June 18 2018 Reference No. 11149943-06

Mr. Kent Nicholson
Manager, Production and Energy Control Operations
Maritime Electric Company, Limited
P.O. Box 1328
Charlottetown, PE C1A 7N2

Dear Mr. Nicholson:

Re: 2017 Decommissioning Study – Preliminary Options Analysis
Demolition of the Charlottetown Thermal Generating Station
Charlottetown, Prince Edward Island

1. Background

GHD was retained by Maritime Electric Company, Limited (MECL) to provide engineering support in the preparation of a Decommissioning Study including closure cost forecasting for the Charlottetown Thermal Generating Station (CTGS). The Decommissioning Study will provide the basis for preparation of tender documents and specifications for the future demolition of the CTGS. Cost estimates for implementation of decommissioning activities and associated engineering will be provided for MECL planning purposes and organized to facilitate an update to the overall cost estimate closer to the scheduled demolition date in 2022.

During the project kick-off meeting on October 31, 2017, MECL requested that GHD complete a Preliminary Options Analysis to explore potential cost differences between maintaining the Combustion Turbine #3 (CT3) Balance of Plant (BOP) equipment within a portion of the existing Steam Plant building (as described in MECL's Request for Proposal 2017-24) versus relocating the CT3 Balance of Plant equipment into a new on-site building and completely demolishing the Steam Plant building (including the current CT3 Balance of Plant area). GHD submitted a proposal providing an overview of the scope of work (SOW) and associated professional fees to conduct this Preliminary Options Analysis, which was approved by MECL on November 17, 2017. Figures showing the current layout of the Steam Plant building, the CT3 Balance of Plant area to be potentially retained, and the proposed location(s) of a new building previously provided by MECL are included in Attachment A for reference purposes.

The agreed upon SOW was to complete an American Association of Cost Engineering (AACE) Class 5 cost analysis for retaining the existing CT3 Balance of Plant building (partial demolition of Steam Plant building as per original SOW) versus construction of a new CT3 Balance of Plant building and total demolition of the Steam Plant building. The Class 5 cost estimate for this Preliminary Options Analysis follows the cost classification system matrix adapted from Recommended Practice No 17R 97 and 18R 97 by the Association for the Advancement of Costing Engineering (AACE) International, which typically provides an accuracy range of +100% to -50%. Based on the findings of the Preliminary Options Analysis, MECL will select a preferred option, which will be carried forward for the Decommissioning Study Report preparation and a Class 3 cost estimate (+30% to -20%).

2. Preliminary Options Analysis Overview

In discussions with MECL, it was determined that the Preliminary Options Analysis should focus on a cost comparison of specific items that will significantly affect costs associated with the two CT3 Balance of Plant options (CT3 Balance of Plant remains in Steam Plant Building or is replaced by a new separate building). As such, the Preliminary Options Analysis does not identify total costs to complete all future decommissioning/demolition work but identifies differences between each scenario and associated costs. Items that are considered to be cost neutral and required regardless of the option chosen for the CT3 Balance of Plant have not been evaluated as part of the current Preliminary Options Analysis. Specific examples of items that are considered to be cost neutral include, but are not limited to, the following:

- **Demolition –** Costs associated with the decommissioning and demolition of the majority of the Steam Plant Building as well as associated permitting and engineering costs will be similar regardless of the Option chosen. The exception would be decommissioning/demolition inefficiencies for the contractor associated with partial building demolition around the existing CT3 Balance of Plant area. Costs for demolition inefficiencies are included in the cost analysis estimate.
- **Dorman Diesels –** The existing emergency back-up diesels currently in the CT3 Balance of Plant building are nearing their life expectancy and will require replacement regardless of the option chosen. For the purposes of this study, it is assumed the new diesel generator(s) will be installed in weather enclosures exterior of either building (existing CT3 Balance of Plant or new separate building).
- **Energy Control Center (ECC) Sprinkler System –** Under either scenario the water supply for the sprinkler system servicing the ECC will need to be re-configured.
- **Life Cycle Costs –** End of life expectancy and life cycle costs for CT3 Balance of Plant electrical and mechanical control equipment to be re-used/re-located to new building is considered to be cost neutral. Examples of end of life expectancy costs that are considered cost neutral would include the Reverse Osmosis (RO) and Electrodeionization (EDI) system, compressors, switchgear, breaker panels, transformers, etc. Costs for re-locating and commissioning the electrical and mechanical control equipment from the existing building to a new building have been included in the cost analysis estimate. Life cycle costs for building services are also included in cost analysis estimate.

An overview of primary components that were reviewed and evaluated for each option are outlined below:

- **Stack Demolition –** Cost differences have been provided for potential stack demolition methodologies assuming CT3 Balance of Plant remains and will need to be operational during future demolition/decommissioning activities versus costs if CT3 Balance of Plant is re-located. Based on our preliminary review, demolition of the 225' high stack (new stack) would utilize mast climbers if the CT3 Balance of Plant is to remain. The use of mast climbers is considered to be the safest alternative given the proximity of the stack to the CT3 Balance of Plant building and would still require significant safety controls and the establishment of strict exclusion zone protocols. With the CT3 Balance of Plant removed, a more economical option of using a crawler crane with a demolition attachment and high reach equipment is considered viable.

- **Partial Building Demolition Costs –** Costs for potential decommissioning/demolition inefficiencies for the contractor associated with partial building demolition around the existing CT3 Balance of Plant have been provided. It is assumed that if the CT3 Balance of Plant is to remain within the steam plant, the contractor's demolition productivity will be slowed considerably around the structure that is to remain. In addition, there will be additional costs associated with temporary supports and shoring that will be required to ensure the remaining structure is protected during demolition activities.
- **Mechanical/Electrical Systems –** Differences in costs for mechanical and electrical systems to be re-configured to keep the existing CT3 Balance of Plant versus mechanical/electrical requirements for a new building have been provided. These new mechanical costs include installation of a new wastewater treatment plant (WWTP) and new demineralized water storage tank(s) for the new building. GHD retained the services of MCA Consultants Inc. (MCA) from Charlottetown, PEI to review the mechanical requirements for each option and prepare a preliminary layout for a new Balance of Plant building (Attachment E). GHD also retained Strum Engineering Associates Ltd. from Dartmouth, NS to review the electrical requirements for each option (Attachment F).
- **Structural Considerations –** GHD completed a visual inspection of structural members within the Steam Plant building to determine if the connection of a new end wall, where Turbine #7 area meets with the CT3 Balance of Plant area, will require structural reinforcement (or structural member replacement) if the option is selected to retain the existing CT3 Balance of Plant area. The review noted that the majority of the existing structure is in good repair with no signs of structural distress and a new end wall installation is feasible. However, the investigation did find that signs of distress to the brick side walls and the “west” end wall of the existing WWTP area were present. Significant cracks in the side walls are present for the full height of the wall (approx. 45 feet). The cracks are continuous from top to bottom with the largest opening at the top and decreasing to hairline at the bottom. Costs to repair the existing masonry side walls and replace the WWTP west end wall have been included in the cost analysis. See below for additional risk items associated with the recent structural review of the existing building. A memorandum outlining the findings of the structural review is provided in Attachment B.
- **Life Cycle Costs –** 35 year building life cycle costs have been considered for both the proposed new building and the existing CT3 Balance of Plant area of the building. These life cycle costs include heating, mechanical and electrical systems, building maintenance and roofing. It is assumed that the built-up roofing for the existing building will have to be replaced twice over the 35 year life cycle due to its current condition. For the second replacement, we have assumed that a resurfacing could be completed at a reduced cost compared to a complete replacement. Heating costs for the existing CT3 Balance of Plant building that is to remain as well as heating costs for the new building were provided by MECL or MCA.

  It is also assumed that localized repairs of the original brick walls could be required over the 35 year life cycle given that the brick is currently 60-80 years of age. For budgeting purposes, we have assumed that on average 1% of the overall brick wall will require re-pointing/localized repairs each year.

MECL's Weighted Cost of Capital for Valuation of Life Cycle Items

A fundamental principle of finance is that a dollar obtained or spent in the future has less value than a dollar obtained or spent today. The connection between the two is the interest rate. To express the value of the dollar obtained or spent in the future in terms of its value today (the present value), the future dollar is discounted to the present using the interest rate. In this calculation the interest rate is usually referred to as the discount rate. This principle of future worth was used in the cost analysis for valuing life cycle cost items for both of the CT3 Balance of Plant options and summarized in the following paragraphs.

For a business, the interest rate is usually its weighted average cost of capital (WACC); i.e., the cost for the business to borrow money, typically through a combination of equity and debt. In deciding whether to make an investment that will reduce operating costs, the business is comparing two future streams of expenses – the annual financing costs associated with the investment and the annual reduction in operating costs that would be achieved through the investment. To compare the two streams of expenses, they are discounted to the present using the interest rate, which for the business is its WACC.

The WACC for MECL was calculated to be 6.44%, based on 40.0% equity at 9.35% allowed return and 60.0% debt at 4.50% interest rate (provided by MECL). The 9.35% is the current allowed rate of return on average common equity, as determined by the Island Regulatory and Appeals Commission (IRAC), and is subject to review and adjustment by the Commission. The 4.50% debt interest rate is the estimated cost for long term borrowing by MECL (minimum of 30 years, longer if available so as to better match the 35 year remaining life of the CT3 generator and its Balance of Plant equipment). Details of the WACC calculated for each life cycle item are provided in Attachment C.

- **New Construction Cost –** A building footprint/layout design for the new building was generated by MCA using computer aided design software based on MECL requirements and subsequent review modifications. The list of equipment and operational requirements provided by MECL are included in Attachment D. The proposed building layout as proposed by MCA and reviewed by MECL is included in the MCA back-up information of Attachment E. A cost for the proposed new building has been provided by MECL based on the agreed upon footprint/layout drawing. Costing includes building shell and foundations only. Costing for electrical/mechanical requirements and equipment relocation for the new building has been included in the "Mechanical/Electrical Systems" line item above.

  New construction that would be required for the existing CT3 Balance of Plant would include the construction of a new end wall at the proposed cut-off location for the CT3 Balance of Plant. Due to the structural deficiencies (cracks and deflection in brick walls) identified above with the WWTP walls, a new steel frame end wall and masonry repairs would also be required for that section of the CT3 Balance of Plant.

- **Fire Protection/Building Code Updates –** Costs for building updates/improvements required to the existing CT3 Balance of Plant area of the building to meet current National Fire and Building Codes (based on recommendations from the local fire marshal) have been provided (Attachment G). These costs are limited to enclosing electrical systems and exits as per instructions from MECL fire protection

specialist (Mr. Byron Webber). Costs for new fire protection systems (or re-configuration of existing system) for the new building have also been provided.

2.1 Assumptions

An overview of the primary assumptions used to develop cost estimates for the preliminary options analysis are outlined below:

- GHD has assumed that the existing wastewater treatment unit as well as the water treatment unit (RO/EDI unit) will stay as-is and will require operation during future demolition activities if existing CT3 Balance of Plant equipment remains in the Steam Plant building.
- GHD has assumed that, for the new building option, the existing RO/EDI water treatment unit will be relocated to the new building (cost for relocating, reconnecting and commissioning have been included in the cost analysis).
- GHD has assumed that a new wastewater treatment system would be required with the new building option (cost for new system has been included in the cost analysis).
- GHD has assumed Boiler 6 will be moth-balled if the existing CT3 Balance of Plant building is retained (least expensive option).
- GHD has assumed that instrument air equipment will be re-located for new building option (cost for relocating, reconnecting and commissioning have been included in the cost analysis).
- GHD has assumed that electrical control equipment will be re-used for new building option to the extent possible (cost for relocating, reconnecting and commissioning have been included in the cost analysis).
- GHD has assumed that CT3 station services transformer can be re-used and re-located for the new building option (cost for relocating, reconnecting and commissioning have been included in the cost analysis).

2.2 Risk Items

During preparation of the cost analysis for each option there were several assumptions or unidentified items that could incur significant costs if they are required based on regulatory obligations (or other agreements) and have therefore been identified as potential risk items. These following items were discussed with MECL during project specific meetings and, as directed by MECL, have also been identified in the cost analysis. An overview of the primary risk items identified specific to the CT3 Balance of Plant options analysis review are outlined below:

- There is a possibility given the age of the original roof system above the CT3 Balance of Plant area that asbestos containing material (ACM) could be found in the original roofing asphalt. If this is the case, this ACM would need to be abated as part of the re-roofing work. This would add significant cost to the re-roofing work. If the CT3 Balance of Plant equipment is to be re-located and it is found that the existing roofing asphalt contains ACM, then the roofing can be cut-off in sections and disposed of as ACM debris

at an approved landfill. Cutting the roof in sections for disposal is much cheaper than having to conduct in-place abatement.

- Costs for the existing CT3 Balance of Plant building currently assume a code review is not required. The estimate specifically precludes the requirement for meeting current National Building Code snow and wind load requirements and post-disaster seismic design requirements. The local building inspector would have final say on whether a full code review is required but based on our recent structural review of the CT3 Balance of Plant, there is a high likelihood that a full code review will be required. This would likely have a significant impact on the costs to keep the existing CT3 Balance of Plant building.
- Costs for existing CT3 Balance of Plant building do not include improvements to existing fire suppression sprinkler system as per instructions from MECL's fire protection specialist.
- Electrical costs for new building assume some cables associated with the CT3 Balance of Plant are suitable for re-use (e.g., transformer, switchgear and MCC).
- Costs for existing CT3 Balance of Plant building assume Boiler 6 will be moth-balled and will stay in-place for 35 years. Costs for manual dismantlement of Boiler 6 are not included in Preliminary Options Analysis.

3. Preliminary Options Analysis Cost Estimate Differential

A summary of the anticipated costs for specific items associated with each CT3 Balance of Plant option (retain existing building or build a new building) and the cost differential between the two options is presented in Table 1 (following text). Based on the specific items outlined in the previous sections, it is anticipated that the costs to keep the existing CT3 Balance of Plant building would be approximately $621,000 higher over the life cycle of the CT3 unit versus construction of a new building. This anticipated cost differential excludes potential risk allowance items.

As previously indicated, this cost estimate is a comparison of specific items that are expected to significantly affect costs associated with the two CT3 Balance of Plant options and is not intended to identify total costs to complete all future decommissioning/demolition work. In addition, the cost estimate provided for specific items associated with each option have an accuracy level range of +100% to -50%. A breakdown of the cost items indicating units, unit rates and assumptions utilized in calculating the Class 5 cost estimates have been provided in Attachments B to G.

4. Closure

We trust that this memorandum meets with your present requirements. If there are any questions please do not hesitate to contact the undersigned at any time.

Sincerely,

GHD

Troy Small, M.Sc. CE
Principal

Michael Gallahue, P.Eng.
Associate

TS/ad/4

List of Attachments

Attachment A – Figures
Attachment B – GHD Structural Review Memorandum
Attachment C – GHD Supplied Costing Information and WACC
Attachment D – MECL Supplied Costing Information
Attachment E – MCA Supplied Costing Information (Mechanical) and New Building Layout
Attachment F – Strum Supplied Costing Information (Electrical)
Attachment G – Fire Protection Requirements and Costing (Byron Webber, Project Advisor)

PRELIMINARY OPTIONS ANALYSIS
2017 DECOMMISSIONING STUDY
CHARLOTTETOWN THERMAL GENERATING STATION
CHARLOTTETOWN, PEI

Item	Options	Estimated Costs (Class 5 Estimate)	Quantitative Assessment	Cost Differential		Comments
				Keep CT3 Balance of Plant	New CT3 Balance of Plant	
Options Analysis Items						
Maintenance & Capital Improvements Required Over a 35 Year Life Cycle Period						
Heating Costs	Keep CT3 Balance of Plant - Heating costs for remaining section of plant is estimated at $95,000/year	$ 1,553,000	Extra $1,283,000 in costs over the 35-years life cycle to keep the CT3 Balance of Plant			Annual heating costs provided by MECL. Costs adjusted for 2% annual inflation over a 35 year period as well as MECL 6.44% Weighted Average Cost of Capital (WACC). Cost difference would be $4,164,781 excluding WACC.
	New CT3 Balance of Plant - Heating costs for new building is estimated at $16,500/year	$ 270,000				
Roofing Costs	Keep CT3 Balance of Plant - Built-up roofing will need to be replaced twice during 35 year life cycle except for the maintenance shop which is a metal roof and will only require replacement once	$ 304,000	Extra $304,000 in costs over the 35-years life cycle to keep the CT3 Balance of Plant			Costing assumes a full roof replacement in Year 1 and a re-surfacing or coating in Year 20 (except for the Maintenance Shop) to extend the life of the roof for another 15 years. Design costs also included. Potential asbestos abatement not included. Year 1 roofing costs are $262,000. Year 20 roofing costs are $42,000. WACC included in year 2040 roof re-surfacing cost calculation ($112,000 is $42,035 in 2040). Costs provided by GHD (see Attachment C).
	New CT3 Balance of Plant - Metal roofing for new building has an expected useful life of over 35 years and will not require replacement during 35 year life cycle	$ -				
Wall Costs	Keep CT3 Balance of Plant - Maintenance of Brick Walls during 35 year life cycle	$ 75,000	Extra $75,000 in costs over the 35-years life cycle to keep the CT3 Balance of Plant	$1,807,000	---	Assumes on average 1% of brick wall/year will require maintenance/re-pointing and/or localized replacement. WACC included in re-surfacing cost calculation ($161,000 in 2017 is $75,135 over 35 years). Costs provided by GHD (see Attachment C).
	New CT3 Balance of Plant - Metal siding for new building has an expected useful life of over 35 years and will not require replacement during 35 year life cycle	$ -				
Structural Analysis and Code Review	Keep CT3 Balance of Plant - Analysis of snow and wind loading as well as post disaster seismic design requirements to meet current National Building Code	$ 145,000	Extra $145,000 in costs to determine structural improvements required to meet current National Building Codes			Includes analysis of all existing structural connections and members to verify strengths and structural capacity and comparison to current loading and seismic requirements. Also includes costing for anticipated design and engineering for structural reinforcements to bring the existing structure up to current code.
	New CT3 Balance of Plant - Not required as new building designed to National Building Code	$ -				

PRELIMINARY OPTIONS ANALYSIS
2017 DECOMMISSIONING STUDY
CHARLOTTETOWN THERMAL GENERATING STATION
CHARLOTTETOWN, PEI

Item	Options	Estimated Costs (Class 5 Estimate)	Quantitative Assessment	Cost Differential		Comments
				Keep CT3 Balance of Plant	New CT3 Balance of Plant	
Demolition Costs						
Building Demolition	Keep CT3 Balance of Plant - Demolition schedule and cost will be increased due to demolition contractor having to carefully remove structures surrounding the CT3 Balance of Plant to ensure no structural damage occurs to the structures that are to remain	$ 120,000	Extra $25,000 in cost to keep the CT3 Balance of Plant structure			Assumes an extra 2.5 weeks of demolition time and extra costs for temporary controls, shoring and supports.
	New CT3 Balance of Plant - If a new building is built the existing CT3 Balance of Plant will need to be demolished	$ 95,000				Demolition costs include a $25,000 credit for salvage value of structural and carbon steel.
Stack Demolition	Keep CT3 Balance of Plant - Due to proximity of CT3 BOP to the 225' high Stack the only option for demolition will be mechanical dismantling using a mast climber and platform, which will be slower, require more manpower and thus be more expensive than using a crane with a mechanical demo attachment. There will also be delays/costs due to the RD-EDI Plant being part of an exclusion zone and demolition having to stop whenever staff are working in that area of the Plant. Significant safety controls will be required around the RD-EDI Plant and the stack would have to be below 35' in height before a high reach excavator could be employed.	See Comment	Anticipated Extra $445,000 in costs to demolish the 225' high stack while keeping the CT3 Balance of Plant	$470,000	---	Costs for stack demolition are variable and will be dependent on methodology acceptable to MECL. Key considerations are safety, constructability, contractor acceptance/bonding, etc. Only the 225' high stack will be affected by whether the CT3 Balance of Plant stays or not. The 200' stack will require mechanical dismantling down to grade due to it's proximity to the existing gas turbine, residential neighborhood and ECC building that is scheduled to remain post demolition. Costs provided by GHD (see Attachment C).
	New CT3 Balance of Plant - There is possibly an opportunity to use the existing building foundations/slab as a pad for a crawler crane with a demolition attachment to demolish the stack. This would be quicker and the bottom 75' could be demolished using high reach excavator, which is considerably cheaper than a crane. This is also a significantly safer option as there would be no demolition above an active/occupied building.	See Comment				
New Construction Costs						
New Construction	Keep CT3 Balance of Plant - Construction of new end wall required, replacement of existing end wall for WWTP required and repairs required for WWTP side walls	$ 135,000	Extra $1,186,000 in cost to construct a New CT3 Balance of Plant building compared to constructing a new end wall for the existing CT3 Balance of Plant structure	See next page	See next page	Cost includes construction of new end wall with structural steel, metal siding and reinforced concrete foundations and minor structural reinforcement to existing structure. Costs assume a new wall will be required the entire length of the west wall (including waste water treatment plant wall - see GHD structural analysis information). Design costs also included.
	New CT3 Balance of Plant - Construction of a new 8,750 sq.ft building will be required	$ 1,321,000				Costs for a new 20 ft high, 8,750 sq. ft. building as provided by MECL. Costs are for building foundation and building shell. Costs for new building services are provided below.

