | **Mon 01/06/20** | **Fri 12/31/49** |
| 2 | **PHASE 1** | **980 days** | **Mon 01/06/20** | **Fri 10/06/23** |
| 3 | **2020** | **259 days** | **Mon 01/06/20** | **Thu 12/31/20** |
| 4 | Submit Closure Plan and Register Project with Environment | 4 wks | Mon 01/06/20 | Fri 01/31/20 |
| 5 | Engineering & Spec Development, Tank Farm & Pipeline Demolition | 39 wks | Mon 01/06/20 | Fri 10/02/20 |
| 6 | Hydro Tender Process | 12.8 wks | Mon 10/05/20 | Thu 12/31/20 |
| 7 | **2021** | **255 days** | **Mon 01/04/21** | **Fri 12/24/21** |
| 8 | Hydro Tender Process (Continued) | 4 wks | Mon 01/04/21 | Fri 01/29/21 |
| 9 | Contract Signed | 2 wks | Mon 02/01/21 | Fri 02/12/21 |
| 10 | Contractor Submittal Period | 7 wks | Mon 02/15/21 | Fri 04/02/21 |
| 11 | Hydro Bulk Chemical Removal, Chemical Sweep, Drain Bunker C fuel, Trip Power to Select Equipment | 15 wks | Mon 04/05/21 | Fri 07/16/21 |
| 12 | Hydro - Pumpout Bunker C Tanks | 4 wks | Mon 04/05/21 | Fri 04/30/21 |
| 13 | Clean Day & Fuel Additive Tanks | 2 wks | Mon 04/05/21 | Fri 04/16/21 |
| 14 | Drain & Clean Pipeline | 13 wks | Mon 04/05/21 | Fri 07/02/21 |
| 15 | Clean Bunker Tanks 1 Through 4 | 9 wks | Mon 05/03/21 | Fri 07/02/21 |
| 16 | Demolish Day and Fuel Additive Tanks | 2 wks | Mon 05/31/21 | Fri 06/11/21 |
| 17 | Clean Day Tank Pad Walls & Foundations | 2 wks | Mon 06/14/21 | Fri 06/25/21 |
| 18 | Demolish Day Tank Pad Walls | 2 wks | Mon 06/28/21 | Fri 07/09/21 |
| 19 | Demolish Pipeline | 9 wks | Mon 07/05/21 | Fri 09/03/21 |
| 20 | Demolish Bunker Tanks 1 Through 4 | 7 wks | Mon 07/05/21 | Fri 08/20/21 |
| 21 | Demolish 10 MW CT | 2 wks | Mon 07/12/21 | Fri 07/23/21 |
| 22 | Drain Transformers | 5 wks | Mon 07/26/21 | Fri 08/27/21 |
| 23 | Clean Tank Foundations | 4 wks | Mon 08/02/21 | Fri 08/27/21 |
| 24 | Disassemble Transformers & Remove From Site | 5 wks | Mon 08/02/21 | Fri 09/03/21 |
| 25 | ESA, Entire Site Except Transformers, #2 Oil Tanks & Yard North of Stacks | 8 wks | Mon 10/04/21 | Fri 11/26/21 |
| 26 | Prepare Tender & Award for Remedial Work (If Required) & To Convert Tank Farm to C&D Site | 4 wks | Mon 11/29/21 | Fri 12/24/21 |
| 27 | **2022** | **265 days** | **Mon 12/27/21** | **Fri 12/30/22** |
| 28 | Prepare Tender & Award for Remedial Work, If Required & To Convert Tank Farm to C & D Site (Continued) | 17 wks | Mon 12/27/21 | Fri 04/22/22 |
| 29 | Prepare Tender Stack & Jetty Demoltion | 27 wks | Mon 03/14/22 | Fri 09/16/22 |
| 30 | Site Remedial Work (If Required) And Convert Tank Farm To C&D Site, Laydown Fabric & Pit Run Gravel North Of Stacks (If Required) | 22 wks | Mon 04/25/22 | Fri 09/23/22 |
| 31 | Hydro Tender Process | 15 wks | Mon 09/19/22 | Fri 12/30/22 |
| 32 | **2023** | **200 days** | **Mon 01/02/23** | **Fri 10/06/23** |
| 33 | Hydro Tender Process (Continued) | 2 wks | Mon 01/02/23 | Fri 01/13/23 |
| 34 | Contract Signed | 3 wks | Mon 01/16/23 | Fri 02/03/23 |
| 35 | Contractor Submittal Period | 8 wks | Mon 02/06/23 | Fri 03/31/23 |
| 36 | Drop Stacks & Demolish Breeching | 18 wks | Mon 05/29/23 | Fri 09/29/23 |
| 37 | **Demolish Jetty** | **135 days** | **Mon 04/03/23** | **Fri 10/06/23** |
| 38 | Install Silt Curtain | 2 wks | Mon 04/03/23 | Fri 04/14/23 |
| 39 | Demolish Jetty / Access Bridge | 24 wks | Mon 04/17/23 | Fri 09/29/23 |
| 40 | Remove Silt Curtain | 1 wk | Mon 10/02/23 | Fri 10/06/23 |




