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2015 System Access Investments

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2015 Meters
Budget Year	2015
Investment Category	System Access
Project Summary	This program includes the installation of Horizon Utilities' metering assets, in compliance with Measurement Canada standards. The work includes: • installation of complex and commercial meters at new service locations; • upgrade of metering installations for expanded service requirements; • inspection and replacement of defective meters; • installation of new and replacement metering for residential and multi-residential metered customers; and, • Smart Meter gatekeepers for replacement and growth.

Capital Investment (5.4.5.2.A.i)		
	Capital Investment	$ 2,471,000
	Total	$ 2,471,000
	O&M Expenditure	$ 0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	n/a

Project Dates (5.4.5.2.A.iii)				
Start Date	2015/01/01			
In Service Date	2015/12/31			
Expenditure Timing				
Q1	Q2	Q3	Q4	
25%	25%	25%	25%	

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Schedule risk for the installation of meters at new service locations is due to customer delays or restricted access to work sites. Horizon Utilities co-ordinates the connection of new services with customers to mitigate this risk.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Metering investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP) - $1,715,716
2011 (CGAAP)- $3,467,413
2012 (MIFRS) - $25,168,043
2013 (MIFRS) - $1,658,707
2014 (MIFRS) - $2,499,104

The increased investment in 2012 was due to the implementation of Smart Meters at a cumulative capital cost of $23,277,588. Horizon Utilities substantially completed its mass deployment of Smart Meters in 2009 and, as at the end of 2011, had installed Smart Meters for 229,322 customers or 98.0% of all metering points.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and as such no associated OM&A costs related to REG will be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act 1998.*

Evaluation Criteria and Information (5.4.5.2.B)

Project Name 2015 Meters Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Access (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Renewal (20%)

Replacement of commercial meters with smart meters.

Investment Priority (5.4.5.2.B.1.b)
5 – Mandatory Project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) (where applicable)

Metering asset management is governed by Measurement Canada regulation and customer requirements for new and upgraded services.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Horizon Utilities' Smart Meter and related AMI network have been procured through Elster. Elster's system supports a multi-layered security approach including: access control, authorization, authentication and data integrity protocols. As part of its continuous improvement model, Horizon Utilities performs periodic security assessments to identify opportunities for enhanced system hardening.

Co-ordination and Interoperability (5.4.5.2.B.4) **(where applicable)**

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Co-ordination with utilities and regional planning is not required. Horizon Utilities coordinates with customers as required by the scope of work involved.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)
A component of this investment supports the capital investment required for the ongoing operation, maintenance, and installation of the Smart Metering infrastructure.

Economic Development (5.4.5.2.B.5) **(where applicable)**
Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**
The Smart Meter infrastructure supports the province's conservation culture. Smart metering also provides environmental benefits through reduction of in field visits associated with manual meter reading.

System Access Specific Requirements (5.4.5.2.C.a)

Project Name 2015 Metering Table 3

System Access Specific Requirements (5.4.5.2.C.a)

Factors Affecting Implementing Project Timing/Priority (5.4.5.2.C.a.i)
Compliance sampling work completed to comply with Measurement Canada regulations. The schedule is created to smooth the annual sampling requirements from the original Smart Meter mass deployments.

New and replacement metering is provided on demand to address new load growth and meter failures.

Factors Related to Customer Preference or 3rd Party Input (5.4.5.2.C.a.ii)

Metering for new and upgraded connection projects are customer initiated and are designed to meet customer identified requirements.

Factors Affecting Final Project Cost (5.4.5.2.C.a.iii)
Please refer to Note I for an explanation on the factors affecting the final project cost.

Controllable Cost Minimization (5.4.5.2.C.a.iv)

Please refer to Note I for an explanation regarding controllable cost minimization.

Other Planning Objectives (5.4.5.2.C.a.v)

Horizon Utilities combines work from multiple work groups to reduce costs and increase efficiency. The line work and meter work is combined when connecting new customers to allow the work to be completed by a single work group.

Assessment of Technical or Implementation Options (5.4.5.2.C.a.vi)

Metering work is Measurement Canada and customer driven and the technology is primarily based on the metering products available from a sole source supplier.

Summary of Options Analysis (5.4.5.2.C.a.vii) (where applicable)

Metering supplier selected as part of the smart meter implementation program.

Final Economic Evaluation Results (5.4.5.2.C.a.viii) (where applicable)

Horizon Utilities completes the economic evaluation for any customer system access project which requires the construction of new facilities to the main distribution system or an increase in the existing capacity of distribution facilities. For further details please see Appendix E of Horizon Utilities' Conditions of Service. The economic evaluation is completed in accordance with section 3.2 of the Distribution System Code ("DSC"). For the 2015-2019 Test Years, Horizon Utilities has no known projects for which to provide the final economic evaluation. When a road authority requests a relocation of Horizon Utilities' plant located on the public road allowance, the costs shall be shared, as outlined in the Ontario *Public Service Works on Highways Act*. Other projects within this category will have an economic evaluation completed where applicable in accordance with both the DSC and Appendix E of Horizon Utilities' Conditions of Service.