PRELIMINARY OPTIONS ANALYSIS
2017 DECOMMISSIONING STUDY
CHARLOTTETOWN THERMAL GENERATING STATION
CHARLOTTETOWN, PEI

Item	Options	Estimated Costs (Class 5 Estimate)	Quantitative Assessment	Cost Differential		Comments
				Keep CT3 Balance of Plant	New CT3 Balance of Plant	
Services	Keep CT3 Balance of Plant - Reconfiguration of Services such as wastewater effluent, building services, etc. (excludes fire suppression equipment) <u>Mechanical</u> - Re-locate Water and Wastewater services ($105,000) - Electrical Unit Heaters ($20,000) - Life Cycle Costs ($263,000) <u>Electrical</u> - Upgrade Building Electrical Services ($155,000) - Electrical Life Cycle Costs ($45,500)	$ 588,500				Fire Suppression for CT3 Balance of Plant not required assuming diesels are moved outside (assumption made based on email from B. Webber Nov. 28/17). ECC fire protection to be provided from municipal waterline. Electrical costs exclude new telecommunications which are cost neutral. Fuel oil piping for new diesel generators cost neutral. Costs for Mechanical Requirements provided by MCA Consultants Inc. (see Attachment E) Costs for Electrical Requirements provided by Strum Engineering (see Attachment F) WACC included in Mechanical and Electrical Life Cycle Costs ($1,115,000 in costs if WACC not considered).
	New CT3 Balance of Plant - Supply & Installation of new equipment and relocation and re-connection of existing equipment for the new building <u>Mechanical</u> - New Waste Water Treatment Plant and O/W Separator ($150,000) - New Piping - RO/WWT/Instrument Air (excludes fuel oil line as cost neutral) ($120,000) - New HVAC equipment and Ventilation ($122,500) - Re-location of RO/EDI, compressors and miscellaneous equipment ($51,000) - One New Stainless Steel Demineralized Water tank ($100,000) - New potable water services including washroom/shower ($97,500) - New Sprinkler System ($44,000) - Commissioning/Fit-up ($31,000) - Mechanical Life Cycle ($193,000) <u>Electrical</u> - Re-location of Station Services Transformer ($25,000) - New Fire Protection Panel and Detectors ($23,000) - Electrical Equipment and Panel Relocation or new equipment ($58,000) - Install and terminate new cables ($132,000) - New building electrical services ($100,000) - Commission Equipment ($30,000) - Electrical Life Cycle Costs ($30,000)	$ 1,307,000	Extra $718,500 in cost for new building equipment and re-location of existing equipment	$271,000	$1,904,500	Costs assume new water treatment unit will be required for new building as well as new de-mineralized water storage tank. Remainder of CT3 Balance of Plant equipment (RO/EDI, compressors, etc.), electrical panels, pad mount transformer and maintenance shop equipment will be re-located to new building. No re-location of fire pump or equipment. Assumes ECC fire protection to be provided from municipal waterline. Costs for Mechanical Requirements provided by MCA Consultants Inc. (see Attachment E) Costs for Electrical Requirements provided by Strum Engineering (see Attachment F) WACC included in Mechanical and Electrical Life Cycle Costs ($801,000 in costs if WACC not considered).

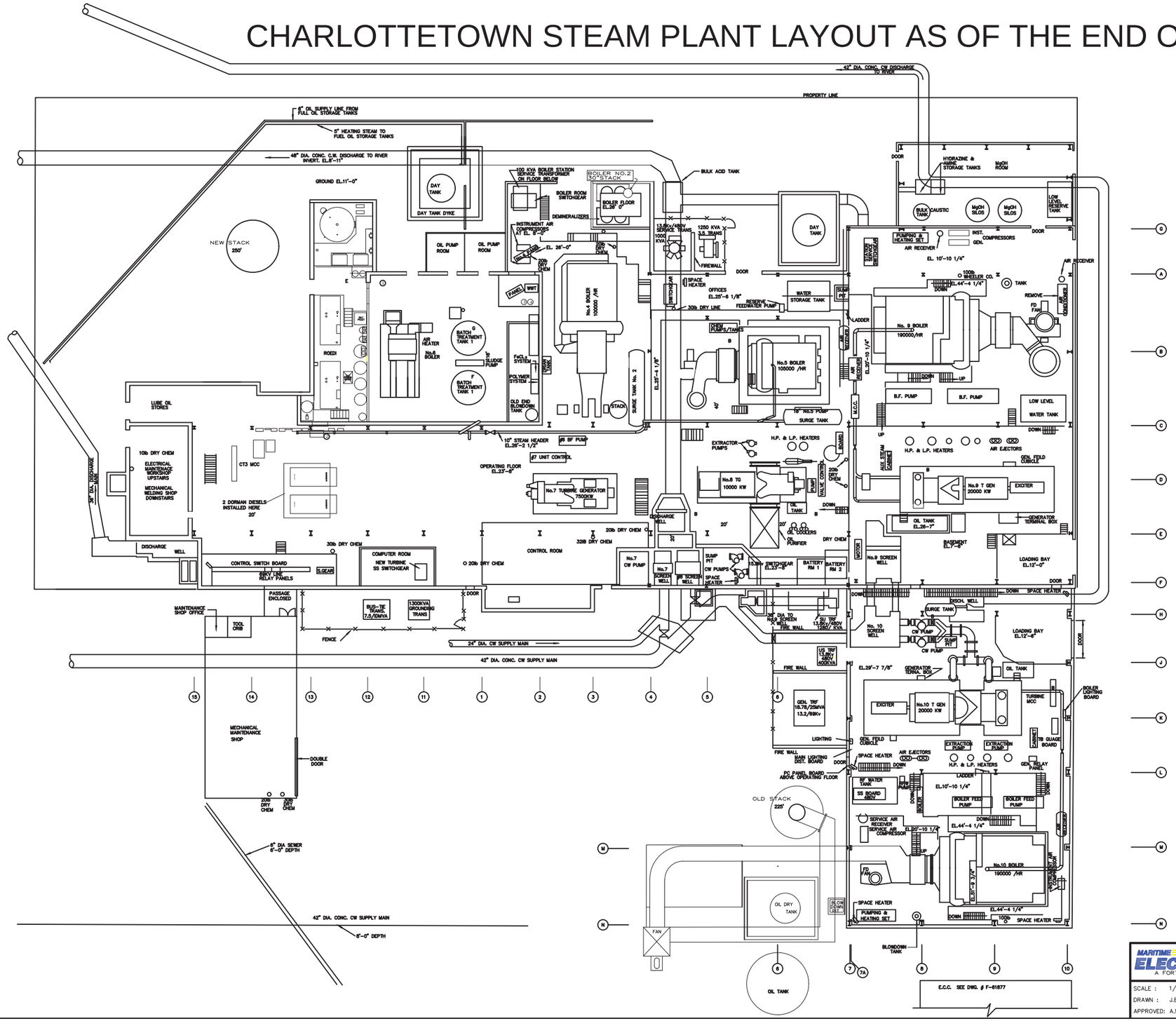
PRELIMINARY OPTIONS ANALYSIS
2017 DECOMMISSIONING STUDY
CHARLOTTETOWN THERMAL GENERATING STATION
CHARLOTTETOWN, PEI

Item	Options	Estimated Costs (Class 5 Estimate)	Quantitative Assessment	Cost Differential		Comments
				Keep CT3 Balance of Plant	New CT3 Balance of Plant	
Fire Code Upgrades	Keep CT3 Balance of Plant - Construction of fire separations for select equipment including stairwell exits	$ 271,000	Extra $271,000 in costs for fire separations including stair wells, control panels, etc.	See previous page	See previous page	Sprinkler protection upgrades not required as per B. Webber. Fire separation requirements provided by B. Webber with costing provided by GHD (see Attachment G)
	New CT3 Balance of Plant - Will be designed and constructed to current fire code. Costs included in costing above for Services in new 8750 sq.ft building.	---				ECC protection cost neutral for either scenario (B. Webber)
			Column Total	**$2,548,000**	**$1,904,500**	
			Estimated Engineering Costs	**$168,000**	**$190,450**	Anticipated Engineering Costs - 15% for keeping existing CT3 building (exclude heating costs and code review engineering) - 10% for new building
			Cost Differential	**$621,050**		Anticipated extra costs for keeping CT3 Balance of Plant

Attachment A
Figures

Current Floor Plan of Steam Plant Building with Equipment

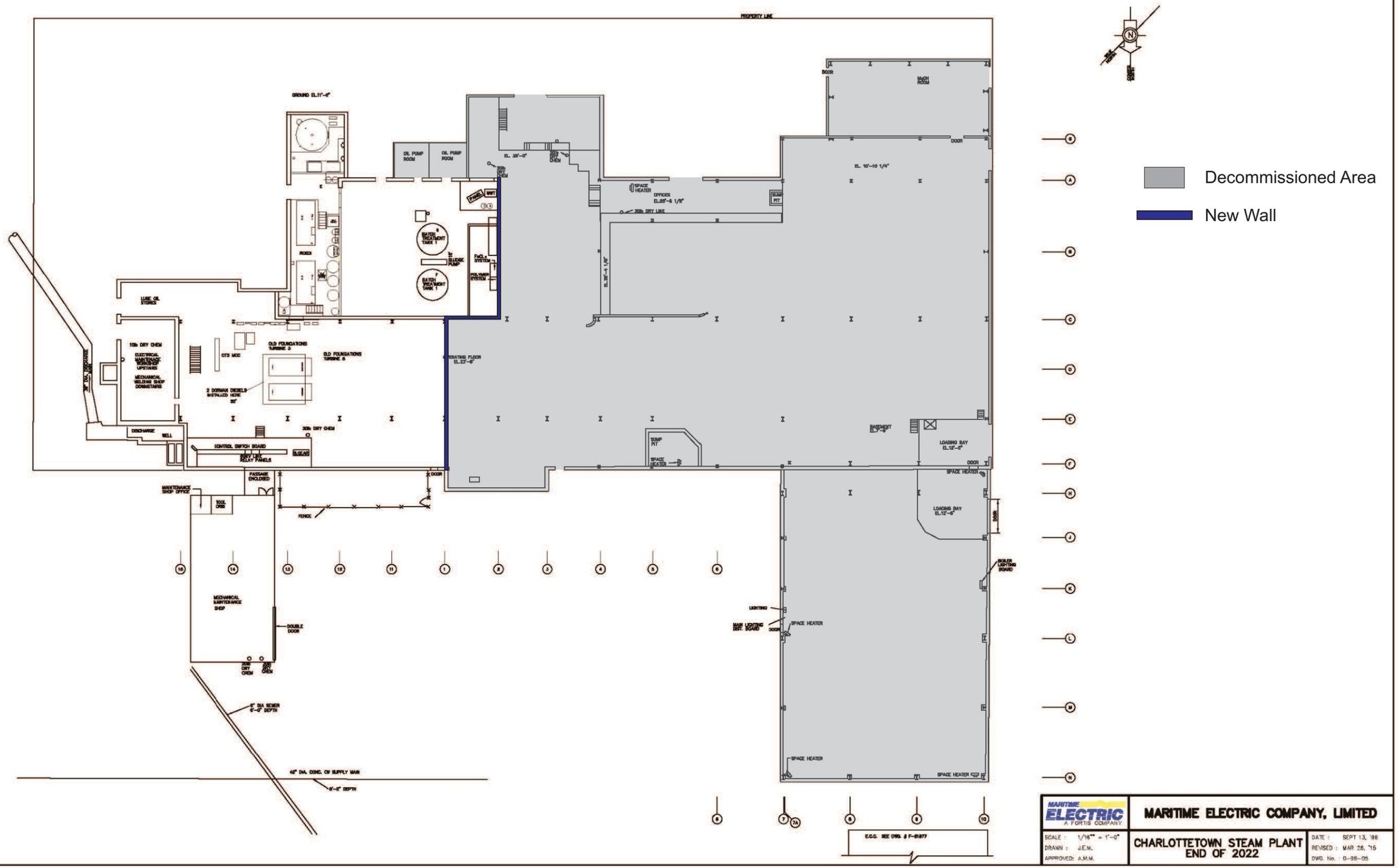
CHARLOTTETOWN STEAM PLANT LAYOUT AS OF THE END OF 2016



MARITIME ELECTRIC A FORTIS COMPANY	MARITIME ELECTRIC COMPANY, LIMITED	
SCALE : 1/16"" = 1'-0" DRAWN : J.E.M. APPROVED: A.M.M.	CHARLOTTETOWN STEAM PLANT END OF 2016	DATE : SEPT 13, '96 REVISED : MAR 26, '15 DWG. No. : G-96-05

CTGS Plant Layout End of 2022

CHARLOTTETOWN STEAM PLANT LAYOUT AS OF THE END OF 2022



MARITIME ELECTRIC A FORTIS COMPANY	MARITIME ELECTRIC COMPANY, LIMITED	
SCALE : 1/16" = 1'-0" DRAWN : J.E.M. APPROVED: A.M.M.	CHARLOTTETOWN STEAM PLANT END OF 2022	DATE : SEPT 13, '96 REVISED : MAR 26, '15 DWG. No. : G-96-05

Option 3

Option 2

Option 1

Option 4

Option 7

Option 6

Option 5

1 / M2 SITE PLAN
SCALE: 1/32" = 1'-0"

NOTES

NO.	REVISIONS	DD/MM/YY

All measurements must be checked on site by the contractor prior to construction or fabrication.

This drawing is the property of MCA Consultants Inc. and shall not be used on other projects or extensions to this project except by agreement in writing from MCA Consultants Inc.

This drawing is not to be used for construction unless stamped and signed by the Engineer.

Stamp

Client
MECL POWER PLANT DECOMMISSIONING

MCA CONSULTANTS
ENGINEERS · PROJECT MANAGEMENT
902.566.9223 | info@mcaconsultants.ca | www.mcaconsultants.ca

Project
MECL POWER PLANT DECOMMISSIONING

Sheet Title
SITE PLAN

Scale	Date
AS NOTED	NOV. 24, 2017
Drn By: S.G.M.	Chk'd By: J.D.M.
Project No.: 17-252	Sheet No.: M2

Attachment B
GHD Structural Review Memorandum

Memorandum

To:	Mr. Troy Small	Ref. No.:	11149943-06
From:	Michael Gallahue, GHD	Date:	December 8, 2017
CC:			

Subject: 2017 Decommissioning Study – Preliminary Options Analysis – Structural Review
Demolition of the Charlottetown Thermal Generating Station
Charlottetown, PEI

On December 5, 2017 Matthew Mitrovich, P.Eng., from our structural group visited the above site to conduct a visual assessment of the CT3 Balance of Plant structure to ascertain whether there were any signs of current or previous structural stress on the structural elements of the building. This visual assessment was required as part of our ongoing Preliminary Options Analysis to help determine whether to keep or demolish the existing CT3 Balance of Plant. Based on a recent meeting with the local Building Inspector on November 21, 2017 it was determined that a structural assessment would be required on the existing structure to help confirm whether or not the structure would be subject to a full code review based on the proposed alterations that would be required to the CT3 Balance of Plant if it were to remain post demolition. A summary of the findings from the structural review are provided below, based on email correspondence attached.

The review noted that the majority of the structure is in good repair with no signs of structural distress and the construction of a new end wall where Turbine #7 area meets with the CT3 Balance of Plant, is feasible. However, the investigation did find that signs of distress to the brick side walls and the “west” end wall of the Wastewater Treatment Plant (WWTP) area were present. Significant cracks in the side walls are present for the full height of the wall (approx. 45 feet). The cracks are continuous from top to bottom with the largest opening at the top and decreasing to hairline at the bottom. Observation of the end wall noted the top to be deflected toward the #4 Boiler Area. It is presumed that the cracks are caused by either differential settlement of the brick end wall and side walls or permanent lateral deformation of the brick end wall or a combination of both. It should be noted that the #4 Boiler Area was an addition to the original structure. This addition had the adverse effect of increasing vertical load to the original end wall and the potential benefit of preventing the end wall from tilting further. In this scenario, removing the additions up the original exterior end wall of the WWTP area poses the risk of decreasing the stability of the end wall. Also, since the building’s original construction, it has contained operational boilers that maintained an interior temperature high enough to melt snow from the roof in winter. Despite the older age of the building, it has yet to experience the full load effects from snow and drifting snow. The structure may be adequate for this loading however it is noted that altering interior temperatures may have an adverse effect and would constitute a change in loading and counter a proven past performance approach to the building not having to meet current codes. Building codes are not retroactive to existing buildings. However, when a change in use, change in loading or alterations/renovations are performed, current building codes apply. It was originally considered an option that the existing CT3

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Balance of Plant building would not fall into this category so long as the original portion of the building to remain was not changed and showed no signs of damage, distress or deterioration. From the field review and the above change in loading and alterations required, it is our opinion that the building would be required to meet current codes. In meeting current codes, the building would be designated with a post-disaster importance category because it is a power plant that provides utilities to the public. At a minimum, the lateral force resisting system would require upgrading to meet ductility requirements. This will require an analysis of the existing structure, which could lead to further reinforcement requirements of other members and footings.

We trust that this memorandum meets with your present requirements. If there are any questions please do not hesitate to contact the undersigned at any time.

GHD

Michael Gallahue, P.Eng.

MG/ad/2

Encl.