Project: sch_pvs_25072016_rev1.
Date: Mon 07/25/16

Task | Summary | External Milestone | Inactive Summary | Manual Summary Rollup | Finish-only
Split | Project Summary | Inactive Task | Manual Task | Manual Summary | Deadline
Milestone | External Tasks | Inactive Milestone | Duration-only | Start-only | Progress

| ID | Task Name | Duration |
|---|---|---|
| 1 | **HOLYROOD THERMAL GENERATING STATION DECOMMISSIONING SCHEDULE** | **7825 days** |
| 41 | **PHASE 2** | **1305 days** |
| 42 | **Year 1** | **260 days** |
| 43 | Engineering & Spec Development, Powerhouse Demolition | 30 wks |
| 44 | Hydro Tender Process | 22 wks |
| 45 | **Year 2** | **260 days** |
| 46 | Contract Signed | 2 wks |
| 47 | Contractor Submittal Period | 11 wks |
| 48 | Hydro Remove Bulk Chemicals | 4 wks |
| 49 | Hydro Chemical Sweep | 2 wks |
| 50 | Abatement, Unit 1 Boiler | 13 wks |
| 51 | Drill Low Points & Drain Oil and Chemical, Remove Haz Mat Items - Unit 2 B/B | 5 wks |
| 52 | Drill Low Points & Drain Oil and Chemical, Remove Haz Mat Items - Unit 3 B/B | 5 wks |
| 53 | Hyrdo Wash Turbine Building & Other Plant Areas | 5 wks |
| 54 | Drain Transformer Oil & Remove From Site | 4 wks |
| 55 | Abatement, Unit 2 Boiler | 13 wks |
| 56 | Hydro Wash Boiler 1 | 4 wks |
| 57 | Shipout Transformer | 9 wks |
| 58 | Drill Low Points & Drain Oil and Chemical, Remove Haz Mat Items - T/G | 5 wks |
| 59 | Drill Low Points & Drain Oil and Chemical, Remove Haz Mat Items - Unit 1 B/B | 5 wks |
| 60 | Clean #2 Tanks & Pads | 2 wks |
| 61 | Demolish #2 Tanks | 2 wks |
| 62 | Phase 2 ESA Transformer & #2 Oil Tank Area | 2 wks |
| 63 | Abatement, Vacc Clean System & Transite | 4 wks |
| 64 | Drill Low Points & Drain Oil and Chemical, Remove Haz Mat Items - Common | 5 wks |
| 65 | Possible Remediation Transformer & #2 Oil Tank Area | 4 wks |
| 66 | Hydro Wash Boiler 2 | 4 wks |
| 67 | Abatement, Unit 3 Boiler | 13 wks |
| 68 | **Year 3** | **325 days** |
| 69 | Hydro Wash Boiler 3 | 4 wks |
| 70 | Hydro Plug Floor Drains | 1 wk |
| 71 | Galbestos Removal T/B | 7 wks |
| 72 | Demolish T/B | 25 wks |
| 73 | Galbestos Removal B/B | 11 wks |
| 74 | Dispose of Crushed Concrete in C&D Site | 10 wks |
| 75 | Demolish B/B | 35 wks |
| 76 | Drop B/B | 4 wks |
| 77 | **Year 4** | **194 days** |
| 78 | Clean Powerhouse Trenches | 4 wks |
| 79 | Clean Buried Piping | 4 wks |
| 80 | Galbestos Removal Stage 2 CW Pumphouse | 2 wks |
| 81 | Demolish CW Pumphouses | 4 wks |
| 82 | Dewater Leachate Lagoon | 2 wks |
| 83 | Backfill Leachate Lagoon | 3 wks |
| 84 | Backfill Below Grade Structures & Burried Pipe | 13 wks |
| 85 | Hydro Staff Move Sludge To Landfill | 5 wks |
| 86 | Cap Hazardous Waste Landfill | 4 wks |
| 87 | Demolish WWTP and EQ Basins | 5 wks |
| 88 | Phase 2 ESA, Yard North Of Stacks | 5 wks |
| 89 | Cap Tank Farm C&D site | 8 wks |
| 90 | Engineering & Tender Preparation, Remediation Of Yard North Of Stacks | 8 wks |
| 91 | Hyrdo Tender Process | 4.8 wks |
| 92 | **Year 5** | **260 days** |
| 93 | Hydro Tender Process (Continued) | 13 wks |
| 94 | Sign Contract | 2 wks |
| 95 | Contractor Submittal Period | 4 wks |
| 96 | Open Cap In Hazardous Waste Landfill | 2 wks |
| 97 | Remediate Yard North Of Stacks | 9 wks |
| 98 | Close Cap, Hazardous Waste Landfill | 6 wks |
| 99 | Environmental Closure Reporting | 15.8 wks |