Identification of System Impacts (5.4.5.2.C.a.ix) (where applicable)

System expansion, if required, to connect customers within this category is governed by Horizon Utilities' Conditions of Service, Section 2.1.2.1.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2015 Road Relocations		
Budget Year	2015		
Investment Category	System Access		
Project Description	Projects in this category involve the relocation of Horizon Utilities' assets to support road relocation and road reconstruction projects at the request of the City of Hamilton, the City of St. Catharines, the Ministry of Transportation, and the Region of Niagara.		
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$ 2,990,011	
	Customer Contribution	$ 904,360	
	Capital Investment (net)	$ 2,085,561	
	O&M Expenditure	$ 0	
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	n/a		
Project Dates (5.4.5.2.A.iii)	Start Date	Various – driven by road authority schedules	
	In Service Date	Various – driven by road authority schedules	

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

The initiation and timing of these projects are dictated by the City of Hamilton, City of St. Catharines, the Ministry of Transportation, or the Region of Niagara. Consequently, the timing and value of investment required by Horizon Utilities is subject to change.
Please refer to Note I for an explanation on general risk and cost mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Road relocations for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP) - $ 2,889,575
2011 (CGAAP)- $ 895,524
2012 (MIFRS) - $ 3,151,887
2013 (MIFRS) - $ 340,491
2014 (MIFRS) - $ 977,024

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2015 Road Relocations	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)

System Access (90%)

Secondary Driver (5.4.5.2.B.1.a)

System Renewal (5%)
System Service (5%)

Investment Priority (5.4.5.2.B.1.b)
5 – Mandatory Project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) (where applicable)

Horizon Utilities co-ordinates project design and discusses design alternatives for each project with the organization (City, Region, Ministry of Transportation) from which the request originates to relocate distribution assets.

Safety (5.4.5.2.B.2)

These projects are not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Timelines for the execution of these projects are dictated by the City of Hamilton, City of St. Catharines, the Ministry of Transportation or the Region of Niagara. Horizon Utilities coordinates work with these stakeholders, wherever possible, on the road relocations with planned distribution projects.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Access Specific Requirements (5.4.5.2.C.a)

Project Name 2015 Road Relocations Table 3

System Access Specific Requirements (5.4.5.2.C.a)

Factors Affecting Implementing Project Timing/Priority (5.4.5.2.C.a.i)

The road authority's schedule and timing of the road project will affect the Horizon Utilities' project implementation and timing.

Factors Related to Customer Preference or 3rd Party Input (5.4.5.2.C.a.ii)

Road relocation projects involve a co-ordinated design process and the initiating organization (City, Municipality, or Ministry of Transportation) has input into the design of the project.
The designs for all projects within the public right-of-way are reviewed with the City (whether Hamilton or St. Catharines) as Municipal Consents are required prior to construction. Consideration is given by the road authority to coordinate all utilities within the right-of-way in the least disruptive manner.

Factors Affecting Final Project Cost (5.4.5.2.C.a.iii)

Please refer to Note I for an explanation on the factors that can affect the final project cost.

Controllable Cost Minimization (5.4.5.2.C.a.iv)

50% of Labour, Labour saving devices and Equipment rentals are recovered from the road authority. Please refer to Note I for an explanation on controllable cost minimization.

Other Planning Objectives (5.4.5.2.C.a.v)

Horizon Utilities combines work to reduce overall costs and increase efficiency. The most common opportunity is during city road relocation projects where a new water main is being installed. Horizon Utilities may be able to take advantage of the fact that installing duct structure is less costly since the road is already excavated. Horizon Utilities may also be able to change the schedule of a renewal project to align with the road authority's work to maximize these benefits. The costs of these additional works are allocated to either system service or system renewal where applicable. Horizon Utilities can maximize the amount of work that can be completed at the lowest cost to benefit ratepayers in these cases.

Assessment of Technical or Implementation Options (5.4.5.2.C.a.vi)

Horizon Utilities co-ordinates project design and discusses design alternatives for each project with the road authority (City, Municipality, Ministry of Transportation) originating the request to relocate distribution assets.

Summary of Options Analysis (5.4.5.2.C.a.vii) (where applicable)

Horizon Utilities reviews proposed design with municipalities and the Ministry of Transportation, as applicable, in an effort to determine the most cost effective solution.

Final Economic Evaluation Results (5.4.5.2.C.a.viii) (where applicable)

n/a

Identification of System Impacts (5.4.5.2.C.a.ix) (where applicable)

Horizon Utilities follows the *Public Service Works on Highways Act*, 1990 and associated regulations governing the recovery of costs related to road reconstruction work by collecting contributed capital for 50% of the labour; labour saving devices, and equipment rentals. Capital contributions toward the cost of all customer demand projects are collected by Horizon Utilities in accordance with the DSC and the provisions of its Conditions of Service.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2015 Customer Connections
Budget Year	2015
Investment Category	System Access
Project Summary	Projects in this category include multiple projects required to connect, upgrade, or disconnect customers to the distribution system. Horizon Utilities' obligation to connect new customers is governed by the *Electricity Act, 1998, Schedule 28.*

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$ 4,414,998
Customer Contribution	$ 728,725
Capital Investment (net)	$ 3,686,273
O&M Expenditure	n/a

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

Horizon Utilities completes approximately 1800 connections annually; 1500 through subdivisions and 300 customer projects, contributing approximately 25MVA in system load growth.