Attachment C
GHD Supplied Costing Information and WACC

Charlottetown Thermal Generating Station
Preliminary Options Analysis - Class 5 Cost Estimate
Cost Breakdown
GHD Project No. 11149943

	Activities	Units	Unit Price	Quantity	Total	Comments
Maintenance & Capital Improvements Required Over a 35 Year Life Cycle Period						
1.0	**Roofing Costs**					
	Re-roof with Built-up roofing (20 year life)	sq.ft	$ 20.00	11250	$ 225,000.00	
	Re-roof with Metal roofing for Maintenance Shop (35+ year life)	sq.ft	$ 16.00	1840	$ 29,440.00	
	Re-surface Built-up roofing after 20 years (coat or re-surface only to extend life by 15 years)	sq.ft	$ 10.00	11250	$ 112,500.00	
	Design Fees	LS	$ 7,500.00	1	$ 7,500.00	
				Subtotal	***$ 374,440.00***	
2.0	**Wall Repairs**					
	Repairs to brick walls which are currently 60-80 years of age (assume 1% of wall per year will need repointing)	sq.ft	$ 24.00	129	$ 3,096.00	Total area of walls in CT3 BOP estimated to be 12,900 sq.ft
	Allowance for localized areas will require repairs	LS	$ 1,500.00	1	$ 1,500.00	
				Yearly Cost	***$ 4,596.00***	
				# of years	***35***	
				Subtotal	***$ 160,860.00***	
3.0	**Heating Costs**					
	Heating costs for CT3 Balance of Plant provided by MECL as $95,000/year vs $16,500/year for new building giving a difference of $78,500/year	LS	$ 78,500.00	1	$ 78,500.00	
				Yearly Cost	***$ 78,500.00***	
				# of years	***35***	
				Subtotal	***$ 2,747,500.00***	
Demolition Costs						
1.0	***Building Demolition - Keep CT3 Balance of Plant***					
	Extra Demolition time due to partial demolition	week	$ 40,000.00	2.5	$ 100,000.00	Assuming a crew of 2 laborers, a foreman, 3 excavators (1 high reach 1/2 time), skid steer loader, consumables and dust control
	Allowance for temporary supports, shoring & controls	LS	$ 20,000.00	1	$ 20,000.00	
				Subtotal	***$ 120,000.00***	
2.0	**Building Demolition - New CT3 Balance of Plant**					
	Extra demolition time due to having to demo CT3 Balance of Plant	week	$ 40,000.00	3	$ 120,000.00	Assuming a crew of 2 laborers, a foreman, 3 excavators (1 high reach 1/2 time), skid steer loader, consumables and dust control
	Credit for salvage that can be obtained if CT3 Balance of Plant is demolished	MT	$ 225.00	114	$ (25,650.00)	Salvage steel from structural steel, trusses, metal roof decking & metal siding
				Subtotal	***$ 94,350.00***	
3.0	**Stack Demolition**					
	Extra costs for demolition using mast climber platform	week	$ 70,000.00	6	$ 420,000.00	Due to proximity of CT3 Balance of Plant to Stack #2 the only option for demolition will be mechanical dismantling using a mast climber and platform, which will be slower, require more manpower and thus be more expensive than using a crane with a mechanical demo attachment. There will also be delays due to the RO-EDI Plant being part of an exclusion zone and demolition having to stop whenever staff are working in that area of the Plant. Add an extra 6 weeks to the stack demolition at $70,000/week
	Allowance for Safety Controls that would need to be employed in the exclusion zone for the duration of the demolition	LS	$ 25,000.00	1	$ 25,000.00	estimate a 12 week demolition period @ $2,000/week for controls (sub-total rounded)
				Subtotal	***$ 445,000.00***	

Charlottetown Thermal Generating Station
Preliminary Options Analysis - Class 5 Cost Estimate
Cost Breakdown
GHD Project No. 11149943

	Activities	Units	Unit Price	Quantity	Total	Comments
New Construction Costs						
1.0	**Construction of New End Wall (50' x 44' wall)**					
	Structural Steel/Girts/Bracing	sq.ft	$ 7.00	2200	$ 15,400.00	
	Metal Siding	sq.ft	$ 9.00	2200	$ 19,800.00	
	4' deep x 12" thick foundation wall	ft	$ 90.00	50	$ 4,500.00	
	24' wide x 12" thick footing	ft	$ 75.00	50	$ 3,750.00	
	Allowance for structural alterations to existing structure at location of new end wall	LS	$ 10,000.00	1	$ 10,000.00	
	Design fees	LS	$ 10,000.00	1	$ 10,000.00	
				Subtotal	***$ 63,450.00***	
2.0	**Replacement of Existing WWTP End Wall (46' x 44' wall) & Masonry Repairs to WWTP Side Walls**					
	Structural Steel/Girts/Bracing	sq.ft	$ 7.00	2024	$ 14,168.00	
	Metal Siding	sq.ft	$ 9.00	2024	$ 18,216.00	
	Repairs to existing brick side walls	sq.ft	$ 50.00	350	$ 17,500.00	Two sections @ 35' high x 5' wide
	Allowance for structural alterations to existing structure and foundations	LS	$ 10,000.00	1	$ 10,000.00	
	Design fees	LS	$ 10,000.00	1	$ 10,000.00	
				Subtotal	***$ 69,884.00***	

PRESENT VALUE COMPARISON OF CT3 BOP AREA HEATING COSTS FOR RETAINED BUILDING VS. NEW BUILDING

Revision: 12/12/2017

Assumptions:

Life Cycle Cost Analysis Time Range	35	years
Discount Rate (WACC)	6.44%	Maritime Electric's Weighted Average Cost of Capital (WACC)
Debt Ratio	60%	
Interest Rate on Debt	4.50%	
Equity Ratio	40%	
Allowed Rate of Return on Equity	9.35%	
Costs:		
Annual Heating Costs for Retained Building	$ 95,000	(2017 Canadian Dollars)
Annual Heating Costs for New CT3 BOP Building	$ 16,500	(2017 Canadian Dollars)
Inflation Rate on Electric Heating Costs	2.0%	

Cash Flow Projections:

Expense Projections	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Expenses													
Annual Heating Costs for Retained Steam Plant Building				$ 100,815	$ 102,831	$ 104,888	$ 106,985	$ 109,125	$ 111,308	$ 113,534	$ 115,804	$ 118,121	$ 120,483
Discounted Cash Flows @ MECL's WACC of 6.44%				$ 83,601	$ 80,113	$ 76,772	$ 73,569	$ 70,500	$ 67,559	$ 64,741	$ 62,041	$ 59,453	$ 56,973
Annual Heating Costs for New CT3 BOP Building				$ 17,510	$ 17,860	$ 18,217	$ 18,582	$ 18,953	$ 19,332	$ 19,719	$ 20,113	$ 20,516	$ 20,926
Discounted Cash Flows @ MECL's WACC of 6.44%				$ 14,520	$ 13,914	$ 13,334	$ 12,778	$ 12,245	$ 11,734	$ 11,245	$ 10,775	$ 10,326	$ 9,895
Difference between Options				$ 83,305	$ 84,971	$ 86,670	$ 88,404	$ 90,172	$ 91,975	$ 93,815	$ 95,691	$ 97,605	$ 99,557
Discounted Cash Flows @ MECL's WACC of 6.44%	$ -	$ -	$ -	$ 69,081	$ 66,199	$ 63,438	$ 60,791	$ 58,255	$ 55,825	$ 53,497	$ 51,265	$ 49,127	$ 47,077

PRESENT VALUE COMPARISON OF CT3 BOP AREA HEATING COSTS FOR RETAINED BUILDING VS. NEW BUILDING
Revision: 12/12/2017

Assumptions:

Life Cycle Cost Analysis Time Range	35	years
Discount Rate (WACC)	6.44%	Maritime Electric's Weighted Average Cost of Capital (WACC)
Debt Ratio	60%	
Interest Rate on Debt	4.50%	
Equity Ratio	40%	
Allowed Rate of Return on Equity	9.35%	
Costs:		
Annual Heating Costs for Retained Building	$ 95,000	(2017 Canadian Dollars)
Annual Heating Costs for New CT3 BOP Building	$ 16,500	(2017 Canadian Dollars)
Inflation Rate on Electric Heating Costs	2.0%	

Cash Flow Projections:

Expense Projections	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**
Expenses														
Annual Heating Costs for Retained Steam Plant Building	$ 122,893	$ 125,350	$ 127,857	$ 130,415	$ 133,023	$ 135,683	$ 138,397	$ 141,165	$ 143,988	$ 146,868	$ 149,805	$ 152,802	$ 155,858	$ 158,975
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 54,596	$ 52,319	$ 50,136	$ 48,045	$ 46,041	$ 44,120	$ 42,280	$ 40,516	$ 38,826	$ 37,207	$ 35,655	$ 34,167	$ 32,742	$ 31,376
Annual Heating Costs for New CT3 BOP Building	$ 21,345	$ 21,771	$ 22,207	$ 22,651	$ 23,104	$ 23,566	$ 24,037	$ 24,518	$ 25,008	$ 25,509	$ 26,019	$ 26,539	$ 27,070	$ 27,611
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 9,483	$ 9,087	$ 8,708	$ 8,345	$ 7,997	$ 7,663	$ 7,343	$ 7,037	$ 6,744	$ 6,462	$ 6,193	$ 5,934	$ 5,687	$ 5,450
Difference between Options	$ 101,548	$ 103,579	$ 105,651	$ 107,764	$ 109,919	$ 112,117	$ 114,360	$ 116,647	$ 118,980	$ 121,359	$ 123,787	$ 126,262	$ 128,788	$ 131,363
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 45,114	$ 43,232	$ 41,429	$ 39,700	$ 38,044	$ 36,457	$ 34,937	$ 33,479	$ 32,083	$ 30,744	$ 29,462	$ 28,233	$ 27,055	$ 25,927

PRESENT VALUE COMPARISON OF CT3 BOP AREA HEATING COSTS FOR RETAINED BUILDING VS. NEW BUILDING
Revision: 12/12/2017

Assumptions:

Life Cycle Cost Analysis Time Range	35	years
Discount Rate (WACC)	6.44%	Maritime Electric's Weighted Average Cost of Capital (WACC)
Debt Ratio	60%	
Interest Rate on Debt	4.50%	
Equity Ratio	40%	
Allowed Rate of Return on Equity	9.35%	
Costs:		
Annual Heating Costs for Retained Building	$ 95,000	(2017 Canadian Dollars)
Annual Heating Costs for New CT3 BOP Building	$ 16,500	(2017 Canadian Dollars)
Inflation Rate on Electric Heating Costs	2.0%	

Cash Flow Projections:

Expense Projections	**2044**	**2045**	**2046**	**2047**	**2048**	**2049**	**2050**	**2051**	**2052**	**2053**	**2054**	**Sum**
Expenses												
Annual Heating Costs for Retained Steam Plant Building	$ 162,154	$ 165,397	$ 168,705	$ 172,079	$ 175,521	$ 179,031	$ 182,612	$ 186,264	$ 189,990	$ 193,789	$ 197,665	$ 5,040,181
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 30,067	$ 28,813	$ 27,611	$ 26,460	$ 25,356	$ 24,298	$ 23,285	$ 22,313	$ 21,383	$ 20,491	$ 19,636	$ 1,553,061
Annual Heating Costs for New CT3 BOP Building	$ 28,164	$ 28,727	$ 29,301	$ 29,887	$ 30,485	$ 31,095	$ 31,717	$ 32,351	$ 32,998	$ 33,658	$ 34,331	$ 875,400
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 5,222	$ 5,004	$ 4,796	$ 4,596	$ 4,404	$ 4,220	$ 4,044	$ 3,875	$ 3,714	$ 3,559	$ 3,410	$ 269,742
Difference between Options	$ 133,991	$ 136,670	$ 139,404	$ 142,192	$ 145,036	$ 147,936	$ 150,895	$ 153,913	$ 156,991	$ 160,131	$ 163,334	$ 4,164,781
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 24,845	$ 23,809	$ 22,816	$ 21,864	$ 20,952	$ 20,078	$ 19,240	$ 18,438	$ 17,669	$ 16,932	$ 16,225	$ 1,283,319

Present Value in 2017 Dollars of Heating Savings of New CT3 BOP Building over Old Building **$ 1,283,319**

PRESENT VALUE COMPARISON OF CT3 BOP AREA ROOFING COSTS FOR RETAINED BUILDING VS. NEW BUILDING

Revision: 12/12/2017

Assumptions:

Life Cycle Cost Analysis Time Range	35	years
Discount Rate (WACC)	6.44%	Maritime Electric's Weighted Average Cost of Capital (WACC)
Debt Ratio	60%	
Interest Rate on Debt	4.50%	
Equity Ratio	40%	
Allowed Rate of Return on Equity	9.35%	
Costs:		
Roofing re-surfacing	$ 112,000	(2017 Canadian Dollars)
Assumed Inflation Rate	2.0%	

Cash Flow Projections:

Expense Projections	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Expenses														
Roof Re-surfacing Costs projected to occur in 2040				$ 118,855	$ 121,232	$ 123,657	$ 126,130	$ 128,653	$ 131,226	$ 133,850	$ 136,527	$ 139,258	$ 142,043	$ 144,884
Discounted Cash Flows @ MECL's WACC of 6.44%	$ -	$ -	$ -	$ 98,561	$ 94,449	$ 90,510	$ 86,734	$ 83,116	$ 79,649	$ 76,327	$ 73,143	$ 70,092	$ 67,168	$ 64,366

PRESENT VALUE COMPARISON OF CT3 BOP AREA ROOFING COSTS FOR RETAINED BUILDING VS. NEW BUILDING

Revision: 12/12/2017

Assumptions:

Life Cycle Cost Analysis Time Range	35	years
Discount Rate (WACC)	6.44%	Maritime Electric's Weighted Average Cost of Capital (WACC)
Debt Ratio	60%	
Interest Rate on Debt	4.50%	
Equity Ratio	40%	
Allowed Rate of Return on Equity	9.35%	
Costs:		
Roofing re-surfacing	$ 112,000	(2017 Canadian Dollars)
Assumed Inflation Rate	2.0%	

Cash Flow Projections:

Expense Projections	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**
Expenses														
Roof Re-surfacing Costs projected to occur in 2040	$ 147,782	$ 150,737	$ 153,752	$ 156,827	$ 159,964	$ 163,163	$ 166,426	$ 169,755	$ 173,150	$ 176,613				
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 61,681	$ 59,108	$ 56,643	$ 54,280	$ 52,016	$ 49,846	$ 47,767	$ 45,774	$ 43,865	$ 42,035				

PRESENT VALUE COMPARISON OF CT3 BOP AREA ROOFING COSTS FOR RETAINED BUILDING VS. NEW BUILDING
Revision: 12/12/2017

Assumptions:

Life Cycle Cost Analysis Time Range	35	years
Discount Rate (WACC)	6.44%	Maritime Electric's Weighted Average Cost of Capital (WACC)
Debt Ratio	60%	
Interest Rate on Debt	4.50%	
Equity Ratio	40%	
Allowed Rate of Return on Equity	9.35%	
Costs:		
Roofing re-surfacing	$ 112,000	(2017 Canadian Dollars)
Assumed Inflation Rate	2.0%	

Cash Flow Projections:

Expense Projections	**2045**	**2046**	**2047**	**2048**	**2049**	**2050**	**2051**	**2052**	**2053**	**2054**
Expenses										
Roof Re-surfacing Costs projected to occur in 2040										
Discounted Cash Flows @ MECL's WACC of 6.44%										

Present Value in 2017 Dollars of re-coating in 2040 **$ 42,035**

PRESENT VALUE COMPARISON OF CT3 BOP AREA BRICK MAINTENANCE COSTS FOR RETAINED BUILDING VS. NEW BUILDING

Revision: 12/12/2017

Assumptions:

Life Cycle Cost Analysis Time Range		35	years
Discount Rate (WACC)		6.44%	Maritime Electric's Weighted Average Cost of Capital (WACC)
Debt Ratio		60%	
Interest Rate on Debt		4.50%	
Equity Ratio		40%	
Allowed Rate of Return on Equity		9.35%	
Costs:			
Annual Brick Re-pointing for Existing Building	$	4,596	(2017 Canadian Dollars)
Assumed Inflation Rate		2.0%	

Cash Flow Projections:

Expense Projections	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Expenses														
Annual Brick Maintenance Costs for Retained Steam Plant				$ 4,877	$ 4,975	$ 5,074	$ 5,176	$ 5,279	$ 5,385	$ 5,493	$ 5,602	$ 5,715	$ 5,829	$ 5,945
Discounted Cash Flows @ MECL's WACC of 6.44%	$ -	$ -	$ -	$ 4,045	$ 3,876	$ 3,714	$ 3,559	$ 3,411	$ 3,268	$ 3,132	$ 3,001	$ 2,876	$ 2,756	$ 2,641

PRESENT VALUE COMPARISON OF CT3 BOP AREA BRICK MAINTENANCE COSTS FOR RETAINED BUILDING VS. NEW BUILDING
Revision: 12/12/2017

Assumptions:

Life Cycle Cost Analysis Time Range	35	years
Discount Rate (WACC)	6.44%	Maritime Electric's Weighted Average Cost of Capital (WACC)
Debt Ratio	60%	
Interest Rate on Debt	4.50%	
Equity Ratio	40%	
Allowed Rate of Return on Equity	9.35%	
Costs:		
Annual Brick Re-pointing for Existing Building	$ 4,596	(2017 Canadian Dollars)
Assumed Inflation Rate	2.0%	

Cash Flow Projections:

Expense Projections	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**	**2044**	**2045**
Expenses															
Annual Brick Maintenance Costs for Retained Steam Plant	$ 6,064	$ 6,186	$ 6,309	$ 6,436	$ 6,564	$ 6,696	$ 6,829	$ 6,966	$ 7,105	$ 7,247	$ 7,392	$ 7,540	$ 7,691	$ 7,845	$ 8,002
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 2,531	$ 2,426	$ 2,324	$ 2,227	$ 2,134	$ 2,045	$ 1,960	$ 1,878	$ 1,800	$ 1,725	$ 1,653	$ 1,584	$ 1,518	$ 1,455	$ 1,394

PRESENT VALUE COMPARISON OF CT3 BOP AREA BRICK MAINTENANCE COSTS FOR RETAINED BUILDING VS. NEW BUILDING
Revision: 12/12/2017

Assumptions:

Life Cycle Cost Analysis Time Range	35	years
Discount Rate (WACC)	6.44%	Maritime Electric's Weighted Average Cost of Capital (WACC)
Debt Ratio	60%	
Interest Rate on Debt	4.50%	
Equity Ratio	40%	
Allowed Rate of Return on Equity	9.35%	
Costs:		
Annual Brick Re-pointing for Existing Building	$ 4,596	(2017 Canadian Dollars)
Assumed Inflation Rate	2.0%	

Cash Flow Projections:

Expense Projections	**2046**	**2047**	**2048**	**2049**	**2050**	**2051**	**2052**	**2053**	**2054**
Expenses									
Annual Brick Maintenance Costs for Retained Steam Plant	$ 8,162	$ 8,325	$ 8,492	$ 8,661	$ 8,835	$ 9,011	$ 9,191	$ 9,375	$ 9,563
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 1,336	$ 1,280	$ 1,227	$ 1,176	$ 1,126	$ 1,079	$ 1,034	$ 991	$ 950

Present Value in 2017 Dollars of Brick Repair of Old Building	**$ 75,135**

PRESENT VALUE COMPARISON OF CT3 BOP AREA LIFE CYCLE COSTS
FOR RETAINED BUILDING VS. NEW BUILDING
Revision: 12/12/2017

Assumptions:

Life Cycle Cost Analysis Time Range	35	years
Discount Rate (WACC)	6.44%	Maritime Electric's Weighted Average Cost of Capital (WACC)
Debt Ratio	60%	
Interest Rate on Debt	4.50%	
Equity Ratio	40%	
Allowed Rate of Return on Equity	9.35%	
Costs:		
Annual Mechanical for Retained Building	$ 16,100	(2017 Canadian Dollars)
Annual Mechanical Costs for New CT3 BOP Building	$ 11,812	(2017 Canadian Dollars)
Electrical Replacement costs for Retained Building in 2045	$ 150,000	(2017 Canadian Dollars)
Electrical Replacement Costs for New CT3 BOP Building in 2045	$ 100,000	(2017 Canadian Dollars)
Inflation Rate on Electric Heating Costs	2.0%	

Cash Flow Projections:

Expense Projections	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
Expenses												
Annual Mechanical Costs for Retained Steam Plant Building				$ 17,085	$ 17,427	$ 17,776	$ 18,131	$ 18,494	$ 18,864	$ 19,241	$ 19,626	$ 20,018
Discounted Cash Flows @ MECL's WACC of 6.44%				$ 14,168	$ 13,577	$ 13,011	$ 12,468	$ 11,948	$ 11,450	$ 10,972	$ 10,514	$ 10,076
Annual Mechanical Costs for New CT3 BOP Building				$ 12,535	$ 12,786	$ 13,041	$ 13,302	$ 13,568	$ 13,840	$ 14,116	$ 14,399	$ 14,687
Discounted Cash Flows @ MECL's WACC of 6.44%				$ 10,395	$ 9,961	$ 9,546	$ 9,147	$ 8,766	$ 8,400	$ 8,050	$ 7,714	$ 7,392
Difference between Options				$ 4,550	$ 4,641	$ 4,734	$ 4,829	$ 4,926	$ 5,024	$ 5,125	$ 5,227	$ 5,332
Discounted Cash Flows @ MECL's WACC of 6.44%	$ -	$ -	$ -	$ 3,773	$ 3,616	$ 3,465	$ 3,321	$ 3,182	$ 3,049	$ 2,922	$ 2,800	$ 2,684

Expense Projections	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
Expenses												
Electrical Replacement Costs for Retained Steam Plant Building in 2045				$ 159,181	$ 162,365	$ 165,612	$ 168,924	$ 172,303	$ 175,749	$ 179,264	$ 182,849	$ 186,506
Discounted Cash Flows @ MECL's WACC of 6.44%				$ 132,001	$ 126,495	$ 121,218	$ 116,162	$ 111,316	$ 106,673	$ 102,223	$ 97,959	$ 93,873
Electrical Replacement Costs for New CT3 BOP Building in 2045				$ 106,121	$ 108,243	$ 110,408	$ 112,616	$ 114,869	$ 117,166	$ 119,509	$ 121,899	$ 124,337
Discounted Cash Flows @ MECL's WACC of 6.44%				$ 88,001	$ 84,330	$ 80,812	$ 77,441	$ 74,211	$ 71,115	$ 68,149	$ 65,306	$ 62,582
Difference between Options				$ 53,060	$ 54,122	$ 55,204	$ 56,308	$ 57,434	$ 58,583	$ 59,755	$ 60,950	$ 62,169
Discounted Cash Flows @ MECL's WACC of 6.44%	$ -	$ -	$ -	$ 44,000	$ 42,165	$ 40,406	$ 38,721	$ 37,105	$ 35,558	$ 34,074	$ 32,653	$ 31,291

PRESENT VALUE COMPARISON OF CT3 BOP AREA LIFE CYCLE COSTS
FOR RETAINED BUILDING VS. NEW BUILDING
Revision: 12/12/2017

Assumptions:

Life Cycle Cost Analysis Time Range	35	years
Discount Rate (WACC)	6.44%	Maritime Electric's Weighted Average Cost of Capital (WACC)
Debt Ratio	60%	
Interest Rate on Debt	4.50%	
Equity Ratio	40%	
Allowed Rate of Return on Equity	9.35%	
Costs:		
Annual Mechanical for Retained Building	$ 16,100	(2017 Canadian Dollars)
Annual Mechanical Costs for New CT3 BOP Building	$ 11,812	(2017 Canadian Dollars)
Electrical Replacement costs for Retained Building in 2045	$ 150,000	(2017 Canadian Dollars)
Electrical Replacement Costs for New CT3 BOP Building in 2045	$ 100,000	(2017 Canadian Dollars)
Inflation Rate on Electric Heating Costs	2.0%	

Cash Flow Projections:

Expense Projections	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**
Expenses													
Annual Mechanical Costs for Retained Steam Plant Building	$ 20,419	$ 20,827	$ 21,244	$ 21,668	$ 22,102	$ 22,544	$ 22,995	$ 23,455	$ 23,924	$ 24,402	$ 24,890	$ 25,388	$ 25,896
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 9,655	$ 9,253	$ 8,867	$ 8,497	$ 8,142	$ 7,803	$ 7,477	$ 7,165	$ 6,866	$ 6,580	$ 6,306	$ 6,043	$ 5,790
Annual Mechanical Costs for New CT3 BOP Building	$ 14,980	$ 15,280	$ 15,586	$ 15,897	$ 16,215	$ 16,540	$ 16,870	$ 17,208	$ 17,552	$ 17,903	$ 18,261	$ 18,626	$ 18,999
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 7,084	$ 6,788	$ 6,505	$ 6,234	$ 5,974	$ 5,725	$ 5,486	$ 5,257	$ 5,038	$ 4,828	$ 4,626	$ 4,433	$ 4,248
Difference between Options	$ 5,438	$ 5,547	$ 5,658	$ 5,771	$ 5,887	$ 6,004	$ 6,124	$ 6,247	$ 6,372	$ 6,499	$ 6,629	$ 6,762	$ 6,897
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 2,572	$ 2,464	$ 2,362	$ 2,263	$ 2,169	$ 2,078	$ 1,991	$ 1,908	$ 1,829	$ 1,752	$ 1,679	$ 1,609	$ 1,542

Expense Projections	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**
Expenses													
Electrical Replacement Costs for Retained Steam Plant Building in 2045	$ 190,236	$ 194,041	$ 197,922	$ 201,880	$ 205,918	$ 210,036	$ 214,237	$ 218,522	$ 222,892	$ 227,350	$ 231,897	$ 236,535	$ 241,266
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 89,957	$ 86,205	$ 82,609	$ 79,163	$ 75,861	$ 72,696	$ 69,664	$ 66,758	$ 63,973	$ 61,305	$ 58,747	$ 56,297	$ 53,948
Electrical Replacement Costs for New CT3 BOP Building in 2045	$ 126,824	$ 129,361	$ 131,948	$ 134,587	$ 137,279	$ 140,024	$ 142,825	$ 145,681	$ 148,595	$ 151,567	$ 154,598	$ 157,690	$ 160,844
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 59,971	$ 57,470	$ 55,072	$ 52,775	$ 50,574	$ 48,464	$ 46,442	$ 44,505	$ 42,649	$ 40,870	$ 39,165	$ 37,531	$ 35,966
Difference between Options	$ 63,412	$ 64,680	$ 65,974	$ 67,293	$ 68,639	$ 70,012	$ 71,412	$ 72,841	$ 74,297	$ 75,783	$ 77,299	$ 78,845	$ 80,422
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 29,986	$ 28,735	$ 27,536	$ 26,388	$ 25,287	$ 24,232	$ 23,221	$ 22,253	$ 21,324	$ 20,435	$ 19,582	$ 18,766	$ 17,983

PRESENT VALUE COMPARISON OF CT3 BOP AREA LIFE CYCLE COSTS
FOR RETAINED BUILDING VS. NEW BUILDING
Revision: 12/12/2017

Assumptions:

Life Cycle Cost Analysis Time Range	35	years
Discount Rate (WACC)	6.44%	Maritime Electric's Weighted Average Cost of Capital (WACC)
Debt Ratio	60%	
Interest Rate on Debt	4.50%	
Equity Ratio	40%	
Allowed Rate of Return on Equity	9.35%	
Costs:		
Annual Mechanical for Retained Building	$ 16,100	(2017 Canadian Dollars)
Annual Mechanical Costs for New CT3 BOP Building	$ 11,812	(2017 Canadian Dollars)
Electrical Replacement costs for Retained Building in 2045	$ 150,000	(2017 Canadian Dollars)
Electrical Replacement Costs for New CT3 BOP Building in 2045	$ 100,000	(2017 Canadian Dollars)
Inflation Rate on Electric Heating Costs	2.0%	

Cash Flow Projections:

Expense Projections	**2042**	**2043**	**2044**	**2045**	**2046**	**2047**	**2048**	**2049**	**2050**	**2051**	**2052**	**2053**	**2054**	**Sum**
Expenses														
Annual Mechanical Costs for Retained Steam Plant Building	$ 26,414	$ 26,942	$ 27,481	$ 28,030	$ 28,591	$29,163	$ 29,746	$30,341	$ 30,948	$31,567	$ 32,198	$32,842	$ 33,499	$ 854,178
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 5,549	$ 5,317	$ 5,096	$ 4,883	$ 4,679	$ 4,484	$ 4,297	$ 4,118	$ 3,946	$ 3,782	$ 3,624	$ 3,473	$ 3,328	$ 263,203
Annual Mechanical Costs for New CT3 BOP Building	$ 19,379	$ 19,766	$ 20,162	$ 20,565	$ 20,976	$21,396	$ 21,824	$22,260	$ 22,705	$23,160	$ 23,623	$24,095	$ 24,577	$ 626,680
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 4,071	$ 3,901	$ 3,738	$ 3,583	$ 3,433	$ 3,290	$ 3,153	$ 3,021	$ 2,895	$ 2,774	$ 2,659	$ 2,548	$ 2,441	$ 193,103
Difference between Options	$ 7,035	$ 7,176	$ 7,319	$ 7,466	$ 7,615	$ 7,767	$ 7,922	$ 8,081	$ 8,243	$ 8,407	$ 8,576	$ 8,747	$ 8,922	$ 227,498
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 1,478	$ 1,416	$ 1,357	$ 1,301	$ 1,246	$ 1,194	$ 1,144	$ 1,097	$ 1,051	$ 1,007	$ 965	$ 925	$ 886	$ 70,100

Present Value in 2017 Dollars of Mechanical Life Cycle Savings of New CT3 BOP Building over Old Building **$ 70,100**

Expense Projections	**2042**	**2043**	**2044**	**2045**
Expenses				
Electrical Replacement Costs for Retained Steam Plant Building in 2045	$ 246,091	$ 251,013	$ 256,033	$ 261,154
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 51,698	$ 49,542	$ 47,475	$ 45,495
Electrical Replacement Costs for New CT3 BOP Building in 2045	$ 164,061	$ 167,342	$ 170,689	$ 174,102
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 34,465	$ 33,028	$ 31,650	$ 30,330
Difference between Options	$ 82,030	$ 83,671	$ 85,344	$ 87,051
Discounted Cash Flows @ MECL's WACC of 6.44%	$ 17,233	$ 16,514	$ 15,825	$ 15,165

Present Value in 2017 Dollars of Electrical Replacement costs in 2045 of New CT3 BOP Building over Old Building **$ 15,165**

Total Combined Difference in Mechanical and Electrical Life Cycle Costs **$ 85,265**

Structural Upgrade Design Services Estimate

Email from Matthew Mitrovich (GHD) to Michael Gallahue (GHD) on December 13, 2017 [cc'd: Tim Morrison (GHD)], Subject: Structural Upgrade Design Services Estimate

The structural upgrade pricing was calculated by compiling a drawing list and extrapolating a cost per sheet. The drawings include an architectural set that would identify the life safety items, among other things, such as the fire rated stairwells and enclosures around equipment. This value was then factored by 2 as past experience where retrofits have been designed typically end up being twice the design/coordination effort as compared to new construction. Other considerations would include another site visit to measure the as-built conditions in detail. A GHD inspector (from Montreal) should also be present to perform testing on rivets and inspect welds. GHD would be reanalyzing the building and verifying member and connection strengths. Situations like this (analysis of existing structures) can be complete after analysis reveals members have adequate resistance or can reveal the need for more design, namely reinforcing of members and/or connections. On new buildings, GHD typically delegates the connection design to fabricators but in this case, it may need to be completed by GHD. An option would be to subcontract that portion of the work as it is a tedious task GHD does not typically perform for every connection present in the building.

Approximate drawing list:

- (10 arch x $3,000) + (2 arch x $1,500) = $33,000
- (12 struc x $4,000) + (4 struc x $2,000) = $56,000
- Total - $89,000 x 2 for additional retrofit/coordination effort
- Total - $178,000 + site work for 2 people for a few days + connections subcontract (potentially)

Email from Michael Gallahue (GHD) to Troy Small (GHD) on December 14, 2017, Subject: Structural Upgrade Design Services Estimate

The estimate for structural upgrade design services totals $178,000. It is noted that this estimate includes drawings for the fire rated enclosures and stairwells, etc. The fire rated enclosures and stairwells were not originally included in the pricing completed with Byron Webber (MECL). Therefore, this estimate should be decreased by $33,000, which should be included in the fire upgrades costing. Structural upgrade design estimated at $145,000.

Attachment D
MECL Supplied Costing Information

CT3 Balance of Plant Requirements for New Building from MECL

Email from Adam MacKenzie (MECL) to Troy Small (GHD) on November 2, 2017 [cc'd: Kent Nicholson (MECL), Joe Steele (MECL) and Kevin Burns (MECL)], Subject: CT3 BOP Equipment

Following the review of the CT3 Balance of the Plant (BOP) Equipment, MECL compiled a detailed list of equipment (**Item #1** following correspondence chain) along with significant items to be relocated, including approximate sizes, suggested clearances and notes pertaining to the final configuration (**Item #2** following correspondence chain). These lists were compiled to assist GHD/MCA in determining the size of the proposed building for CT3 BOP equipment for cost comparison purposes.

MECL indicated that the following considerations should also be made:

- The building should be expandable to accommodate the addition of another combustion turbine on the same site.
- The building does not require lunchrooms, locker rooms, washrooms, etc. as it has been determined that the ECC building has adequate excess space to accommodate these areas.
- The building should not contain offices, with the exception of the 10 x 10 foot office indicated within the mechanical maintenance room.
- Black-start generators should be installed on the exterior of the building, in weather/sound enclosures.
- The unit station service transformer should be an outdoor pad-mount.
- Electrical and battery rooms should be separate.

Email from Troy Small (GHD) to Kent Nicholson (MECL) on November 24, 2017 [cc'd: Adam MacKenzie (MECL), Doug Matheson (MCA), Michael Gallahue (GHD)], Subject: Preliminary Building Layout – CT3 Balance of Plant Equipment

As per previous discussions between GHD and MECL, the preliminary layout for the proposed CT3 BOP Building is intended to provide an idea of the building sizing requirements for costing purposes as part of the Class 5 options analysis. GHD will refine the actual building layout during the Class B cost estimate evaluation if this is the preferred option. However, if MECL has any modification requirements to the preliminary layout, they should be communicated directly to Doug Matheson (MCA). It is recommended that MECL meet at MCA's office to incorporate any required modifications directly into CAD.

Email from Kent Nicholson (MECL) to Joe Steele (MECL), Adam MacKenzie (MECL), Kevin Burns (MECL) on November 24, 2017 [cc'd: Angus Orford (MECL)], Subject: Preliminary Building Layout – CT3 Balance of Plant Equipment

Kent Nicholson requested that Joe Steele and Adam MacKenzie review the Preliminary Building Layout for the CT3 BOP Equipment individually and then collectively to ensure it includes all Equipment and the Operating & Maintenance Clearances that had been compiled for GHD/MCA. The main focus should be on ensuring that the building is the correct size and that all that is

needed for costing is included. Kent also requested that Kevin provide comments in terms of the needs for "Mechanical Maintenance" if MECL bases this group at this location in the future. Less focus should be put on the location of the building, as this can be assessed if a new building is the most cost effective option. It was also noted that MECL desires a higher quality building than the pre-fabricated steel Butler-type building that MCA seems to indicate on their drawings, and that MCA should be made aware of this up-front as it may increase the costing.

Email from Adam MacKenzie (MECL) to Troy Small (GHD) on November 28, 2017 [cc'd: Kent Nicholson (MECL) and Joe Steele (MECL)], Subject: Preliminary Building Layout – CT3 Balance of Plant Equipment

Following the review of the layout drawing for the proposed new CT3 BOP Building, the subsequent list of items was compiled for future discussion with MCA:

- Reconsideration has been made to the addition of locker/washrooms, and MECL would like for these areas to be added. The locker room would need to accommodate 4-6 people, with 6 lockers, a small bench and adequate space for 1-2 people to change.
- Following a discussion between MECL and a General Contractor, the electrical room should be relocated to the 2nd level within the same footprint, and locker/washrooms should be installed below the electrical room. In the event that space remains, another office should be added.
- A 2nd level mezzanine above the spare parts and tool crib should be installed for additional storage for spare parts. Access, in the form of stairs, should be shared with access to the electrical room.
- Air compressor equipment could likely be condensed or stacked. Stairs to the electrical room or additional storage could potentially be installed in this area.
- The ASCO panel should be located adjacent to the Siemen's switchgear as they currently share a bus.
- To accommodate space for mechanical equipment for the building, consideration has been made for an electric boiler, feeding in-floor heat with possible unit heaters at overhead doors as MECL's electricity rates are quite reasonable (open to other suggestions). Use house backflow preventer, water meter, etc. (allocate space, not necessary to have another room).
- If a sprinkler is required in the building, the associated equipment should be included in the mechanical space mentioned above.
- Is a 2nd roll-up door required in the water treatment area, or can service be provided from one door?
- Indicate a future 3rd RO train in the water treatment room.
- Details are missing for the WWT space. If this design is not complete, allocate space for pumps, oil/water separator, control panel, etc.
- Indicate black-start diesel generator exterior of the building, including one 600 kW unit with fuel tank in base and weather enclosure.

Email from Adam MacKenzie (MECL) to Troy Small (GHD) on December 14, 2017 [cc'd: Kent Nicholson (MECL)], Subject: New Building Estimate

Adam met with a local contractor and developed a budgetary quote for the new CT3 BOP Building. Began with a recent quote completed for an 8,000 ft^2 building that was also 20 ft clear. The quote was modified to include mezzanine, higher end finishes on half of the building (which Kent and Adam then changed to include higher end finishes on the entire building), etc. The pricing seems reasonable. One item to note is that the contractor increased his mark-up from 15% to 20% to cover miscellaneous items which had been left out. Other budget items were added, such as landscaping, paving, miscellaneous concrete and architectural fees. A 15% contingency was then added to the subtotal. The total budget was $1,320,775 (**Item #3** following correspondence chain). MECL is satisfied with this budget. Note that there are no funds within this budget for mechanical or electrical equipment, installation or engineering fees.

Potential Requirements for New CT3 Balance of Plant Equipment Building

If Rotable Engine is Swapped-Out 2 week Outage

Reverse Osmosis/Electrodeionization (RO/EDI) Equipment

All of the RO/EDI room equipment needs to be relocated (or replaced) but we could potentially have a smaller Demineralized Water Storage Tank (1/2 size). The room does need to be larger for RO maintenance.

- 2 x 90USGPM GE Osmonics Reverse Osmosis/Electrodeionization Trains
- 2 x 125 USGPM GE Betz Model S48-VN-A Water Softener Trains
- 1 x Water Softener Control Unit 120VAC, 15Amp, 1 Phase
- 1 x 500 US Gallon Softener Brine Storage Tank
- 2 x Brine Injection Pumps (Prominent Gamma/L Version 1005, 0 to 7 GPD)
- 1 x 66 US Gallon Caustic Storage Tank
- 2 x Caustic Injection Pumps (Prominent Gamma/L Version 1601, 0 to 4 GPD)
- 1 x 66 US Gallon Bisulphite Storage Tank
- 2 x Bisulphite Injection Pumps (Prominent Gamma/L Version 1601, 0 to 4 GPD)
- 1 x 300 US Gallon EDI Brine Storage Tank
- 1 x 18,500 US Gallon Stainless Steel Demineralized Water Storage Tank
- 2 x 90 USGPM @ 58feet TH, Demineralized Water Transfer Pumps
- Salt Pallet Storage Area (bags of Salt Pellets)
- Clean-In-Place Tank
- 135 USGPM Goulds Clean-In-Place Circulation Pump
- Eye Wash Station and Hot Water Tank
- Collection System for Water Softener/RO/EDI/Equipment Washing/Floor Drain waste streams

Instrument Air Equipment (currently located in RO/EDI Room)

The following Instrument Air equipment needs to be relocated (or replaced).