Project: sch_pvs_25072016_rev1.
Date: Mon 07/25/16

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Task | Summary | External Milestone | Inactive Summary | Manual Summary Rollup | Finish-only |
| Split | Project Summary | Inactive Task | Manual Task | Manual Summary | Deadline |
| Milestone | External Tasks | Inactive Milestone | Duration-only | Start-only | Progress |

# APPENDIX C

Decommissioning and Demolition Methodology

# HOLYROOD THERMAL GENERATING STATION DECOMMISSIONING

# DEMOLITION METHODOLOGY

# APPENDIX C

## A) Phase 1 - April to December, 2021

1. Hydro staff will drain and collect bulk chemicals, fuel additive and lube oils from the plant equipment not required to maintain synchronous condenser operations or plant building integrity. These will be removed from site by a local disposal/recycle contractor.

2. Fyrquel will be drained by hydro staff and returned to the supplier.

3. Surplus recoverable Bunker C fuel will be drained from the fuel feed system by hydro staff to the extent possible and will be removed from site by a local disposal/recycle contractor.

4. Hydro staff will collect containers of surplus chemical, oils, paints and like products and have them removed from site by a local disposal/recycle contractor.

5. Hydro staff can trip power feeds to various disused pieces of equipment.

6. Completing items 2 through 6 above will result in the plant being in a safer condition from the standpoint of potential spills or accidents and fire loading.

7. Demolish all 4 Bunker C storage tanks. Assume that the contents of the tanks have been consumed to the 3 foot level. A local contractor will set up temporary piping and pumping to transfer the remaining useable bunker from the tanks to tanker trucks for sale to an offsite user. The oil level will be dropped to the sludge level which is expected to be at approx. the 1 foot level. Tanks will be cleaned by a local cleaning sub- contractor. Waste oil and sludge to be disposed of off site locally. Demolition will be by excavators with shear attachments. Plates will be sold for scrap in large sizes cut to suit trucking, not reduced to 5 foot and under. Debris will be stockpiled in the South West corner of the tank farm until this area is converted to a C&D landfill.

8. In the Fall, once the tanks have been removed from the tank farm a Phase 2 environmental assessment will be performed. Any remedial work required as well as required modifications to convert the tank farm area into a C and D landfill will be completed in 2022.