Project Dates (5.4.5.2.A.iii)

Start Date	Various – as driven by the customer
In Service Date	Various – as driven by the customer

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable investments, net of capital contributions, for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 1,023,336
2011 (CGAAP)- $ 2,030,541
2012 (MIFRS) - $ 1,652,000
2013 (MIFRS) - $ 3,541,455
2014 (MIFRS) - $ 4,063,471

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2015 Customer Connections	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Access (100%)

Secondary Driver (5.4.5.2.B.1.a)
N/A

Investment Priority (5.4.5.2.B.1.b)
5 – Mandatory Project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

Customer connection projects are driven by customer requests and the customer's specific technical requirements. To build efficiencies into the process, Horizon Utilities utilizes a set of design standards that have been engineered and approved. Customer connections requests are fulfilled consistent with Horizon Utilities' Conditions of Service, designed to meet the customer requirements and maintain system reliability.

Safety (5.4.5.2.B.2)

These projects are not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) (where applicable)

n/a

Co-ordination and Interoperability (5.4.5.2.B.4) **(where applicable)**

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

This is not applicable for these projects.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

System Access Specific Requirements (5.4.5.2.C.a)	**Project Name**	2015 Customer Connections	Table 3

System Access Specific Requirements (5.4.5.2.C.a)

Factors Affecting Implementing Project Timing/Priority (5.4.5.2.C.a.i)

Schedule of work is based on customer expectations; customer request may not be standard design.

Factors Related to Customer Preference or 3rd Party Input (5.4.5.2.C.a.ii)

These projects are customer initiated and are designed to meet customer identified requirements.

Factors Affecting Final Project Cost (5.4.5.2.C.a.iii)

Please refer to Note I for an explanation on the factors affecting final project cost.

Controllable Cost Minimization (5.4.5.2.C.a.iv)

Please refer to Note I for an explanation on the factors affecting controllable cost.

Other Planning Objectives (5.4.5.2.C.a.v)

n/a

Assessment of Technical or Implementation Options (5.4.5.2.C.a.vi)

Please refer to Note III for information on the technical and implementation options.

Summary of Options Analysis (5.4.5.2.C.a.vii)

Please refer to Note III for information on the technical and implementation options.

Final Economic Evaluation Results (5.4.5.2.C.a.viii)

Horizon Utilities completes the economic evaluation for any customer system access project which requires the construction of new facilities to the main distribution system or an increase in the existing capacity of distribution facilities. For further details please see Appendix E of Horizon Utilities' Conditions of Service. The economic evaluation is completed in accordance with section 3.2 of the Distribution System Code ("DSC"). For the 2015-2019 forecast period Horizon Utilities has no known projects for which to provide the final economic evaluation. When a road authority requests a relocation of Horizon Utilities' plant located on the public road allowance, the costs shall be shared, as outlined in the Ontario *Public Service Works on Highways Act*. Other projects within this category will have an economic evaluation completed where applicable in accordance with both

	the DSC and Appendix E of Horizon Utilities' Conditions of Service. **Identification of System Impacts (5.4.5.2.C.a.ix) (where applicable)** System expansion, if required, to connect customers within this category are governed by Horizon Utilities' Conditions of Service Section 2.1.2.1.

2015 System Renewal Investments

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2015 Reactive Renewal
Budget Year	2015
Investment Category	System Renewal
Project Summary	This category includes all projects required for the reactive renewal or repairs driven by emergency equipment failures and associated corrective action. Projects arise from trouble calls or inspection programs identifying an urgent need to replace system assets and the scope of the equipment replacement requires engineering. Also included in this category are projects to address customer power quality issues and Electrical Safety Authority ("ESA") due diligence inspection outcomes.

Capital Investment (5.4.5.2.A.i)		
	Capital Investment (gross)	$4,780,000
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	n/a

Project Dates (5.4.5.2.A.iii)				
	Start Date	January 1, 2015		
	In Service Date	December 31, 2015		
	Expenditure Timing			
	Q1	Q2	Q3	Q4
	25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable investments for the 2010 to 2013 Historical Year and the 2014 Bridge Year are:
2010 (CGAAP)- $ 8,745,125
2011 (CGAAP)- $ 8,230,970
2012 (MIFRS) - $ 4,032,000
2013 (MIFRS) - $ 6.069,566
2014 (MIFRS) - $ 4,840,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

	Leave to Construct Approval (5.4.5.2.A.vii) This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act 1998.*

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name**	2015 Reactive Renewal	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 5 – Mandatory project		
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) (where applicable) No alternatives are considered for these projects as they involve the emergency replacement of failed equipment required to restore service.		
	Safety (5.4.5.2.B.2) These projects are intended to primarily address failed assets however investments required to address immediate safety issues, including issues presenting a potential risk to public safety identified by the ESA, and are included in this project.		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) (where applicable) n/a		
	Co-ordination and Interoperability (5.4.5.2.B.4) **(where applicable)** **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** This is not applicable to these projects.		
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.		