- 2 x 94 cfm(FAD) @125psig Sullair Model ES-825H-AC Screw-type Instrument Air Compressors
- 2 x Sullair Model S-MPH-125N Instrument Air Pre Filters
- 2 x Sullair Model SM-88 Desiccant-type Air Dryers
- 2 x Sullair Model S-MPF-125N Instrument Air After Filters
- 2 x 80 US Gallon Manchester Tank Model V80TF Air Receiver tanks

Waste Water Treatment Plant

Oil Water Separator for processing of oily water pumped from an underground wastewater tank which is fed by gravity from drains on the enclosure sump for the LM6000 engine (CT3).
Equipment for Treatment of:

- Water Softener Regenerations

- RO waste streams
- EDI waste streams
- LM6000 (CT3) enclosure sump drains
- Equipment Washing
- CT3 BOP Building floor drain(s) waste streams

Black Start Generator(s)

- NEW 1 x 1,000 kVA Diesel generator (currently we have 2 generators but perhaps could be reduced to one) could be located outdoors in a 80dBA enclosure like the existing Energy Control Center (ECC) generator.
- Generator Breaker Protection, Synchronization Panel, and Generator Breaker Panels, DP600-02, Interlocks and Tie Connection to Main 600V System (Our Contact from Kohler, who installed panel originally, figured we should be able to relocate these panels).

Alternatively, if the cost premium was not too high the two diesels could be located indoors for improved ease of maintenance. However, exhaust system including silencer and air intake/ducting will be required.

The existing Black Start Dorman Diesels are fed from a 969 Liter carbon steel double-walled Diesel Day Tank with vacuum gauge alarm/pump trip.

Electrical Room

Electrical vault for the following equipment:

- 600V Distribution Switchgear DP600-01, Siemens, 2000Amp, 3 Phase, 3 Wire Main Bus with Draw-out Circuit Breakers and Protection Relays
- 600V Balance of Plant Motor Control Center BOP-MCC-01, 1200Amp Bus, 600V, 3 Phase, 3 Wire
- General Distribution Transformer T-02, 45kVA, 3 Phase, 600V-120/208V, Dry Type, Floor Mounted
- Balance of Plant General Distribution Panel DP-01, 120/208V, 3 Phase, 4 Wire, 225Amp, Surface Mount
- Lighting Transformer T-03, 30kVA, 3 Phase, 600V-347/600V Dry Type, Floor Mounted
- Lighting Distribution Panel LP-01, 225Amp, 3 Phase, 4 Wire, 347/600V
- Fuel Oil Heater Control Panel LFO-HCP-01 for 138kW Field Installed Oil Heater Unit
- Balance of Plant Fuel Oil PLC Cabinet PLC-BOP-01 (See Drawings 16562EI-106 and 16562EI-107)

Same general floor area only 1½ times the size as per National Building Code.

Battery Room

125VDC Charger Unit and Battery Bank for Switchgear, Supplied by Siemens

Parts Storage for CT3

We would like a storage area for spare parts the same size as the area that the Dorman Diesels take up, if not larger.

Work Shop

We would like a workshop to be 1/3 the size of the current Machine Shop. (possible area to work on LM6000 gas turbine if necessary)

If the new CT3 BOP building were built attached to the existing Machine Shop (1976 vintage) then the workshop could be incorporated into the Machine Shop.

Offices

Office space for manuals and computers for 4 people (one office with 4 workstations).

Unit Station Service Transformer

1500kVA, 13800V-347/600V, Outdoor Pad Mount Transformer complete with Fire Barrier and Oil Retention Sump will need to remain post-Steam Plant Decommissioning

Additional Potential Items to Consider

- Make building expandable for possible CT4 BOP Equipment and show 'Future' Expansion locations on Layout Drawings
- Probably demolish welding shop with Steam Plant, do we need to replace it?
- Probably demolish locker room with Steam Plant, do we need to replace it?
- Do the staff need a lunchroom, as that will also be demolished.
- Could probably modify ECC to house offices for Combustion Turbine staff, but probably tougher to fit locker room, lunch room, welding shop into the ECC building.

System	Name of Equipment	Size of Equipment	Suggested Clearance	Size of Existing Room	Notes
RO/EDI	RO/EDI Train (1 of 2)	6ft-9" x 16ft x 12ft high skid	5ft	75ft x 20ft	Fork Truck or Hoist access for removal of heavy equipment
	Water Softeners	12ft x 6ft	3ft on front and side		
	Chemical Area	10ft x 6ft	access from centre		Footprint indicated includes access space in middle
	Salt Storage	11ft x 6ft (plus 4-6 pallets)	3ft on one side		4ft x 4ft pallets
	Water Heater / Eyewash	4ft-6" x 6ft	3ft on front and side		
	18,500 US Gallon SS Demin Water Storage Tank	25ft-6" High x 11ft6" Diam.	3ft on front and side		Could likely shrink the size
Air Compressors	Air Compressors (1 of 2)	5ft x 3ft	3 ft on front and back		Suggest these could fit in a box - 14ft x 8ft x 8ft (high)
	Receiver (1 of 2)	23" Dia.	1 ft between tanks, 3ft access on one side		
	Dryer (1 of 2)	4ft x 2ft (both)	3ft on one side		
Electrical Equipment Room	Wall Mounted Equipment	33ft long	6 ft clearance in front	15ft x 22ft + additional 20ft of wall space	
	ASCO Panel	3ft x 4ft-6"	6 ft clearance on 3 sides		
	Siemens LV Switchgear	4ft x 6 ft	6 ft clearance on 3 sides		
	Battery Cabinet	5ft x 3ft	?		Batteries should be in separate Battery Room as per current regulations
	BOP 600V MCC	20" x 13.5ft	6ft clearance on front and 4ft clearance on back (along long dimension)		
Blackstart Diesels	Dorman Diesel footprint with Fuel Tank		4ft	24ft x 18ft	Likely will go with New Diesel located outdoors in Sound/Weather Enclosure
Spare Parts	Spare Parts Room	15ft x 26ft	-	15ft x 26ft	Wishlist includes about 50% more storage space, so 25ftx25ft
Machine Shop	Large Lathe	5ft x 16ft	4-5ft in front, 2-3ft remaining sides	60ft x 30ft	Would likely only keep one of these lathes, suggest keeping the smaller one as it is used more frequently
	Small Lathe	9ft-4" x 3ft-6"	4-5ft in front, 2-3ft remaining sides		
	Drill Press	7ft x 5ft	3ft on 3 sides		
	Ban Saw	7ft x 3ft	10-12ft in front, 2 ft remaining sides		Left a lot of room in front to allow cutting of lengths of steel
	Milling Machine	6ft x 9ft	4ft on 3 sides		
	Work Bench	10ft x 2ft each (quantity of 7)	4ft in front		Presently have 7 work benches, could likely reduce to 4 as there will be 4 employees
	Laydown Area	30ft x 20ft	-		Unsure what size this would need to be, guessed at 30ft x 20ft, should have an overhead door nearby, guess 16ft x 12ft door
	Tool Crib	10ft x 10ft	-		
	Office	10ft x 10ft	-		
Waste Water Treament Plant	GHD/MCA to determine requirements for Downsized WWT Plant				

New CT3 BOP Building Budget							
Maclean Construction breakdown					MECL Adjustment		
	Unit	Cost	Allowance	SubTotal	MECL Adjustment	Total	Notes
General Conditions	-	-	$ 46,750.00	$ 46,750.00	-	$ 46,750.00	
Concrete	-	-	$ 85,635.92	$ 85,635.92	-	$ 85,635.92	
Concrete Form Rentals	-	-	$ 7,500.00	$ 7,500.00	-	$ 7,500.00	
Metals	-	-	$ 2,857.00	$ 2,857.00	-	$ 2,857.00	
Finishes	-	-	$ 7,716.98	$ 7,716.98	-	$ 7,716.98	
Exterior finish allowance	3,900	14	$ -	$ 54,600.00	$ 109,200.00	$ 109,200.00	MacLean Const. allowed increased exterior costs for 2 sides, double for all 4 sides
Building Cost	-	-	$ 520,780.00	$ 520,780.00	-	$ 520,780.00	
Windows	10	1,000	$ -	$ 10,000.00	$ 20,000.00	$ 20,000.00	Double # of windows from 10 to 20
Seamfilling	-	-	$ 7,200.00	$ 7,200.00	-	$ 7,200.00	
Acoustic Ceilings	500	4	$ -	$ 2,000.00	-	$ 2,000.00	
Floor Coating	8,750	5.7	$ 49,625.00	$ 49,875.00	-	$ 49,875.00	
Specialities (Lockers)	-	-	$ 1,600.00	$ 1,600.00	-	$ 1,600.00	
Earthwork	-	-	$ 50,000.00	$ 50,000.00	-	$ 50,000.00	
Financial	-	-	$ 10,826.38	$ 10,826.38	-	$ 10,826.38	
Subtotal				**$ 857,341.28**	**-**	**$ 857,341.28**	
Markup	$ 857,341.28	0.2	$ -	$ 171,468.26	-	$ 171,468.26	
Landscaping			-		$ 20,000.00	$ 20,000.00	Based on 85 trees at a price of $175/tree and $5,000 misc shrubs, etc.
Paving			-		$ 40,000.00	$ 40,000.00	Based on paving 10ft along 125ft side and 40ft along 70ft side@ $10/ft2
Misc. Concrete Add-ons			-		$ 5,000.00	$ 5,000.00	Floor drains, housekeeping pads, sumps, etc.
Subtotal			**-**		**-**	**$ 1,093,809.54**	
Architectural Fees			-		$ 54,690.48	$ 54,690.48	5% because mech/elec all figured out and very little inside the building
Subtotal			**-**		**-**	**$ 1,148,500.01**	
Contingency			-		$ 172,275.00	$ 172,275.00	Contingency is 15%
Total						**$ 1,320,775.01**	

*Confirmed number with Dept. of Transportation and Infrastructure Renewal - $9.50/ft2 12 months ago

** AAPEI guidelines say 4-5% for a warehouse with less than 10% office space (closest comparison)

Heating Requirements for Existing CT3 Balance of Plant versus New Building from MECL

Email from Adam MacKenzie (MECL) to Troy Small (GHD) on December 7, 2017 [cc'd: Kent Nicholson (MECL)], Subject: Life Cycle Comparison – Electric Heating for Portions of Steam Plant

Adam estimated that the existing building will cost MECL $95,000 per year to heat. He noted that the annual heating costs for the new building should be adjusted down to approximately $16,500 (assuming a rate of 0.135 $/kWh) per year based on MECL's actual cost of electricity. Refer to the following for items for details and brief descriptions:

- *Boiler Info* (**Item #4** following correspondence chain): Information based on the boilers used to get boiler efficiency.
- *Existing Oil Consumption* (**Item #5** following correspondence chain): Breakdown of the actual historical bunker volumes to determine how much of MECL's consumption is used to heat the building. Assumptions:
    - 25% of steam is used to heat the bunker tank
    - Actual energy requirements will reduce by 40% when only electric heat is used based on more efficient delivery of heat.
- *Heating Degree Days* (**Item #6** following correspondence chain): List of the Heating Degree Days (HDDs)
- *Station Service* (**Item #7** following correspondence chain): List of all of the station service usage since 2010. Assumptions:
    - Only used months between March and November as heaters have only been used during these months.
    - Corrected for any months that had generation as MECL assumes the numbers would be inaccurate during generation.
    - Corrected for period that Boiler 2 was heating (assuming that electric heaters were off while Boiler 2 was on).
    - Adjusted HDDs by 25% as heaters have only run in shoulder season and plant is able to obtain adequate heat during the day to not require heating during the night during shoulder season. HDDs were based on 18°C, although this is based on residential need to keep house at 20°C, plant only requires to be kept between 15°C and 20°C. Therefore, HDD should have been based on a lower value.
- *Station Service Analysis* (**Item #8** following correspondence chain): Average of the years between 2010 and 2013, which is used as the base consumption. Heater consumption is assumed to be the amount used between 2015 and 2017 above this base consumption. Did not use the 2014 data as heaters weren't installed in the spring (were installed in the fall). Did not use the 2016 data as it appears to be too low and there was an issue with station service 2 meter during this period.

- *Steam Plant Zone* (**Item #9** following correspondence chain): Estimated consumption for the building broken down by zone based on volumes and exposures.
- *Compared to New Bldg* (**Item #10** following correspondence chain): Comparison between MECL's estimates and MCA's projection for the building, correcting for the decreased volume.

The estimate appears to be quite accurate, despite the large assumptions. After the volume is adjusted, the estimate indicates that it would cost 2.3 times more to heat the old building versus the new building. With an R5 roof and leakage through the old building, this seems relatively low.

Maritime Electric - New burner Start up Report

Date 3/29/2006

Burner Serial #	AP114061	Boiler Make	Volcano
Burner Model #	F18-0-150-E110-EPD160-F9H.2	Boiler Model	5M
		Serial #	W1013
Burner Rating	#2 OIL 150 GPH 140K BTU/GAL	Capacity	16000 lbs/hr
	#6 OIL 140 GPH 150K BTU/GAL		

Combustion Data For #2 Oil

Boiler Load	Steam Flow	Oil Pressure	Atm Air/Stm	O2	CO2	CO	Stack Temp	Efficiency
%	Lbs/Hr	PSI	PSI	%	%	%	Deg F	%
30	4500	16	15	6.1	10	6	475	82.4
40	6300	19	18	5.7	10.7	90	496	82.4
50	7500	22	20	4.2	12.5	29	529	83.1
60	9600	26	24	3.8	12.3	15	576	81.8
70	11000	31	28	3.8	11.8	15	616	80.3
80	12500	34	31	3	12.6	15	644	80.3
90	14600	38	35	3.3	12.2	17	673	79.2
100	16500	40	35	2.5	12.9	23	690	79.5

Combustion Data For #6 Oil

Boiler Load	Steam Flow	Oil Pressure	Atm Air/Stm	O2	CO2	CO	Stack Temp	Efficiency
%	Lbs/Hr	PSI	PSI	%	%	%	Deg F	%
30	4500	15	12	5.6	11.4	17	480	83.5
40	6000	17	13.5	na	10.9	9	524	81.8
50	7600	21	16.5	4.4	12.3	9	560	82.3
60	9500	25	19	2.9	13.5	12	588	82.9
70	10800	29	22	3.3	13.3	15	623	81.3
80	12400	33	26	3.8	12.8	15	664	79.7
90	14000	39	29	3.6	13	17	694	79.2
100	16000	43	34	3.3	13.3	39	723	78

#2 Oil Supply Pressure	105 PSI
#6 Oil Supply Pressure	100PSI
#6 Oil Supply Temperature	230-240 F Low Fire - 210-220 F High Fire
Operating Drum Pressure	115-120 PSI

Boiler # 2 Operation

Month	Fuel: Bunker C Loading %	Efficiency	Total bbls	Vented Steam bbls	Bunker Heating bbls	Plant Heating bbls
November	40%	82%	1,082	108	243	730
December	45%	82%	1,217	-	304	913
January	60%	83%	1,623	-	406	1,217
February	60%	83%	1,623	-	406	1,217
March	45%	82%	1,217	-	304	913
April	40%	82%	1,082	-	270	811
May	35%	83%	947	95	213	639
Average/Total	46.4%	82.3%	8,791	203	2,147	6,441

Current Operation - Equivalent heating requirements of new system

Annual Consumption	6,441	bbls
Heating value	6,472,433	BTU/bbl
MMBTU's purchased	41,690	MMBTU
MMBTU's used	34,313	MMBTU

Notes Building heating for November, December, March, April and May Only

No Labour For this Period
No Bunker Heating for this period, may effect length of time required to start generation

Electric heat

Electricity		8.5	kWh = 1 litre furnace oil
Efficiency		100%	
kWh's needed		10,056,291	kWh
Cost per kWh		8.382	cents/kWh
Cost of electricity		$ 842,918	
Labour	$	-	
Cost		$ 842,918	This is the estimated cost to heat the plant from November to May. Note that this is as heated now,
Reduction due adjusted temperatures		45%	
Cost		$ 463,605	

Description: Celsius-based heating degree days for a base temperature of 18C
Source: www.charlottetown.weatherstats.ca/charts/hdd-monthly.html
Station: Charlottetown, P. E. I., PE, CA (63.13W,46.29N)
Station ID: CYYG

Month starting	HDD	Month starting	HDD	Month starting	HDD	Month starting	HDD
1/1/2010	686	1/1/2012	714	1/1/2014	769	1/1/2016	712
2/1/2010	608	2/1/2012	700	2/1/2014	717	2/1/2016	627
3/1/2010	556	3/1/2012	572	3/1/2014	759	3/1/2016	654
4/1/2010	367	4/1/2012	380	4/1/2014	454	4/1/2016	475
5/1/2010	263	5/1/2012	225	5/1/2014	309	5/1/2016	260
6/1/2010	110	6/1/2012	120	6/1/2014	121	6/1/2016	122
7/1/2010	13	7/1/2012	12	7/1/2014	1	7/1/2016	30
8/1/2010	22	8/1/2012	5	8/1/2014	29	8/1/2016	24
9/1/2010	108	9/1/2012	77	9/1/2014	119	9/1/2016	102
10/1/2010	287	10/1/2012	244	10/1/2014	229	10/1/2016	256
11/1/2010	429	11/1/2012	452	11/1/2014	461	11/1/2016	402
12/1/2010	515	12/1/2012	592	12/1/2014	582	12/1/2016	664
1/1/2011	743	1/1/2013	804	1/1/2015	828	1/1/2017	711
2/1/2011	696	2/1/2013	675	2/1/2015	857	2/1/2017	657
3/1/2011	620	3/1/2013	597	3/1/2015	743	3/1/2017	690
4/1/2011	421	4/1/2013	442	4/1/2015	537	4/1/2017	416
5/1/2011	261	5/1/2013	239	5/1/2015	234	5/1/2017	265
6/1/2011	150	6/1/2013	101	6/1/2015	164	6/1/2017	94
7/1/2011	22	7/1/2013	18	7/1/2015	28	7/1/2017	27
8/1/2011	14	8/1/2013	19	8/1/2015	3	8/1/2017	30
9/1/2011	90	9/1/2013	107	9/1/2015	73	9/1/2017	92
10/1/2011	250	10/1/2013	302	10/1/2015	316	10/1/2017	204
11/1/2011	398	11/1/2013	475	11/1/2015	421	11/1/2017	455
12/1/2011	569	12/1/2013	743	12/1/2015	545		