9. Day tank and fuel oil additive tanks will be demolished in a similar fashion to the large storage tanks. The concrete dike will be cleaned by steam cleaning or pressure washing and the walls will be broken to grade using excavators with crusher attachments and rock hammers. A vacuum truck will be used to remove wash water which will be disposed of offsite.

10. The bunker fuel piping system will be drained, flushed and cleaned using steam or high pressure washing and vacuum trucks from the tanker unloading arms on the jetty through to the burner fronts of all 3 units. As has been done in the past the line will be cleaned in 100 foot sections with coupons cut into the piping for cleaning wand access. Contaminated wash water will be collected in a vacuum truck for offsite disposal. The fuel pumps and heaters will be cleaned as well.

11. The piping system from the jetty to the South wall of the powerhouse will be removed, along with the supports, to grade level. The open pipe ends will be capped.

12. A phase 2 ESA will be completed in the area of demolition and any remedial work required will be completed in 2022.

13. Unit 1 and 2 main output, station service and exciter transformers and T9 (unused old CT transformer) will be drained of oil, oil to be trucked to a recycle/disposal facility and transformer carcasses to be shipped off for salvage at a licensed facility. The main output transformers are a Transmission asset therefore they will determine the final disposal of this item.

14. Decommissioned CT to be demolished using excavators with shear attachments. The concrete pad will have holes punched in it using an excavator with a rock hammer attachment.

15. Debris from the above activities will be disposed of in the South West corner of the tank farm.

**B) <u>Phase 1 - 2022</u>**

1. Prior to demolition work taking place in the area between the stacks and EQ basins a 6" layer of backfill material will be placed over the yard. This will prevent any possible ground contamination from being spread over the plant site during demolition activities. A phase 2 ESA will be performed in this area after final plant demolition and any remediation required will be addressed at that time.

2. The tank farm area will be converted to a C and D landfill and any remediation required will be accomplished at this time.

**C) Phase 1 - 2023**

1. Jetty demolition will be accomplished using a barge with integral crane. This work will take place through the summer. Delay days due to weather will have to be factored in.

2. The piles will be cut below the deck manually with a diamond wire saw. It's expected the deck is strong enough it won't cantilever over and bind the cuts.

3. The crane will then take the load of a piece of deck to be sliced and the piece will be cut with a diamond wire saw. These pieces will be 3 feet thick. The cuts will be made perpendicular to the shoreline.

4. The pieces will then be lowered into the barge.

5. For the piles, an underwater team will cut the metal pipe perimeter and also the concrete filler if rebar is present. If there is no rebar then no concrete cutting is required. The pile will be snapped off.

6. The pile will be removed after it's cut or snapped and place in the barge.

7. The concrete will be disposed of in the old tank farm. The barge will come to shore where a shore based crane will load the pieces on trucks.

8. A silt curtain will be installed around the entire in-water works.

9. The stacks will be dropped towards the East. All stacks will all be dropped on the same day with a few hours delay between drops. The stacks will be prepped for blasting by cutting a mouth in each stack on the East side, similar to how a tree would be cut to fell it. Sections of wind shell will be left in the mouth and these will be drilled and filled with dynamite. Just prior to the blast the back of the stack will be cut horizontally along the bottom. Stack concrete will be pulverized and disposed of in the old tank farm. Stack liner will be processed for scrap and insulation will go to the tank farm C&D location.

10. The breeching exterior to the boiler house will be demolished prior to the stack drops. The bricks lining the breeching are expected to be contaminated with flue gas by products therefore these will be disposed of in the hazardous waste landfill. Siding will then be installed over the breeching openings.

**D) Phase 2 - Following Cessation of Synchronous Condenser Operations - Year 1**

1. Planning and engineering development.

**E) Phase 2 - Year 2**

1. Starting in April, Hydro staff will drain and collect bulk chemicals from the WTP and powerhouse and lube oils and no. 2 fuel oil from the plant equipment that was in operation. These will be removed from site by a local disposal/recycle contractor. The WWTP will be kept operational.