	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

System Renewal Specific Requirements (5.4.5.2.C.b)	**Project Name** 2015 Reactive Renewal	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

These projects are reactive in nature and are initiated from equipment that has failed or that has a high risk of failure that would result in a service interruption. These projects have a very high probability of impacting Horizon Utilities' reliability targets.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

These projects address failed assets or assets with a high risk of imminent failure and as such, these assets are at the end of their useful life. The asset condition relative to their typical life cycle varies in each incident or outage.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

The number of customers impacted varies in each incident or outage.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

The quantitative customer impact varies in each incident or outage.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

These projects address customer satisfaction as they are required to address failed assets that have either caused a system interruption, or have a high probability of causing a service interruption.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each incident or outage.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

These projects are reactive in nature and address failed assets, or assets at risk of imminent failure. Investments must be performed when identified.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

Improvements to reliability and security are expected as secondary benefits to this project.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v) (where applicable)

Investment for this project addresses failed assets, or assets at risk of imminent failure. Investments are not subject to project prioritization as they are reactive and non-discretionary.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

Assets are replaced reactively to replace failed assets, or assets at risk of imminent failure are performed on a like-for-like basis. No extra costs to address other distributor planning objectives are incurred with these projects.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	HI-F3 Renewal –Governor's Road West of Pirie Drive
Budget Year	2015
Investment Category	System Renewal
Project Summary	This project involves the renewal of 4kV distribution assets on the Highland F3 feeder as part of the 4kV and 8kV Renewal Program. The assets are located along Governor's Road West of Pirie Drive.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$973,728
Customer Contribution	$0
Capital Investment (net)	$973,728
O&M Expenditure	$ 0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

The project affects 48 customers and 1,025kVA of transformation.

Project Dates (5.4.5.2.A.iii)

Start Date 2015/03/01

In Service Date 2015/09/30

Expenditure Timing

Q1	Q2	Q3	Q4
14%	43%	43%	O%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Highland substation as part of the 4kV and 8kV Renewal Program. The 2015 investment for the renewal of Highland substation is $1,128,000. The 2015 investment in the 4kV and 8kV Renewal Program is $8,160,000. Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

	Leave to Construct Approval (5.4.5.2.A.vii) This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name** HI-F3 Renewal –Governor's Road West of Pirie Drive	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the program is $70,000,000 for all 28 substations. Therefore the renewal of the distribution assets at the current 4kV level was not a feasible alternative. This project is the first project of multiple projects required to renew the service territory serviced by Highland substation.	
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a	
	Co-ordination and Interoperability (5.4.5.2.B.4) **(where applicable)** **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name HI-F3 Renewal –Governor's Road West of Pirie Drive Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The distribution assets in the Dundas operating area are in poor health and have significant operating constraints. The Dundas operating area also contains 25% of the 4kV XLPE cable. The 4kV XLPE cable is in poor health with 38% of the assets having a Health Index of either 'very poor' or 'poor'.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 48 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.002

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Highland substation is scheduled for renewal in 2015, 2016 and 2017. This project is required to be completed in 2015 to allow for the renewal of the remaining area to completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Renewal of this area will allow for the decommissioning of the substation assets by 2017 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	HI-F3 Renewal U/G Bridlewood subdivision
Budget Year	2015
Investment Category	System Renewal
Project Summary	This project involves the renewal of XLPE in the Bridlewood subdivision within the Dundas operating area.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$2,105,630
Customer Contribution	$0
Capital Investment (net)	$2,105,630
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project affects 178 customers and 600kVA of transformation

Project Dates (5.4.5.2.A.iii)

Start Date 2015/06/01

In Service Date 2015/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
0%	14%	43%	43%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project supports both the 4kV and 8kV Renewal Program and the XLPE Renewal Program.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)			
	Project Name	HI-F3 Renewal U/G Bridlewood subdivision	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project		
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This is currently a 4kV underground distribution and Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore, the renewal of this project at the current 4kV level was not a feasible alternative.		
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a		
	Co-ordination and Interoperability (5.4.5.2.B.4) **(where applicable)** **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.		
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.		
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a		

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	HI-F3 Renewal U/G Bridlewood subdivision	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

XLPE primary cable is the asset group with the largest investment requirement as identified by the Kinectrics ACA. The current backlog volume of XLPE primary cable requiring renewal cannot be addressed in a single year and requires a multiple year investment strategy. The optimal level of renewal for XLPE cable, based on a 40-year useful life replacement cycle, is 50km/year. Horizon Utilities' proposed investment for the 2015 to 2019 Test Years is $36,014,000, which provides for the replacement of 180km of cable over the 2015 to 2019 Test Years. This represents a managed, gradual increase in investment in order to balance rate payer concerns and practical operational limitations

The Dundas operating area has 13.5km of XLPE cable with a Health Index of either "very poor" or "poor".