Station Service	January	February	March	April	May	June	July	August	September	October	November	December	Total	Total	Total without Dec/Jan/Feb	Total Corrected for Generation		
						2010												
2	66,240	59,400	62,040	60,240	48,000	34,320	30,300	33,600	34,440	49,920	72,780	106,920	658,200	1,821,280	1,161,830	1,161,830		
3	13,030	12,240	13,170	12,380	13,950	14,670	15,660	14,810	22,900	15,640	22,270	24,820	195,540	3,964	2,155		Average Consumption	1,124,553
9	48,500	42,100	51,500	41,100	0	0	0	0	0	0	23,700	92,900	299,800					
10	52,600	51,300	57,100	62,100	95,100	72,800	70,700	78,300	66,300	71,600	45,000	89,400	812,300					
ECC	11,200	12,320	13,920	11,840	12,240	10,240	11,920	11,920	11,760	11,680	13,280	12,240	144,560					
Generation	0	1,800	0	0	0	0	0	0	0	0	129,000	1,047,000	1,177,800					
Degree Days	686	608	556	367	263	110	13	22	108	287	429	515	3,964					
						2011												
2	67,800	80,880	61,200	60,660	54,300	35,160	33,240	30,960	28,080	36,180	67,080	83,340	638,880	1,929,890	1,134,150	1,130,140		
3	28,470	25,220	26,670	26,000	33,480	26,370	23,860	22,540	25,230	22,950	25,810	16,830	303,430	4,234	2,226			
9	22,000	70,100	22,500	25,000	23,300	21,400	21,400	24,700	21,700	20,800	38,400	127,200	438,500					
10	47,600	87,000	32,000	34,100	41,100	53,400	40,100	52,500	44,100	61,500	37,500	139,300	670,200					
ECC	12,080	7,440	8,160	8,560	9,440	9,200	11,360	11,680	10,240	11,520	11,280	10,160	121,120					
Generation	53,000	1,032,000	0	0	0	0	0	0	0	0	141,800	1,616,600	2,843,400					
Degree Days	743	696	620	421	261	150	22	14	90	250	398	569	4,234					
						2012												
2	51,600	67,620	66,840	55,680	54,180	56,640	45,540	25,080	21,240	28,320	55,500	75,540	603,780	2,593,220	1,998,690	1,155,740		
3	13,680	13,990	26,080	23,490	10,880	10,250	19,030	10,320	11,930	13,710	22,180	14,100	189,640	4,093	2,087			
9	50,100	70,000	28,300	30,900	54,000	78,500	372,200	47,200	42,600	41,100	30,100	68,400	913,400					
10	51,100	48,700	38,000	34,200	35,600	116,000	390,800	53,900	61,500	68,300	57,000	69,700	1,024,800					
ECC	9,200	8,800	10,800	9,920	11,680	11,920	14,880	14,000	9,360	11,520	12,480	13,840	138,400					
Generation	0	313,600	0	0	0	1,329,000	12,695,000	0	0	0	0	66,000	14,403,600					
Degree Days	714	700	572	380	225	120	12	5	77	244	452	592	4,093					
						2013												
2	61,320	58,200	56,940	49,740	36,480	27,240	30,120	27,300	24,600	24,840	49,320	110,160	556,260	1,788,750	1,050,500	1,050,500		
3	21,570	14,530	20,020	28,300	23,590	16,170	14,080	11,190	12,370	17,170	20,450	20,170	219,610	4,522	2,300			
9	39,000	48,100	40,300	28,300	36,400	33,300	23,300	20,300	21,400	21,400	23,200	141,000	476,000					
10	132,800	49,800	54,900	40,800	51,700	43,200	58,600	54,700	61,100	68,200	43,400	41,600	700,800					
ECC	12,000	10,880	13,920	12,880	14,800	13,440	16,560	18,320	14,960	12,960	12,800	10,400	163,920					
Generation	1,194,300	0	0	0	0	0	0	0	0	0	0	944,600	2,138,900					
Degree Days	804	675	597	442	239	101	18	19	107	302	475	743	4,522					
						2014												
2	90,900	76,560	51,900	49,500	32,580	23,940	23,700	20,760	26,340	46,860	85,320	132,060	660,420	2,114,040	1,184,450	1,184,450		
3	11,790	12,690	11,250	10,560	11,400	14,710	16,580	10,310	12,520	13,270	11,750	13,290	150,120	4,550	2,482		2014 is an odd year as the heaters were used in Fall but not Spring	
9	161,400	50,400	45,900	30,100	20,000	19,600	20,400	43,800	53,000	60,400	67,200	138,500	710,700					
10	104,200	40,500	36,600	47,200	61,000	67,900	61,500	46,700	48,200	49,900	66,600	97,300	727,600					
ECC	13,520	12,000	12,160	11,200	13,120	12,960	17,520	14,240	14,640	13,440	0	0	134,800					
Generation	3,109,900	49,100	0	0	0	0	0	0	0	0	0	1,496,600	4,655,600					
Degree Days	769	717	759	454	309	121	1	29	119	229	461	582	4,550				Additional heating Consumption	
						2015												
2	81,360	138,660	65,460	129,300	103,920	28,560	0	0	14,820	84,660	131,580	71,340	849,660	2,910,620	1,913,090	1,913,090		
3	10,340	15,470	9,480	9,010	9,720	23,760	23,650	21,160	12,330	11,410	12,370	12,260	170,960	4,749	2,519		788,538	
9	79,000	274,000	89,400	83,800	74,900	35,700	20,800	21,800	18,800	63,200	72,300	53,300	887,000					
10	71,100	158,600	64,400	150,500	153,000	68,400	40,800	40,000	40,200	100,900	83,000	32,100	1,003,000					
ECC	0	0	0	0	0	0	0	0	0	0	0	0	0					
Generation	0	4,005,300	0	0	0	0	0	0	0	0	0	0	4,005,300					
Degree Days	828	857	743	537	234	164	28	3	73	316	421	545	4,749					
% BLR On	100%	100%	100%	42%	8%	0%	0%	0%	0%	0%	56%	100%						
Corrected HDD	0	0	0	310	215	164	0	0	73	316	186	0	1,265	948.7301				
						2016												
2	66,600	119,400	17,820	0	0	0	0	0	0	0	0	43,020	246,840	2,100,560	1,473,400	1,473,400		
3	11,270	17,180	45,120	57,020	70,330	49,690	22,960	23,580	25,250	50,190	52,240	15,290	440,120	4,328	2325			
9	49,300	124,700	44,900	48,200	75,000	33,400	29,000	32,500	35,700	52,000	48,700	35,300	608,700					
10	22,800	79,200	37,700	85,900	133,100	54,400	38,000	42,700	42,800	124,800	100,400	43,100	804,900					
ECC	0	0	0	0	0	0	0	0	0	0	0	0	0					
Generation	0	1,460,100	85,200	0	0	0	0	0	0	0	0	0	1,545,300					
Degree Days	712	627	654	475	260	122	30	24	102	256	402	664	4,328					
% BLR On	100%	100%	100%	72%	8%	2%	0%	0%	0%	0%	54%	100%						
Corrected HDD	0	0	0	134	239	120	0	0	102	256	185	0	1,036	777.1666				
						2017												
2	52,320	107,520	70,500	79,680	120,960	38,760	18,780	22,020	19,380	58,740	85,980	0	674,640	2,291,480	1,701,520	1,701,520		
3	9,920	13,290	12,970	9,530	11,390	12,460	10,360	12,130	11,330	12,560	11,090	0	127,030	4,305	2273			
9	26,700	128,700	57,000	68,200	95,400	56,200	36,300	49,500	52,100	94,400	94,700	0	759,200					
10	42,300	72,500	59,300	55,100	112,400	71,300	20,300	17,200	22,700	42,700	78,100	0	593,900					
ECC	0	0	0	0	0	0	0	0	0	0	0	0	0					
Generation	0	1,512,300	429,600	0	0	0	0	0	0	0	0	0	1,941,900					
Degree Days	711	657	690	416	265	94	27	30	92	204	455	0	4305					
% BLR On	100%	100%	100%	68%	5%	3%	0%	0%	0%	0%	40%	100%						
Corrected HDD	0	0	0	133	252	91	0	0	92	204	273	0	1,045	783.7875				

		Additional Consumption	Additional Consumption Adjusted for HDD's	
Average consumption 2010-2013	2,033,285	-		
Average consumption (Mar-Nov) 2010-2013	1,124,553	-		
KWH's excluding BLR2 Consumption	899,642			
Average HDD's 2010-2016	4,349			
2014 is Odd year because heaters were working for fall but not for spring so do not use figures from 2014				
2015 consumption	2,910,620	-		
2015 Consumption (Mar-Nov)	1,913,090	1,013,448	4,645,211	
2016 Consumption	2,100,560	-		
2016 Consumption (Mar-Nov)	1,473,400	573,758	3,210,415	
2017 Consumption (Dec assumed)	2,291,480	-		
2017 Consumption (Mar-Nov)	1,701,520	801,878	4,448,940	
Average HDD's				
2016 appears to be an outlier, something wrong with KWH for 2016				
Average between 2015 & 2017			4,547,075	
Cost of Electricity				8.382
Cost to Heat Entire Building			381135.8615	

$ 463,605.07 Estimated Total Cost to Heat Steam Plant with Electric Heat

Zone	Approx. Footprint of Zone (ft2)	Approx. Elevation of Roof Above Grade (ft)	Average	Volume (ft3)	Outdoor Wall Ratio	Multiplier	Estimated Annual Cost to Heat		
#10 Boiler / #10 Turbine Zone	8,220	55.5 (exluding 18 ft Penthouse)	58.2	478,404	5	0.916667	**$ 133,343.50**		
#9 Boiler / #9 Turbine Zone	8,920	55.5 (exluding 18 ft Penthouse)	58.2	519,144	3	0.75	**$ 118,389.92**		
MgOH Zone	1,630	Varies 30 - 32	31	50,530	4	0.833333	**$ 12,803.65**		
#5 Boiler Zone	3,145	44.5	44.5	139,953	1	0.583333	**$ 24,823.50**		
#8 Turbine Zone	3,520	38	38	133,760	1	0.583333	**$ 23,725.13**		
#4 Boiler Zone	3,305	53	53	175,165	1	0.583333	**$ 31,069.18**		
#7 Turbine Zone	3,455	Varies 28 - 44	36	124,380	1	0.583333	**$ 22,061.39**		
Waste Water Treatment Plant Zone	2,630	Varies 28 - 44	36	94,680	1	0.583333	**$ 16,793.48**		
RO-EDI Water Treatment Plant Zone	1,880	Varies 28 - 44	36	67,680	4	0.833333	**$ 17,149.23**		
CT3 Balance of Plant Equipment Zone	5,940	Varies 28 - 44	36	213,840	3	0.75	**$ 48,765.85**	$	97,388.80
Welding Shop	800	Varies 28 - 44	36	28,800	3	0.75	**$ 6,567.79**		
Mechanical Maintenance Shop	1,840	Varies 14-15	14.5	26,680	6	1	**$ 8,112.44**		
	45,285		58.2	2,053,016	6	8.75	**$ 463,605.07**		

$ 381,135.86 Estimated Total Cost to Heat Steam Plant with Electric Heat

Zone	Approx. Footprint of Zone (ft2)	Approx. Elevation of Roof Above Grade (ft)	Average	Volume (ft3)	Outdoor Wall Ratio	Multiplier	Estimated Annual Cost to Heat		
#10 Boiler / #10 Turbine Zone	8,220	55.5 (exluding 18 ft Penthouse)	58.2	478,404	5	0.916667	**$ 109,623.46**		
#9 Boiler / #9 Turbine Zone	8,920	55.5 (exluding 18 ft Penthouse)	58.2	519,144	3	0.75	**$ 97,329.92**		
MgOH Zone	1,630	Varies 30 - 32	31	50,530	4	0.833333	**$ 10,526.05**		
#5 Boiler Zone	3,145	44.5	44.5	139,953	1	0.583333	**$ 20,407.73**		
#8 Turbine Zone	3,520	38	38	133,760	1	0.583333	**$ 19,504.75**		
#4 Boiler Zone	3,305	53	53	175,165	1	0.583333	**$ 25,542.38**		
#7 Turbine Zone	3,455	Varies 28 - 44	36	124,380	1	0.583333	**$ 18,136.96**		
Waste Water Treatment Plant Zone	2,630	Varies 28 - 44	36	94,680	1	0.583333	**$ 13,806.14**		
RO-EDI Water Treatment Plant Zone	1,880	Varies 28 - 44	36	67,680	4	0.833333	**$ 14,098.61**		
CT3 Balance of Plant Equipment Zone	5,940	Varies 28 - 44	36	213,840	3	0.75	**$ 40,091.05**	$	80,064.62
Welding Shop	800	Varies 28 - 44	36	28,800	3	0.75	**$ 5,399.47**		
Mechanical Maintenance Shop	1,840	Varies 14-15	14.5	26,680	6	1	**$ 6,669.34**		
	45,285		58.2	2,053,016	6	8.75	**$ 381,135.86**		

MCA Estimate for new building	$	26,000.00
Assumed $/KWH	$	0.13
Actual $/KWH	$	0.08
Corrected Annual Heating Costs	$	16,227.25
Volume of New Building (ft3)		175,000
Volume of Old Building (ft3)		431,680
Annual Costs corrected for volume	$	40,028.46
Old Building Heating Costs (Oil based Calculation)	$	97,388.80
Ratio to New Building		2.4
Old Building Heating Costs (Station Service based Calculation)	$	80,064.62
Ratio to New Building		2.0

The estimated costs to heat the existing building is only 2.4 times the projected costs to heat the new building when corrected for volume. Therefore assume the higher estimation for heating old building of $97,388.8

Estimated yearly costs to heat old building	**$**	**97,388.80**

Attachment E
MCA Supplied Costing Information (Mechanical) and New Building Layout

MCA CONSULTANTS
ENGINEERS - PROJECT MANAGEMENT

CLASS 5 OPTIONS ANALYSIS

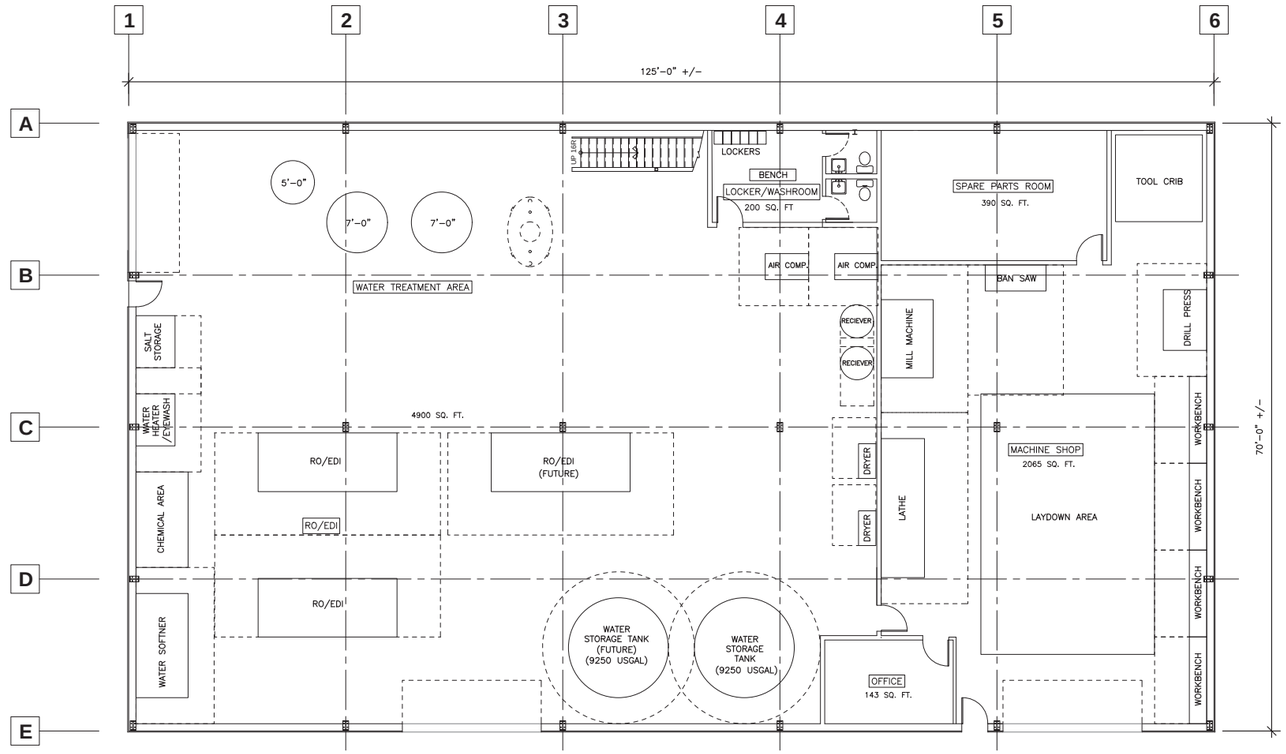
PROJECT	PROJECT NO.
MECL Decommissioning	17-232
DESCRIPTION	**DATE**
Class 5 Options Analysis	2/5/2018

CLASS 5 OPTIONS ANALYSIS											
CT3 BOP TO REMAIN IN EXISTING BUILDING					NEW BUILDING					COMPARISON	NOTE
Description	Unit	Quantity	Unit Price	Amount	Description	Unit	Quantity	Unit Price	Amount	Difference	
PART 1 CT3 BOP Equipment											
Existing RO-EDI	hrs.	0	$ 80.00	$ -	Relocate RO-EDI System (4 people, 4 weeks)	hrs.	640	$ 80.00	$ 51,200.00	$ 51,200.00	
RO-EDI Tank (Ex.)	qty.	1	$ -	$ -	RO-EDI Tanks (New) - Stainless	qty.	1	$ 100,000.00	$ 100,000.00	$ 100,000.00	1/2/8
Commissioning (Ex.)	hrs.	0	$ 100.00	$ -	Commissioning (2 people, 2 weeks)	hrs.	160	$ 100.00	$ 16,000.00	$ 16,000.00	3
RO Water Piping	ft.	0	$ -	$ -	RO Water Piping	ft.	500	$ 80.00	$ 40,000.00	$ 40,000.00	2/3
Existing Waste from CT3	ft.	0	$ -	$ -	New Waste Line from CT3	ft.	500	$ 40.00	$ 20,000.00	$ 20,000.00	2/3
Existing WWT to Remain	lot	1	$ -	$ -	New WWT System	lot	1	$ 100,000.00	$ 100,000.00	$ 100,000.00	2/7
Oil Water Separator (Ex.)	lot	1	$ -	$ -	New Oil Water Separator	lot	1	$ 10,000.00	$ 10,000.00	$ 10,000.00	2/7
Sand Filter	lot	1	$ -	$ -	New Sand Filter	lot	1	$ 40,000.00	$ 40,000.00	$ 40,000.00	2/7
WWT Piping	ft.	0	$ -	$ -	WWT Piping	ft.	500	$ 40.00	$ 20,000.00	$ 20,000.00	2/3/7
WWT Discharge Piping	lot	1	$ 30,000.00	$ 30,000.00	WWT Discharge Piping	lot	1	$ 20,000.00	$ 20,000.00	$ (10,000.00)	2/3
Compressed Air (Ex.)	lot	1	$ -	$ -	Comressed Air (Ex.)	lot	1	$ -	$ -	$ -	
Black Start Diesels (New)	qty.	2	$ -	$ -	Black Start Diesels (New)	qty.	2	$ -	$ -	$ -	
Instrument Air Piping	ft.	0	$ -	$ -	Instrument Air Piping	ft.	500	$ 40.00	$ 20,000.00	$ 20,000.00	2/3
Fuel Oil Piping	ft.	250	$ 40.00	$ 10,000.00	Fuel Oil Piping	ft.	250	$ 40.00	$ 10,000.00	$ -	2/3
Maintenance Fit-Up (Air/Water)	lot	0	$ -	$ -	Maintenance Fit-Up (Air/Water)	lot	1	$ 15,000.00	$ 15,000.00	$ 15,000.00	2/3
									TOTAL	$ 422,200.00	
PART 2 EEC BUILDING SERVICES											
Water Service	lot	1	$ -	$ -	Water Service	lot	1	$ -	$ -	$ -	
Fire Service	lot	1	$ -	$ -	Fire Service	lot	1	$ -	$ -	$ -	
									TOTAL	$ -	
PART 3 HVAC											
Existing to Remain	lot	1	$ -	$ -	HVAC Equipment	sq. ft.	8750	$ 10.00	$ 87,500.00	$ 87,500.00	2/3
Electric Unit Heaters	kW	100	$ 200.00	$ 20,000.00	Electric Unit Heaters	kW	100	$ 200.00	$ 20,000.00	$ -	2/8
Task Ventilation (Ex.)	lot	1	$ -	$ -	Task Ventilation	lot	1	$ 15,000.00	$ 15,000.00	$ 15,000.00	2/8
									TOTAL	$ 102,500.00	
PART 4 PLUMBING											
New Dom. Water Service	ft.	1	$ -	$ -	New Dom. Water Service	ft.	1	$ -	$ -	$ -	
New Sanitary Service	ft.	1	$ -	$ -	New Sanitary Service	ft.	1	$ -	$ -	$ -	
Reconfigure Services In Building	lot	1	$ 75,000.00	$ 75,000.00	New Building Water/Sanitary	sq. ft.	8750	$ 10.00	$ 87,500.00	$ 12,500.00	2/3
Existing Washrooms/Locker	lot	1	$ -	$ -	New Washrooms/Locker	lot	1	$ 10,000.00	$ 10,000.00	$ 10,000.00	2/8
									TOTAL	$ 22,500.00	
PART 5 FIRE PROTECTION											
Relocate/New Fire Pump	lot	1	$ -	$ -	Relocate/New Fire Pump	lot	1	$ -	$ -	$ -	
Fire Entrance	lot	1	$ -	$ -	Fire Entrance	lot	1	$ -	$ -	$ -	
Sprinkler Update	sq. ft.	14000	$ -	$ -	New Sprinkler System	sq. ft.	8750	$ 5.00	$ 43,750.00	$ 43,750.00	2/3
									TOTAL	$ 43,750.00	
PART 6 LIFE CYCLE COSTS											
HVAC Annual Energy Cost	sq. ft.	14000	$ -	$ -	HVAC Annual Energy Cost	sq. ft.	8750	$ -	$ -	$ -	5
HVAC Equipment Annual	sq. ft.	14000	$ 0.75	$ 10,500.00	HVAC Equipment Annual	sq. ft.	8750	$ 0.75	$ 6,562.50	$ (3,937.50)	6a
Plumbing Equipment Annual	sq. ft.	14000	$ 0.40	$ 5,600.00	Plumbing Equipment Annual	sq. ft.	8750	$ 0.40	$ 3,500.00	$ (2,100.00)	6b
Fire Protection (Redundant Sys.)	sq. ft.	14000	$ -	$ -	Fire Protection Annual	sq. ft.	8750	$ 0.20	$ 1,750.00	$ 1,750.00	6c
									TOTAL ($/yr)	$ (4,287.50)	