2. Hydro staff will collect containers of surplus chemical, ODS, firefighting gaseous agents, oils, paints and like products and have them removed from site by a local disposal/recycle contractor.

3. Hydro staff can trip power feeds to disused pieces of equipment. Lighting panels, receptacles and the elevator will be kept operational until the abatement is complete.

4. Approx. April, the demolition contractor (DC) will have mobilized to site and will start work.

5. Hydro staff work identified in 1 through 3 above will be performed concurrent with the abatement work proceeding. The various aspects of the work will be scheduled so that they don't interfere with each other.

6. The 2 outside no. 2 fuel oil tanks will be cleaned and demolished through the summer per methodology in items 8, 10 and 11 above. The pipeline supports will be cut at grade. Insulation will be disposed of in the tank farm C and D landfill.

7. Each boiler will be abated as a type 3 ACM job, one at a time in succession. This is expected to take 9 months total. If necessary the plant will have to be kept heated until all final lock down gluing is completed. Hydro will retain an asbestos monitoring company to oversee the health and safety of the work.

8. The vacuum cleaning piping is ACM contaminated so it will be removed in sections using glove bagging, sealed and disposed of at the Robin Hood landfill. As well the remaining non friable ACM under the MCC's will be removed and wrapped in plastic and placed in the tank farm C&D site.

9. Concurrent with abatement, the demolition contractor will be drilling low points and draining the residual fluids from all plant systems.

10. These systems will then be flushed and cleaned to the point that the piping is safe to work on and the scrap is not contaminated. Oily waste water will be collected and sent offsite for disposal.

11. Hydro staff will be washing the plant in areas that the contractor is not working in and will also wash the outside and the inside of the gas path of each boiler following abatement of each boiler. Wash water will be treated in the WWTP.

12. Hydro staff will have the ODS removed by a local contractor.

13. The demo contractor will also be removing plant lighting and disposing of hazardous bulbs as well as any mercury found or PCB filled bushings that may be found.

14. The DC will drain remaining liquid filled transformers, 4 in total, and dispose of the oil at a licensed facility. The transformer carcasses will then be shipped off site to a licensed cleaning and recycling facility. As mentioned above the Unit output transformers are a transmission asset.

15. As of year-end , except for washing the unit 3 boiler area, the plant should be washed clean, abated of friable ACM and ash contaminated insulation and be free of all PCB's, hazardous products oils and chemicals.

16. A phase 2 ESA will be completed in the no. 2 fuel tank and transformer areas and any remedial work required will be completed prior to cold weather.

**F) <u>Phase 2 – Year 3</u>**

1. In January hydro staff will finish washing the Unit 3 boiler and boiler building area.

2. Starting approx. April demolition will commence with the turbine building first. Any remaining galbestos siding will be removed by machine. As areas of the turbine hall become exposed demolition will proceed on the building structure using excavators, both high reach and regular, with shears and crusher attachments. Heavier thickness steel will be cut by hand using torches with staff on man lifts.

3. All equipment and concrete pedestals will be removed to grade. The crushed concrete will be disposed of in the C and D landfill. Demolition of the turbine hall should be complete by the end of September.

4. Once the turbine hall galbestos is removed the boiler building galbestos removal will be completed. Galbestos will be wrapped in plastic and landfilled in the tank farm C and D landfill.

5. Following demolition of the turbine building the boiler building will be prepped for explosive charges and the boilers and boiler building will be dropped South into the turbine hall. For preparation, the lower 2 floors will have all of the equipment totally removed using machinery and by hand with torches as required. The columns will be stripped of items attached to them. Cuts will be made in select columns and shaped charges will be installed to cut and blast the columns. All gas path scrap should be kept on the turbine and boiler building concrete pad until it is determined to be free of ash otherwise precipitation will produce contaminated runoff. Runoff from the pad areas can still be treated in the WWTP.

The runoff will collect in the various sumps in the powerhouse where it will be pumped via submersible pumps to the WWTP. When the boilers and building are down the scrap will be cut up and prepped for shipping.