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

An analysis of all service interruptions, caused by material or equipment failure from 2010 to 2013, revealed that 50% of service interruptions, measured by customer minutes of outage, were due to failures of underground cable and equipment. Over 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration. These durations far exceed Horizon Utilities' corporate target of one hour and nine minutes of outage on average per customer.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 178 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.006

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The timing of this project is required to co-ordinate with the 4kV and 8kV Renewal Program as it involves both the renewal of XLPE primary cable and the renewal of the underground section of the Highland substation F3 feeder. Renewal of this area will allow for the decommissioning of the substation assets by 2017 thereby avoiding the need for capital investment into these substations.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of XLPE primary cable will provide reliability improvements through reduced service interruptions caused by failed equipment. The cable renewed by this project is direct buried and therefore subject to extended outages, requiring multiple hours to repair, upon failure.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project is required to co-ordinate with the 4kV and 8kV Renewal Program as it involves both the renewal of XLPE primary cable and the renewal of the underground section of the Highland substation F3 feeder. Renewal of this area will allow for the decommissioning of the substation assets by 2017 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2015 Pole Residual Replacements
Budget Year	2015
Investment Category	System Renewal
Project Summary	This project involves the replacement of wood poles identified by pole residual testing as having a high risk of failure.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$1,225,920
Customer Contribution	$0
Capital Investment (net)	$1,225,920
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2015/01/01

In Service Date 2015/06/30

Expenditure Timing

Q1	Q2	Q3	Q4
50%	50%	0%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Year and the 2014 Bridge Year are:
2010 (CGAAP)- $ 1,326,407
2011 (CGAAP)- $ 895,000
2012 (MIFRS) - $ 930,000
2013 (MIFRS) - $ 718,074
2014 (MIFRS) - $ 1,190,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2015 Pole Residual Replacements	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (100%)

Secondary Driver (5.4.5.2.B.1.a)
n/a

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

The replacement of wood poles in this project is identified through Horizon Utilities' pole testing maintenance program. The pole testing categorized the poles requiring replacement into two categories: 1) requiring immediate replacement; and 2) requiring replacement within five years.

Horizon Utilities replaces poles requiring immediate replacement as soon as possible to mitigate the risk of service interruptions and the risk to public safety resulting from a failure of the pole.

Horizon Utilities replaces poles requiring replacement within five years in the following year. Failure to replace in the following year compounds the volume of work in subsequent years resulting in cascading delays and compounded volumes in subsequent years.

Poles replaced in this project are replaced on a like-for-like basis where possible.

Safety (5.4.5.2.B.2)

This project will address wood poles requiring replacement as identified through testing. Renewal of these assets prior to failure avoids the potential risk to public safety that would result from a failure of a wood pole.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4) **(where applicable)**

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b) (where applicable)
n/a

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name 2015 Pole Residual Replacements Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

This project is reactive in nature the work required is initiated through Horizon Utilities' maintenance and inspection programs. This project has a very high probability of impacting Horizon Utilities' reliability targets if the poles are not replaced.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

This project address wood poles that have been identified as having a high risk of failure and as such, these assets are at the end of their useful life. The asset condition relative to their typical life cycle varies in case.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

The number of customers impacted varies in each incident or outage.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

The quantitative customer impact varies in each incident or outage.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

These projects address customer satisfaction as they are required to address assets at risk of failure which would result in a service interruption.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each incident or outage.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

These projects are reactive in nature and address assets at risk of failure. Horizon Utilities replaces poles requiring immediate replacement as soon as possible to mitigate the risk of service interruptions and the risk to public safety resulting from a failure of the pole.

Horizon Utilities replaces poles requiring replacement within five years in the following year. Failure to replace in the following year compounds the volume of work in subsequent years resulting in cascading delays and compounded volumes in subsequent years.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

This project will provide reliability and safety benefits as the project involves the replacement of wood poles that are at risk of failure. Failure of the asset would result in a service interruption and a potential risk to public safety.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

These poles present a risk to public safety and are scheduled in the near term.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

Poles replaced in this project are replaced on a like-for-like basis where possible as this presents the lowest cost option. No additional costs are incurred to address other distributor planning objectives.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2015 Load Break Disconnect Switch ("LBDS") Replacement
Budget Year	2015
Investment Category	System Renewal
Project Summary	This project involves the replacement of LBDS found to be either inoperable or beyond economic repair (where the cost of maintenance is not warranted) as found through Horizon Utilities' maintenance and inspection programs. Such switches will be replaced with automated switches where an operational benefit can be realized. This is a multi-year program based on 16 replacements per year

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$323,000
Customer Contribution	$0
Capital Investment (net)	$323,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2015/01/01

In Service Date 2015/06/30

Expenditure Timing

Q1	Q2	Q3	Q4
0%	0%	50%	50%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 212,000
2014 (MIFRS) - $ 312,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2015 LBDS Replacement	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project involves the replacement of LBDS switches identified as requiring replacement through Horizon Utilities' maintenance and inspection programs. When feasible, the switches are refurbished rather than replaced. Where refurbishment is not possible the switches will be replaced with an automated switch where an operational benefit can be realized.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Horizon Utilities utilizes the Smart Meter communication infrastructure when communicating with automated switches. Horizon Utilities' Smart Meter and related AMI network have been procured through Elster. Elster's system supports a multi-layered security approach including: access control, authorization, authentication and data integrity protocols. As part of its continuous improvement model, Horizon Utilities performs periodic security assessments to identify opportunities for enhanced system hardening.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b) (where applicable)
n/a