Lifetime (Years)	35
Relative Cost of New Building	$ 440,888

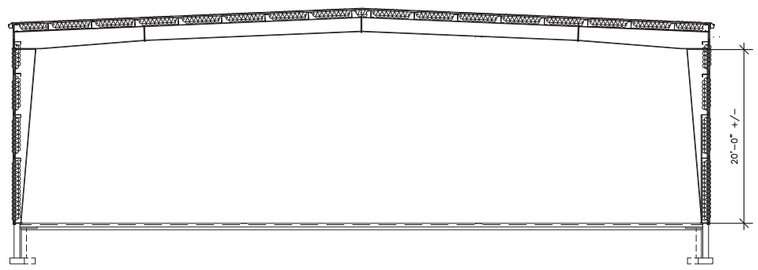
NOTES

1. RO-EDI Tanks could be provided as plastic tanks for $50,000 each (budget pricing from supplier). To be reviewed with MECL.
2. Unless otherwise noted, cost estimates are for supply and install.
3. Cost estimates based on mechanical cost estimating handbooks (RSMeans and Historical Data)
4. The scope of this analysis is to identify differential costs. These estimates may not be representative of real project costs for each option.
5. Preliminary heating load calculations provided to MECL and MECL to prepare annual heating cost estimates.
6. Life cycle costs are based on estimated present value cost of systems per sq. ft., divided by estimated life span of equipment/system.
    a. HVAC @ $15/sq. ft. with 20 year lifetime = $0.75/sq. ft. annual.
    b. Plumbing @ $10/sq. ft. with 25 year lifetime = $0.40/sq. ft. annual.
    c. Fire Protection @ $5/sq. ft. with 25 year lifetime = $0.20/sq. ft. annual.
7. New WWT System may not be necessary. MCA/MECL must confirm with city whether RO-EDI waste and Water Softener Backwash meets acceptable levels to be discharged to city sanitary.
8. Budget pricing obtained from supplier or product literature.



1 / M1 MECHANICAL LAYOUT PLAN - GROUND FLOOR

SCALE: 1/8" = 1'-0"



2 / M1 SECTION PLAN

SCALE: 1/8" = 1'-0"

PRELIMINARY
FOR REVIEW ONLY
Date FEB. 5, 2018

NOTES

NO.	REVISIONS	DD/MM/YY
0	ISSUED FOR CLASS 5 OPTIONS ANALYSIS	05/02/18

Stamp

Client

MECL POWER PLANT DECOMMISSIONING

MCA CONSULTANTS INC
ENGINEERS - PROJECT MANAGEMENT
902.566.9223 info@mcaconsultants.ca www.mcaconsultants.ca

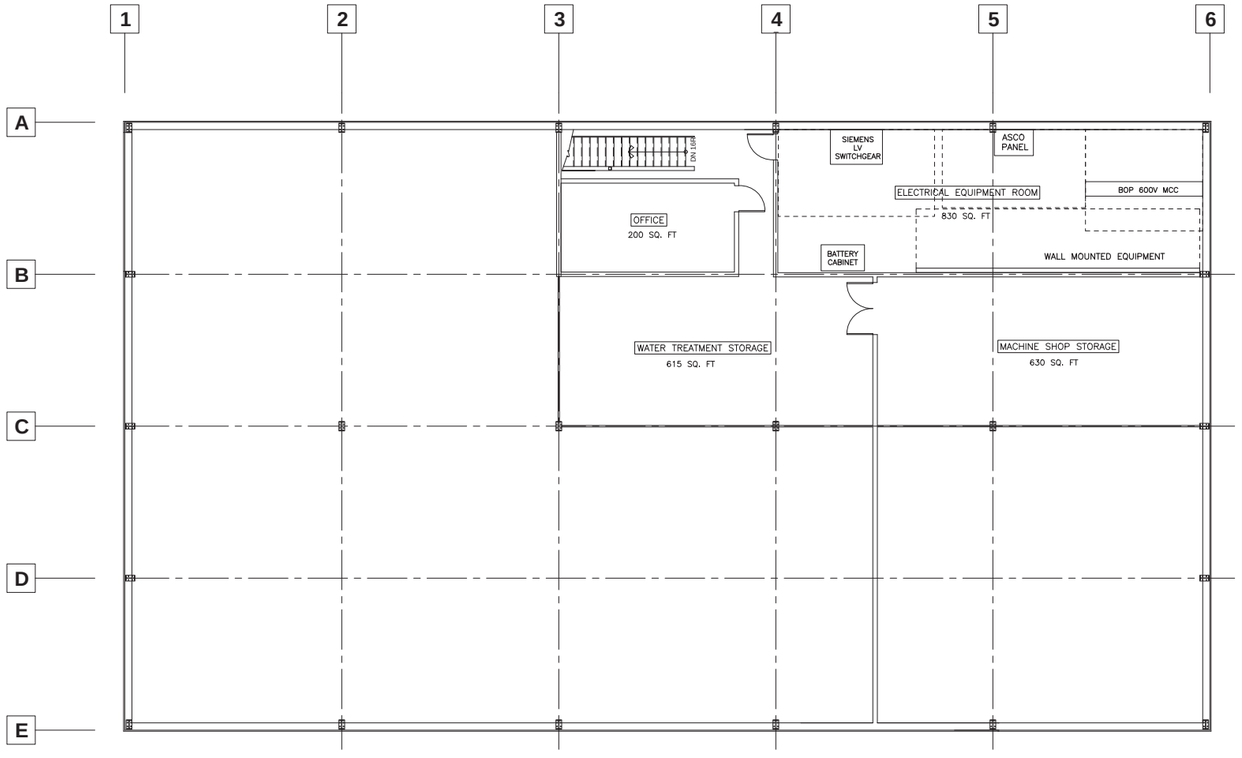
Project

MECL POWER PLANT DECOMMISSIONING

Sheet Title

MECHANICAL LAYOUT PLAN, & SECTION - GROUND FLOOR

Scale	Date
AS NOTED	FEB. 5, 2018
Drn By: S.G.M.	Chk'd By: J.D.M.
Project No.: 17-232	Sheet No.: M1



1/M1 MEZZANINE PLAN
SCALE: 1/8" = 1'-0"

PRELIMINARY
FOR REVIEW ONLY
Date FEB. 5, 2018

NOTES

NO.	REVISIONS	DD/MM/YY
0	ISSUED FOR CLASS 5 OPTIONS ANALYSIS	05/02/18

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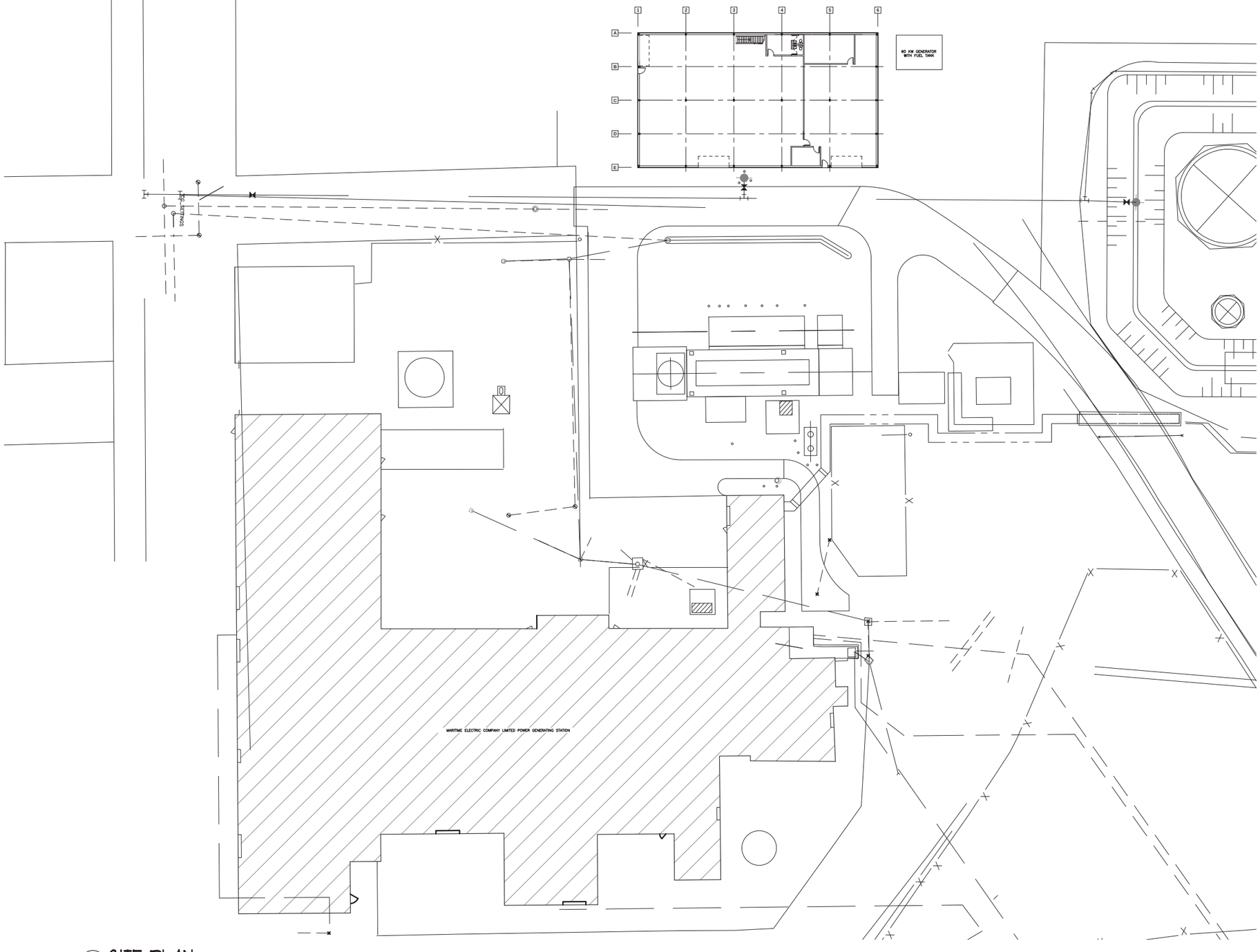
MECL POWER PLANT DECOMMISSIONING

Sheet Title

MEZZANINE PLAN

Scale	Date
AS NOTED	FEB. 5, 2018
Drn By: S.G.M.	Chk'd By: J.D.M.
Project No.: 17-232	Sheet No.: M2



1 / M3 SITE PLAN
SCALE: 1:300

PRELIMINARY
FOR REVIEW ONLY
Date FEB. 5, 2018

NOTES

NO.	REVISIONS	DD/MM/YY
0	ISSUED FOR CLASS 5 OPTIONS ANALYSIS	05/02/18

Stamp

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Project

MECL POWER PLANT DECOMMISSIONING

Sheet Title

SITE PLAN

Scale	Date
AS NOTED	FEB. 5, 2018
Drn By: S.G.M.	Chk'd By: J.D.M.
Project No.: 17-232	Sheet No.: M3

Attachment F
Strum Supplied Costing Information (Electrical)

MECL CHARLOTTETOWN
STEAM PLANT DECOMMISSIONING
OPTIONS COST ANALYSIS - ELECTRICAL

EQUIPMENT AND INSTALLATION COST

	CT3 BOP TO REMAIN IN EXISTING BUILDING					CT3 BOP TO MOVE TO NEW BUILDING					
CT3 BOP ELECTRICAL EQUIPMENT	**TASK**	**UNIT**	**UNIT PRICE**	**QUANTITY**	**AMOUNT**	**TASK**	**UNIT**	**UNIT PRICE**	**QUANTITY**	**AMOUNT**	**DIFFERENCE**
Siemens, 2000A, 3P, 3W, Switchgear	No change required	lot				Move Equipment, re-terminate existing conductors	lot	$6,000	1	$6,000	$6,000
2x900kVA Diesel Generators	Replace Generators with 1x1000kVA generator	lot	$400,000	1	$400,000	Replace Generators with 1x1000kVA generator	lot	$400,000	1	$400,000	$0
Generator Breaker, Synchronization Panel, and Generator Breakers	No change required	lot				Move Equipment, re-terminate existing conductors	lot	$6,000	1	$6,000	$6,000
600V, CT3, BOP MCC, 600V, 1200A, 3P, 3W	No change required	lot				Move Equipment, re-terminate new/existing conductors	lot	$12,000	1	$12,000	$12,000
45kVA, 3P, 600V/120-208V, Dry Type, General Dist. Transformer	No change required	lot				Disconnect and Move Equipment	lot	$2,000	1	$2,000	$2,000
Balance of Plant General Distribution Panel, 225A, 120/208V, 3P, 4W	No change required	lot				Install new general distribution panel	lot	$5,000	1	$5,000	$5,000
30kVA, 3P, 600V/347-600V, Dry Type, Lighting Dist. Transformer	No change required	lot				Disconnect and Move Equipment	lot	$2,000	1	$2,000	$2,000
347/600V, 3P, 4W, 225A, Lighting Distribution panel	No change required	lot				Install new lighting distribution panel	lot	$5,000	1	$5,000	$5,000
Fuel Oil Heater Control Panel	No change required	lot				Disconnect and Move Equipment	lot	$2,000	1	$2,000	$2,000
Balance of Plant Fuel Oil PLC Cabinet	No change required	lot				Disconnect and Move Equipment	lot	$2,000	1	$2,000	$2,000
BOP DC Supply (Charger and Batteries)	No change required	lot				Disconnect and Move Equipment	lot	$4,000	1	$4,000	$4,000
RO VEDA Drive #1, 50HP, 600V	No change required	lot				Disconnect and Move Equipment	lot	$3,000	1	$3,000	$3,000
RO VEDA Drive #1, 50HP, 600V	No change required	lot				Disconnect and Move Equipment	lot	$3,000	1	$3,000	$3,000
RO Rectifier #1, 400VDC, 27A	No change required	lot				Disconnect and Move Equipment	lot	$3,000	1	$3,000	$3,000
RO Rectifier #2, 400VDC, 27A	No change required	lot				Disconnect and Move Equipment	lot	$3,000	1	$3,000	$3,000
1500kVA, 13.8kV/347-600V, Outdoor Pad Mount Transformer	No change required	lot				Move Equipment, re-terminate existing conductors	lot	$25,000	1	$25,000	$25,000
Fire Protection System	No change required	lot				New fire control panel and associated detectors	lot	$23,000	1	$23,000	$23,000
Telecom	New Telecom System	lot	$13,000	1	$13,000	New Telecom System	lot	$13,000	1	$13,000	$0
Replace RO Power and Instrumentation cables	No new cables required	lot				Install and terminate new cables	lot	$19,000	1	$19,000	$19,000
Replace WWT Power and Instrumentation cables	No new cables required	lot				Install and terminate new cables	lot	$28,000	1	$28,000	$28,000
Replace Fuel System Instrumentation cables	No new cables required	lot				Install and terminate new cables	lot	$38,000	1	$38,000	$38,000
Replace BOP 347/600V Power Feeders (Panel LP-01)	No new cables required	lot				Install and terminate new cables	lot	$10,000	1	$10,000	$10,000
Replace BOP 120/208V Power Feeders (Panel DP-01)	No new cables required	lot				Install and terminate new cables	lot	$19,000	1	$19,000	$19,000
Replace BOP 125VDC Power Feeders	No new cables required	lot				Install and terminate new cables	lot	$10,000	1	$10,000	$10,000
Replace short cables associated with the BOP MCC	No new cables required	lot				Install and terminate new cables	lot	$8,000	1	$8,000	$8,000
Station Service for BOP Building Services	Building electrical service to be replaced and brought up to present electrical code. Building area is 14000 sq. ft.	lot	$150,000	1	$150,000	Install new building electrical services. Building area is 8750 sq. ft.	lot	$100,000	1	$100,000	-$50,000
Testing/Commissioning	Minimal testing/commissioning required	lot	$5,000	1	$5,000	Test/commissioning of relocated equipment	lot	$30,000	1	$30,000	$25,000
											DIFFERENCE
											$213,000

CT3 BOP LIFE CYCLE COST ANALYSIS (35 Years)