6. Hydro staff will plug any drains that would allow contaminated water to be routed anywhere but the WWTP.

**G) <u>Phase 2 – Year 4</u>**

1. The timing of demolition of the WWTP and EQ basins has to be coordinated with the capping of the hazardous waste landfill and backfilling of the leachate pond.

2. Hydro staff will remove any remaining sludge in the WWTP, EQ basins and leachate pond and dispose of it in the hazardous waste landfill. A vacuum truck will be used for this purpose and dewatering of the sludge is not considered. This will be completed just prior to demolition of the WWTP and EQ basins.

3. Remaining buildings including the 2 CW pumphouses, the WWTP and EQ basin building will be demolished and backfilled. This work will start in May and the order of demolition will be the CW pumphouses first then the WWTP and EQ basins. The WWTP and basins must be left until last so any contaminated water can be treated. The galbestos siding on the stage 2 pumphouse will be removed first and deposited in the tank farm C&D site.

4. The hazardous waste landfill site will be capped starting in May and will be completed just after the last sludge is deposited.

5. The leachate lagoon will be dewatered to the WWTP just before it's demolished and the sludge and liner will be disposed of in the hazardous waste landfill. The leachate pond will then be backfilled and hydroseeded. Any contaminated water accumulating in the landfill will have to be disposed of off-site following this time period.

6. Buried piping will be exposed by excavation, removed or broken open and backfilled. Below grade structures will be backfilled. Concrete caps will be installed on the CW pumphouse inlets and CW discharge piping. Below grade structures include the CW pumphouses, EQ basins, seal pits, utilidors and oil separators.

7. Buried piping that is contaminated will be cleaned using similar equipment to that used for bunker pipeline cleaning. Waste water from heavy metal contaminated lines will go to the WWTP prior to its demolition. Oil contaminated lines will have the waste wash water disposed of off site.

8. A phase 2 ESA will be completed on the area North of the boiler building where the pumphouses and WWTP/EQ basins were.

9. The powerhouse floor trenches and sumps will be cleaned by the DC using steam or power washers and the contaminated wash water will be disposed of off site. The floor slab will have holes hammered in it to facilitate drainage.

10. Crushed concrete from the boiler house demolition will be disposed of in the C and D landfill.

11. The tank farm C and D site will be closed and capped in the fall.

**H) <u>Phase 2 – Year 5</u>**

1. Remediation will be completed as required in the area North of the boiler building.

# APPENDIX D

Site Project Management Staffing

## Appendix D

## Site Project Staff

| A. Site Project Management Staff | | |
|---|---|---|
| **Position** | **Year** | **Utilization** |
| Site Supervisor | Phase 1 - 2020 & 2023 and Phase 2 – Year 1 & Year 5 | 50% |
| | Phase 1 - 2021 & 2022 and Phase 2 – Years 2, 3,and 4 | 100% |
| Administrative Assistant | Phase 1 - 2020 & 2023 and Phase 2 – Year 1 & Year 5 | 50% |
| | Phase 2 - Years 2, 3, and 4 | 100% |
| Safety Specialist | Phase 1 - 2020 & 2023 and Phase 2 – Year 1 & Year 5 | 50% |
| | Phase 2 - Years 2, 3, and 4 | 100% |
| Plant Engineers x 2 | Phase 1 - 2020 through 2023 | 25% |
| | Phase 2 – Years 1 through 5 | 25% |

| B. Site Project Plant Labour | | |
|---|---|---|
| **Position** | **Staff Hours** | |
| | **Phase 1** | **Phase 2** |
| Shift Supervisor/Operators | 420 | 11,420 |
| Chemical Technicians/EMS Coordinators | 410 | 5,200 |
| Electricians | 180 | 1,460 |
| Utility/Labourers | 640 | 8,030 |

# APPENDIX E

Head Office Project Management Staffing

## Appendix E

## Head Office Project Staff

| Position | Utilization |
|---|---|
| Project Manager | 50% |
| Project Engineer x 2 | 50% |
| Environment Specialist | 25% |
| Safety/Hygienist | 10% |
| Communications Personnel | 5% |
| Scheduling | 5% |

These positions are required in Phases 1 and 2.