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name 2015 LBDS Replacement Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

LBDS are critical devices for the operation of the distribution system and are installed at key operating points (e.g. feeder tie points, feeder sectionalizing). Unplanned failures of these devices would impact Horizon Utilities' ability to restore power, resulting in extended outages.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

The asset condition of LBDS relative to their typical lifecycle varies from switch to switch depending upon the operational stresses experienced by the switch. LBDS that are identified for replacement are replaced because they would not operate properly when required and are beyond economical repair.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

No customers impacted if the work is planned.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

n/a

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

Failure of an LBDS to operate when required can impact Horizon Utilities' operational ability which can adversely affect the service experienced by customers.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each instance.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The timing of this project is dependent upon the timing of Horizon Utilities' LBDS maintenance program.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

Reliability can be adversely affected when a LBDS fails to operate when required as part of switching to restore service.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

LDBS are replaced with an automated switch where an operational benefit can be realized. Otherwise they are replaced on a like-for-like basis.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2015 Proactive Transformer Replacement
Budget Year	2015
Investment Category	System Renewal
Project Summary	This project was established to proactively replace distribution transformers as required. Renewal of distribution transformers in the past has either been reactive upon failure or proactive when included in the 4kV & 8kV Renewal or XLPE Primary Cable renewal programs. There are instances where proactive replacement of transformers is required even when the replacement is outside of the scope of the programs mentioned above. This is a multi-year project, based on 25 replacements per year.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$350,000
Customer Contribution	$0
Capital Investment (net)	$350,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2015/06/01

In Service Date 2015/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
0%	0%	50%	50%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 104,447
2012 (MIFRS) - $ 185,523
2013 (MIFRS) - $ 276,978
2014 (MIFRS) - $ 339,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2015 Proactive Transformer Replacement	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (100%)

Secondary Driver (5.4.5.2.B.1.a)
N/A

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

Proactive transformer replacements are identified through Horizon Utilities' visual inspection programs and PCB testing programs. Proactive replacement criteria include:

- Transformers that have visibly deteriorated and have a high risk of imminent failure;
- Obsolete Transformers that do not have replacement units in inventory and, in a reactive replacement scenario, the customer(s) may be subject to an extended outage duration;
- Transformers that have visible oil leaks; and
- Transformers that have been identified through testing as containing PCBs.

These criteria were selected due to the level of associated risk. Transformers with visible oil leaks or containing PCBs represent a significant environmental risk. All oil spills must be tracked, reported, and the oil reclaimed where possible. Obsolete transformers, where a replacement is not available in inventory, represent a risk of prolonged service interruption upon failure and are replaced to reduce the risk of outage to the customer.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4) **(where applicable)**

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b) (where applicable)
This is not applicable to this project.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name 2015 Proactive Transformer Replacement Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The transformers selected for proactive replacement represent a level of risk to Horizon Utilities and this project provides risk mitigation consistent with Horizon Utilities' asset management objectives.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

The asset condition of these transformers relative to their typical lifecycle varies from transformer to transformer. Transformers selected for replacement present a level of risk to Horizon Utilities either through imminent failure of the transformer or through the need to address environmental risk associated with PCBs; or through the risks associated with transformers that have visible oil leaks.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

Varies per project.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

Varies per project.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

These criteria were selected due to the level of associated risk. Transformers with visible oil leaks or containing PCBs represent a significant environmental risk. All oil spills must be tracked, reported, and the oil reclaimed where possible. Obsolete transformers, where a replacement is not available in inventory, represent a risk of prolonged service interruption upon failure and are replaced to reduce the risk of outage to the customer.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each instance.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

n/a

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

n/a.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)
n/a.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)
n/a.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	ST-F7 Renewal – Part 1
Budget Year	2015
Investment Category	System Renewal
Project Summary	The project involves the renewal of the Strouds Substation F7 feeder in the Hamilton West operating area. This project is part of the 4kV and 8kV Renewal Program.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$1,020,180
Customer Contribution	$0
Capital Investment (net)	$1,020,180
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project affects 474 customers and 1,818kVA transformation

Project Dates (5.4.5.2.A.iii)

Start Date 2015/03/01

In Service Date 2015/10/31

Expenditure Timing

Q1	Q2	Q3	Q4
28%	28%	28%	16%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Strouds substation as part of the 4kV and 8kV Renewal Program. The 2015 investment for the renewal of Strouds substation is $1,406,000. The 2015 investment in the 4kV and 8kV Renewal Program is $8,160,000.

Comparable gross investments for the 4kV and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi) **(where applicable)**

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	ST-F7 Renewal – Part 1	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
4 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore, the renewal of the distribution assets at the current 4kV level was not a feasible alternative.