	CT3 BOP TO REMAIN IN EXISTING BUILDING					CT3 BOP TO MOVE TO NEW BUILDING					
CT3 BOP ELECTRICAL EQUIPMENT	**LIFE CYCLE INFORMATION**	**UNIT PRICE**	**EQUIPMENT AGE**	**LIFE CYCLE**	**LIFE CYCLE COST**	**LIFE CYCLE INFORMATION**	**UNIT PRICE**	**EQUIPMENT AGE**	**LIFE CYCLE**	**LIFE CYCLE COST**	**DIFFERENCE**
Siemens, 2000A, 3P, 3W, Switchgear	25 Year Life Cycle, Present Value	$40,000	10	25	$40,000	25 Year Life Cycle, Present Value	$40,000	10	25	$40,000	$0
2x900kVA Diesel Generators	35 Year Life Cycle, Present Value	$400,000	0	35	$0	35 Year Life Cycle, Present Value	$400,000	0	35	$0	$0
Generator Breaker, Synchronization Panel, and Generator Breakers	25 Year Life Cycle, Present Value	$30,000	10	25	$30,000	25 Year Life Cycle, Present Value	$30,000	10	25	$30,000	$0
600V, CT3, BOP MCC, 600V, 1200A, 3P, 3W	25 Year Life Cycle, Present Value	$30,000	10	25	$30,000	25 Year Life Cycle, Present Value	$30,000	10	25	$30,000	$0
45kVA, 3P, 600V/120-208V, Dry Type, General Dist. Transformer	25 Year Life Cycle, Present Value	$7,500	10	25	$7,500	25 Year Life Cycle, Present Value	$7,500	10	25	$7,500	$0
Balance of Plant General Distribution Panel, 225A, 120/208V, 3P, 4W	25 Year Life Cycle, Present Value	$5,000	10	25	$5,000	25 Year Life Cycle, Present Value	$5,000	0	25	$5,000	$0
30kVA, 3P, 600V/347-600V, Dry Type, Lighting Dist. Transformer	25 Year Life Cycle, Present Value	$5,000	10	25	$5,000	25 Year Life Cycle, Present Value	$5,000	10	25	$5,000	$0
347/600V, 3P, 4W, 225A, Lighting Distribution panel	25 Year Life Cycle, Present Value	$5,000	10	25	$5,000	25 Year Life Cycle, Present Value	$5,000	0	25	$5,000	$0
Fuel Oil Heather Control Panel	25 Year Life Cycle, Present Value	$10,000	10	25	$10,000	25 Year Life Cycle, Present Value	$10,000	10	25	$10,000	$0
Balance of Plant Fuel Oil PLC Cabinet	25 Year Life Cycle, Present Value	$10,000	10	25	$10,000	25 Year Life Cycle, Present Value	$10,000	10	25	$10,000	$0
BOP DC Supply (Charger and Batteries)	25 Year Life Cycle, Present Value	$20,000	10	25	$20,000	25 Year Life Cycle, Present Value	$20,000	10	25	$20,000	$0
RO VFD Drive #1, 50HP, 600V	25 Year Life Cycle, Present Value	$10,000	10	25	$10,000	25 Year Life Cycle, Present Value	$10,000	10	25	$10,000	$0
RO VFD Drive #1, 50HP, 600V	25 Year Life Cycle, Present Value	$10,000	10	25	$10,000	25 Year Life Cycle, Present Value	$10,000	10	25	$10,000	$0
RO Rectifier #1, 400VDC, 27A	25 Year Life Cycle, Present Value	$10,000	10	25	$10,000	25 Year Life Cycle, Present Value	$10,000	10	25	$10,000	$0
RO Rectifier #2, 400VDC, 27A	25 Year Life Cycle, Present Value	$10,000	10	25	$10,000	25 Year Life Cycle, Present Value	$10,000	10	25	$10,000	$0
1500kVA, 13.8kV/347-600V, Outdoor Pad Mount Transformer	25 Year Life Cycle, Present Value	$100,000	10	25	$100,000	25 Year Life Cycle, Present Value	$100,000	10	25	$100,000	$0
Building Services	25 Year Life Cycle, Present Value	$150,000	0	25	$150,000	25 Year Life Cycle, Present Value	$100,000	0	25	$100,000	-$50,000
											DIFFERENCE
											-$50,000

Relative Cost Electrical Services of New Building **$163,000**

**CT3 BOP Power Cables. It has been assumed that power cables associated with CT3 BOP Transformer, Switchgear and MCC will be re-used. If the existing cables are not long enough, new cables will be required, this is dependent on the location of CT3 BOP loads and condition of cables which will need to be tested after they are disconnected.*

Building Services Cost Calculations

Existing Building

	QTY	UNIT	LABOUR				COMMENTS	MATERIAL/EQPT/EXPENSES		TOTAL	
			UNIT MH	MH RATE	UNIT COST	AMOUNT		UNIT COST	AMOUNT	UNIT COST	AMOUNT
Remove existing electrical distribution equipment	1	lot	128	$90.00	$11,520.00	$11,520.00		$0.00	$0.00		$11,520.00
Install new Electrical Cables Associated with Branch Circuits	100	Circuits	4	$90.00	$360.00	$36,000.00		$75.00	$7,500.00		$43,500.00
Install new Electrical Cables Associated with Distribution Circuits	5	Circuits	8	$90.00	$720.00	$3,600.00		$250.00	$1,250.00		$4,850.00
Install Light Fixtures	50	Fixtures	1	$90.00	$90.00	$4,500.00		$75.00	$3,750.00		$8,250.00
Install Light Switch	15	Switches	0.5	$90.00	$45.00	$675.00		$5.00	$75.00		$750.00
Install Receptacles	75	Recpt.	1	$90.00	$90.00	$6,750.00		$5.00	$375.00		$7,125.00
Install Distribution Panel	3	Panel	20	$90.00	$1,800.00	$5,400.00		$3,000.00	$9,000.00		$14,400.00
Install Lighting Panel	2	Panel	8	$90.00	$720.00	$1,440.00		$3,000.00	$6,000.00		$7,440.00
Building Services Transformer	1	XFMR	8	$90.00	$720.00	$720.00		$40,000.00	$40,000.00		$40,720.00
Shop Transformer	1	XFMR	8	$90.00	$720.00	$720.00		$8,000.00	$8,000.00		$8,720.00

$147,275.00

New Building

	QTY	UNIT	LABOUR				COMMENTS	MATERIAL/EQPT/EXPENSES		TOTAL	
			UNIT MH	MH RATE	UNIT COST	AMOUNT		UNIT COST	AMOUNT	UNIT COST	AMOUNT
Install new Electrical Cables Associated with Branch Circuits	80	Circuits	4	$90.00	$360.00	$28,800.00		$75.00	$6,000.00		$34,800.00
Install new Electrical Cables Associated with Distribution Circuits	3	Circuits	8	$90.00	$720.00	$2,160.00		$250.00	$750.00		$2,910.00
Install Light Fixtures	40	Fixtures	1	$90.00	$90.00	$3,600.00		$75.00	$3,000.00		$6,600.00
Install Light Switch	10	Switches	0.5	$90.00	$45.00	$450.00		$5.00	$50.00		$500.00
Install Receptacles	50	Recpt.	1	$90.00	$90.00	$4,500.00		$5.00	$250.00		$4,750.00
Install Distribution Panel	2	Panel	20	$90.00	$1,800.00	$3,600.00		$3,000.00	$6,000.00		$9,600.00
Install Lighting Panel	1	Panel	8	$90.00	$720.00	$720.00		$3,000.00	$3,000.00		$3,720.00
Building Services Transformer	1	XFMR	8	$90.00	$720.00	$720.00		$25,000.00	$25,000.00		$25,720.00
Shop Transformer	1	XFMR	8	$90.00	$720.00	$720.00		$8,000.00	$8,000.00		$8,720.00

$97,320.00

Equipment Relocation/Replacement Cost Calculations

	Labour				Equipment				
CT3 BOP ELECTRICAL EQUIPMENT	Unit	Unit Rate	Quantity	Amount	Unit	Unit Rate	Quantity	Amount	Total
Siemens, 2000A, 3P, 3W, Switchgear	hours	$90	48	$4,320	lot	$1,000	1	$1,000	$5,320
2x900kVA Diesel Generators					lot	$400,000	1	$400,000	$400,000
Generator Breaker, Synchronization Panel, and Generator Breakers	hours	$90	48	$4,320	lot	$1,000	1	$1,000	$5,320
600V, CT3, BOP MCC, 600V, 1200A, 3P, 3W	hours	$90	112	$10,080	lot	$1,000	1	$1,000	$11,080
45kVA, 3P, 600V/120-208V, Dry Type, General Dist. Transformer	hours	$90	8	$720	lot	$1,000	1	$1,000	$1,720
Balance of Plant General Distribution Panel, 225A, 120/208V, 3P, 4W	hours	$90	16	$1,440	lot	$3,000	1	$3,000	$4,440
30kVA, 3P, 600V/347-600V, Dry Type, Lighting Dist. Transformer	hours	$90	8	$720	lot	$1,000	1	$1,000	$1,720
347/600V, 3P, 4W, 225A, Lighting Distribution panel	hours	$90	16	$1,440	lot	$3,000	1	$3,000	$4,440
Fuel Oil Heater Control Panel	hours	$90	8	$720	lot	$1,000	1	$1,000	$1,720
Balance of Plant Fuel Oil PLC Cabinet	hours	$90	8	$720	lot	$1,000	1	$1,000	$1,720
BOP DC Supply (Charger and Batteries)	hours	$90	32	$2,880	lot	$1,000	1	$1,000	$3,880
RO VEDA Drive #1, 50HP, 600V	hours	$90	16	$1,440	lot	$1,000	1	$1,000	$2,440
RO VEDA Drive #1, 50HP, 600V	hours	$90	16	$1,440	lot	$1,000	1	$1,000	$2,440
RO Rectifier #1, 400VDC, 27A	hours	$90	16	$1,440	lot	$1,000	1	$1,000	$2,440
RO Rectifier #2, 400VDC, 27A	hours	$90	16	$1,440	lot	$1,000	1	$1,000	$2,440
1500kVA, 13.8kV/347-600V, Outdoor Pad Mount Transformer	hours	$90	160	$14,400	lot	$10,000	1	$10,000	$24,400
Fire Protection System	hours	$90	80	$7,200	lot	$15,000	1	$15,000	$22,200
Telecom	hours	$90	80	$7,200	lot	$5,000	1	$5,000	$12,200
Replace RO Instrumentation cables	hours	$90	96	$8,640	lot	$10,000	1	$10,000	$18,640
Replace WWT Instrumentation cables	hours	$90	192	$17,280	lot	$10,000	1	$10,000	$27,280
Replace Fuel System Instrumentation cables	hours	$90	192	$17,280	lot	$20,000	1	$20,000	$37,280
Replace BOP 347/600V Power Feeders (Panel LP-01)	hours	$90	48	$4,320	lot	$5,000	1	$5,000	$9,320
Replace BOP 120/208V Power Feeders (Panel DP-01)	hours	$90	96	$8,640	lot	$10,000	1	$10,000	$18,640
Replace BOP 125VDC Power Feeders	hours	$90	48	$4,320	lot	$5,000	1	$5,000	$9,320
Replace short cables associated with the BOP MCC	hours	$90	32	$2,880	lot	$5,000	1	$5,000	$7,880

Attachment G
Fire Protection Requirements and Costing

Email from Adam MacKenzie (MECL) to Winston Bryan (City of Charlottetown) on November 16, 2017 [cc'd: Kent Nicholson (MECL), Mel Cheverie (City of Charlottetown) and Troy Small (GHD)], Subject: Fire Inspector Tour of CTGS - Notes

Summary of the Fire Inspection Tour of CTGS with Winston Bryan (Fire Inspector for the City of Charlottetown), Kent Nicholson and Adam MacKenzie:

- The ECC Building plans were reviewed and the areas intended to be kept and demolished were discussed.
- A Site tour of the Steam Plant Facility was conducted, visiting only the areas that are slated to remain within the building.
- The following areas of concern were mentioned by Winston, which will require further investigation:
    - Currently, approximately 25% of the building that is to remain is serviced by the sprinkler system (e.g., "RO-EDI Plant" and half of "CT3 Balance of Plant" areas) and 75% is not serviced by the sprinkler system. In Winston's opinion, the entire space to remain would be required to be serviced by the sprinkler system.
    - The building currently has an open concept, with very few fire separations. Winston suggested that the space would likely be required to be compartmentalized with separate zone (with appropriate fire ratings) for the following spaces)
        - Electrical Room
        - Generator Room
        - Locker Room
        - Office Space
    - Would likely require proper fire ratings on some of the existing separated zones, such as the RO Room, WWT Room, Welding Shop and Maintenance Shop.
    - Would need to address emergency exiting from all of the spaces within the building which may include stairs to the 2nd and 3rd level spaces.
    - Fire Water Supply Piping will need to be modified as it presently runs through the portion of the building to be demolished.
    - Fire Pump will likely still be required. It will need to be relocated or the renovations/demolition will need to allow to keep that portion of the building.
    - Need to review the ECC Building sprinkler system as it is presently fed off of the fire pump but this would likely be changed to have its own feed for fire water off of the Cumberland Street water main.
    - Winston indicated that MECL may want to get a consultant (similar to RJ Bartlett) to conduct a fire code review of the space to ensure it is suitable from a life safety code point of view

Email from Byron Webber (MECL) to Kent Nicholson (MECL) on November 26, 2017 [cc'd: Troy Small (GHD), Michael Gallahue (GHD) and Adam MacKenzie (MECL)], Subject: Class 5 Cost Estimates for Fire Protection Upgrades Likely for CT3 BOP Area in Retained Portion of Steam Plant Building

Byron Webber reviewed the drawings provided by Kent Nicholson, along with Winston Bryan's comments. Byron compared the information to NFPA 850, 2015 version and also to the methods and logic for similar NB Power facilities to meet, exceed or limit the Code recommendations. The comments were reviewed based on NBC requirements:

1) **Sprinkler the remaining 75% of the building** – NFPA 850 does not recommend the outright sprinklering of any areas that would remain within the existing building. Electrical rooms are to be protected only if there are large concentrations of combustible cables in the room (3 x 2 foot wide trays at the 40% fill CEC were used to allow as a point where they would consider protection) (Section 7.8.4 of 850). Detection is recommended. RO Rooms, WWT Rooms and Locker Rooms are not mentioned in the Code and do not require protection. Offices, Welding and Maintenance Shops should be protected if the combustible content warrants it and if a fire in these areas could endanger critical areas of the remaining building (Section 7.9.2 of 850). Based on Byron's memory of these areas on the site tour, the protection of these areas is not warranted. The diesels do not automatically have to be protected but Byron would recommend they be protected if they remain inside the building, as they currently are.

2) **2 hour separation** - Although not mentioned by Winston, the NFPA 850 recommends a 2 hour separation. NFPA 850 recommends that the Electrical Rooms, Generator Room, Office, Welding and Maintenance Shops be separated, provided this is required based on type, quantity, density and location of combustible material, the location and configuration of the plant equipment, the consequence of losing the plant equipment and existence of suppression or detection in the area. Byron's recommendation would be that the diesel generators definitely be separated, however, since they will be replaced the most cost effective solution may be to locate new skid mounted units exterior the building. Byron would separate the Electrical Room mostly to prevent smoke contamination of any electronics in the MCC's, etc. in the event of a fire elsewhere. Contamination of the electronics could require replacement of MCC tubs needlessly. Winston also did not mention the existing Control and Computer Rooms and Byron did not recall to what extent they have to remain. If they are critical to the operation of CT3 then they should have a 2 hour separation, mostly for smoke control.

3) **Upgrade exiting to meet the NBC including 2nd and 3rd levels** – Enclosed stairwells would be required by the NBC and this is a good improvement to incorporate. As far as travel distances, Byron would advise Winston that the NFPA 101 distances (Section 5.2.2 of 850) be used if needed to reduce or eliminate any horizontal exiting structures. In other words, only perimeter exit doors would be needed, as well as exit hallways connected to vertical stairwells. Travel distances to these stairwells could fall under NFPA 202 to possible limit the number of stairwells required to two.

4) **Rework the fire water supply in demolished area** – It appears that the only sprinkler system that would remain that was based on a fire pump being available would be the ECC Building so it cannot be fed off of Cumberland Street without another fire pump being installed. The existing protection over the RO and diesels appears to use City water pressure (approximately

60 psig). If new diesels are installed on the exterior of the building, Byron would not recommend sprinklers in any areas of the remaining building, therefore is may be cheapest to feed the ECC from Cumberland Street and add a booster pump. The piping in the demolished part of the plant can then be demolished with the building. If the diesels stay interior the building, Byron would not continue to use the existing pre-action sprinkler system. The piping is Sch 10 roll grooved carbon steel which will, in time, pinhole from water remaining in the bottom of the pipe. Since this has been identified as an issue in the past, Sch 40 cut groove is now used to eliminate the trough in each piece of pipe from the roll grooving process. The system also relies on smoke detection which is prone to false trips on something like a diesel which can smoke for many reasons other than a fire. The pre-action sprinkler and ceiling level detection are expensive to access and maintain annually. Byron would recommend that a flat ceiling be built over the diesels to reduce heating costs and then would install a ceiling level wet pipe sprinkler system to protect this area. This would provide the cheapest solution to install and maintain protection that is the most reliable. A new water feed would have to be constructed, most likely from the ECC to the retained BOP. Byron does not have RJB Drawing 6, which is referred to as Protection for the Old Control and Computer Rooms, however, it does not appear these areas were serviced by the sprinkler system and that would not be a typical choice for the type of protection these rooms would warrant. If this is the case then Byron's recommendation above would be still valid.

5) **Existing fire pump house** – Based on Byron's recommendation above, there would be no need to retain this pump house, and it could therefore be demolished.

Email from Byron Webber (MECL) to Troy Small (GHD) and Michael Gallahue (GHD) on November 29, 2017, Subject: Fire Rated Exits

Byron reviewed the fire rated exits that would be required if the BOP for CT3 is kept. The following items were provided to Michael to estimate:

1) Turbine Hall Stairwell 1, East Side, Walls 1548 ft^2, Roof 352 ft^2, Doors 3

2) Turbine Hall Stairwell 2, West Side, Walls 1132 ft^2, Roof 144 ft^2, Doors 3

3) WWT/Boiler 6 Stairwell, Walls 1196 ft^2, Rood 144 ft^2, Doors 4

4) Total, Walls 2328 ft^2, Roofs 640 ft2, Doors 10

Walls to be standard 2 hour rated, 8" block walls with rebar and filled cavities. Roof to be Q deck with 4' to 6" poured concrete. Doors to be single leaf 1-1/2 hour rated. Allow for extra cost to retrofit walls around existing steel, etc., and some possible extra support steel to tie the wall to existing structure. Concrete roof to use concrete pump to place concrete.

Email from Michael Gallahue (GHD) to Byron Webber (MECL) and Troy Small (GHD) on November 30, 2017, Subject: Fire Rated Exits

Michael's costing for the fire rated exits are as follows:

- Concrete block wall costs - $150,000 ($64/ ft^2 for 8" clock wall with reinforcing rod and all cavities grouted)
- Concrete roofs - $25,000 ($36/ft^2 for 4" slab on metal deck)

- Fire doors - $10,000 ($1,000/door installed)
- Allowance for steel tie-ins, alterations to black walls to fit into existing space and structural members, etc. - $10,000

It is noted that $50/lineal foot should be added for supply and installation of fire sealant at the tops of the block walls to create a fire seal between the top of the wall and the roof.

Email from Byron Webber (MECL) to Troy Small (GHD) and Michael Gallahue (GHD) on November 29, 2017, Subject: Electrical Panel Room, BOP Area

A 2 hour room is required to enclose the electrical wall panels on the south wall of the turbine floor. Wall area is 800 ft^2, roof is 444 ft^2 and two doors are required.

Email from Michael Gallahue (GHD) to Byron Webber (MECL) and Troy Small (GHD) on November 30, 2017, Subject: Electrical Panel Room, BOP Area

Michael's costing for the electrical panel room in the BOR area are as follows:

- Concrete block wall costs - $40,000 ($50/ ft^2 for 8" clock wall with reinforcing rod and all cavities grouted). It is noted that there is reduced costing for black walls given that it is a simpler construction than stairwells.
- Concrete roofs - $16,000 ($36/ ft^2 for 4" slab on metal deck)
- Fire doors - $2,000 ($1,000/door installed)
- Allowance for steel tie-ins, alterations to black walls to fit into existing space and structural members, etc. - $10,000

It is noted that $50/lineal foot should be added for supply and installation of fire sealant at the tops of the block walls to create a fire seal between the top of the wall and the roof.

Email from Byron Webber (MECL) to Troy Small (GHD) and Michael Gallahue (GHD) on November 30, 2017, Subject: Final Estimate, Block Walls

Based on the numbers received from Michael, the following block wall cost was generated. Fire sealant quantities are 208 feet for the stairwells and 160 feet for the Electrical Room

- Stairwells: $205,400
- Electrical Room: $66,000
- Total: $271,400