The renewal of the area serviced by the Strouds substation started in 2014 and is scheduled to be completed in 2018. Strouds substation was constructed in 1938. The switchgear at this substation is 44 years old and has a Health Index of 'very poor' as identified in the Substation Asset Condition Assessment ("SACA") and confirmed by the Kinectrics ACA.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b) (where applicable)
Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	ST-F7 Renewal – Part 1	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The distribution assets in the Hamilton West operating area are in poor health and the switchgear in both substations servicing this area has switchgear with a 'very poor' Health Index.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 474 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.016

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by the Strouds substation is scheduled for 2014 to 2018. This project is required to be completed in 2015 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Kinectrics identified that both substations' switchgear had a high probability of failure within one to three years. Failure of both substations would leave the 5400 customers serviced by these substations without power until the substation assets were repaired. Renewal of this area will allow for the decommissioning of the substation assets by 2018, thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e., same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g., undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	WH-F3 Renewal
Budget Year	2015
Investment Category	System Renewal
Project Summary	This project involves the renewal of Whitney substation F3 feeder in the Hamilton West operating area. This project is part of the 4kV and 8kV Renewal Program.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$2,871,286
Customer Contribution	$0
Capital Investment (net)	$2,871,286
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project affects 802 customers and 1,678kVA of transformation.

Project Dates (5.4.5.2.A.iii)

Start Date 2015/02/01

In Service Date 2015/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
16%	28%	28%	28%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Whitney substation as part of the 4kV and 8kV Renewal Program. The 2015 investment for the renewal of Whitney substation is $4,384,000. The 2015 investment in the 4kV and 8kV Renewal Program is $8,160,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	WH-F3 Renewal	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore, the renewal of the distribution assets at the current 4kV level was not a feasible alternative.

The renewal of the area serviced by the Whitney substation started in 2014 and is scheduled to be completed in 2018. Whitney substation was constructed in 1962. The switchgear at this substation is 46 years old and has a Health Index of 'very poor' as identified in the Substation Asset Condition Assessment ("SACA") and confirmed by the Kinectrics ACA.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b) (where applicable)
Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name WH-F3 Renewal Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The distribution assets in the Hamilton West operating area are in poor health and the switchgear in both substations servicing this area have a 'very poor' Health Index.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 802 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.027

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by the Whitney substation is scheduled for 2014 to 2018. This project is required to be completed in 2015 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Kinectrics identified that both substations' switchgear had a high probability of failure within one to three years. Failure of both substations would leave the 5400 customers serviced by these substations without power until the substation assets were repaired. Renewal of this area will allow for the decommissioning of the substation assets by 2018, thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and will require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis, where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	WH-F3 Renewal – Rear Lot
Budget Year	2015
Investment Category	System Renewal
Project Summary	This project involves the renewal of Whitney Substation F3 feeder in the Hamilton West operating area. This project is part of the 4kV and 8kV Renewal Program. This project addresses a section of the feeder that serves customers via rear lot construction

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$1,512,165
Customer Contribution	$0
Capital Investment (net)	$1,512,165
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project impacts 102 customers.

Project Dates (5.4.5.2.A.iii)

Start Date 2015/04/01

In Service Date 2015/08/31

Expenditure Timing

Q1	Q2	Q3	Q4
0%	40%	60%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no directly comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Whitney substation as part of the 4kV and 8kV Renewal Program. The 2015 investment for the renewal of Whitney substation is $4,384,000. The 2015 investment in the 4kV and 8kV Renewal Program is $8,160,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name WH-F3 Renewal – Rear Lot Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefor the renewal of this project at the current 4kV level was not a feasible alternative

The renewal of the area serviced by the Whitney substation started in 2014 and is scheduled to be completed in 2018. Whitney substation was constructed in 1962. The switchgear at this attain is 46 years old and has a Health Index of 'very poor' as identified in the Substation Asset Condition Assessment ("SACA") and confirmed by the Kinectrics ACA.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b) (where applicable)
Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements

Project Name WH-F3 Renewal – Rear Lot Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The distribution assets in the Hamilton West operating area are in poor health and the switchgear in both substations servicing this area has switchgear with a 'very poor' Health Index.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 102 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.007

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by the Whitney substation is scheduled for 2014 to 2018. This project is required to be completed in 2015 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Kinectrics identified that both substations' switchgear had a high probability of failure within one to three years. Failure of both substations would leave the 5400 customers serviced by these substations without power until the substation assets were repaired. Renewal of this area will allow for the decommissioning of the substation assets by 2018 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	GR-F4 Renewal
Budget Year	2015
Investment Category	System Renewal
Project Summary	This project involves the renewal of Grantham Substation F4 feeder in St Catharines. This project is part of the 4kV and 8kV Renewal Program.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$650,256
Customer Contribution	$0
Capital Investment (net)	$650,256
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project impacts 156 customers and 2,000kVA of transformation.

Project Dates (5.4.5.2.A.iii)

Start Date 2015/04/01

In Service Date 2015/08/31

Expenditure Timing

Q1	Q2	Q3	Q4
0%	50%	50%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Grantham substation as part of the 4kV and 8kV Renewal Program. The 2015 investment for the renewal of Grantham substation is $650,000. The 2015 investment in the 4kV and 8kV Renewal Program is $8,160,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

	Leave to Construct Approval (5.4.5.2.A.vii) This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name** GR-F4 Renewal	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore, the renewal of the distribution assets at the current 4kV level was not a feasible alternative. This is the initial year of the multi-year project to renew the area serviced by Grantham substation. Renewal of this area is scheduled to be completed in 2017.	
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b) (where applicable)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name GR-F4 Renewal Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The 4kV distribution assets and substations assets in the St. Catharines operating area are in poor health and require renewal. The overall substation Health Indices for Vine, Welland and Grantham substations are 57%, 59%, 58% respectively. There is limited back-up between these substations. The loss of the Grantham or Vine substations would result in 900 and 1,100 customers respectively being without service for several days, at a minimum. The SAIDI for these customers is 28% higher than for the customers served by the 13.8kV system in St. Catharines and 100% higher than Horizon Utilities' corporate target.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project affects 156 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.005

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Grantham substation is scheduled for 2015 to 2017. This project is required to be completed in 2015 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Kinectrics' evaluation found that the switchgear assets were at a high risk of failure within five years. Failure of this substation would leave the 900 customers serviced by it substations without power until the substation assets were repaired. Renewal of this area will allow for the decommissioning of the substation assets by 2018 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	GR-F4 Renewal Charleen Circle U/G
Budget Year	2015
Investment Category	System Renewal
Project Summary	This project involves the renewal of the Grantham Substation F4 feeder in St. Catharines and the renewal of XLPE cable serving customers on Charleen Circle.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$309,695
Customer Contribution	$0
Capital Investment (net)	$309,695
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project affects 300 customers and 612 kVA of transformation.

Project Dates (5.4.5.2.A.iii)

Start Date 2015/06/01

In Service Date 2015/09/30

Expenditure Timing

Q1	Q2	Q3	Q4
0%	75%	25%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project supports both the 4kV and 8kV Renewal Program and the XLPE Renewal Program.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)		
	Project Name GR-F4 Renewal Charleen Circle U/G	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This is currently a 4kV underground distribution and Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore, the renewal of the distribution assets at the current 4kV level was not a feasible alternative. In addition, this is a mature area currently serviced via an underground distribution system; it would not be feasible to renew the assets with an overhead solution.	
	Safety (5.4.5.2.B.2) These projects are not intended to address safety concerns with the distribution system.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b) (where applicable)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a	

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	GR-F4 Renewal Charleen Circle U/G	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The 4kV distribution assets and substations assets in the St. Catharines operating area are in poor health and require renewal. The overall substation Health Indices for Vine, Welland and Grantham substations is 57%, 59%, 58% respectively. There is limited back-up between these substations. The loss of the Grantham or Vine substations would result in 900 and 1,100 customers respectively being without service for several days, at a minimum. The SAIDI for these customers is 28% higher than for the customers served by the 13.8kV system in St. Catharines and 100% higher than Horizon Utilities' corporate target.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

300

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.015

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets pose an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Grantham substation is scheduled for 2015 to 2017. This project is required to be completed in 2015 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Kinectrics' evaluation of the switchgear assets were at a high risk of failure within five years. Failure of the substation would leave the 900 customers serviced by it without power until the substation assets were repaired. Renewal of this area will allow for the decommissioning of the substation assets by 2018 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	VE-F5 Renewal
Budget Year	2015
Investment Category	System Renewal
Project Summary	This project involves the renewal of the Vine Substation F5 feeder in St. Catharines.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$978,064
Customer Contribution	$0
Capital Investment (net)	$978,064
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project affects 592 customers and 2,220kVA of transformation.

Project Dates (5.4.5.2.A.iii)

Start Date	2015/01/01
In Service Date	2015/06/30

Expenditure Timing

Q1	Q2	Q3	Q4
50%	50%	0%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Vine substation as part of the 4kV and 8kV Renewal Program. The 2015 investment for the renewal of Vine substation is $978,000. The 2015 investment in the 4kV and 8kV Renewal Program is $8,160,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

	Leave to Construct Approval (5.4.5.2.A.vii) This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name** VE-F5 Renewal	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the program is $70,000,000 for all 28 substations. Therefore, the renewal of the distribution assets at the current 4kV level was not a feasible alternative.	
	Safety (5.4.5.2.B.2) These projects are not intended to address safety concerns with the distribution system.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) (where applicable) n/a	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b) (where applicable)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.	

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a.

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name VE-F5 Renewal Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The 4kV distribution assets and substations assets in the St. Catharines operating area are in poor health and require renewal. The overall substation Health Indices for Vine, Welland and Grantham substations is 57%, 59%, 58% respectively. There is limited back-up between these substations. The loss of the Grantham or Vine substations would result in 900 and 1,100 customers respectively being without service for several days, at a minimum. The SAIDI for these customers is 28% higher than for the customers served by the 13.8kV system in St. Catharines and 100% higher than Horizon Utilities' corporate target.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project affects 592 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.02

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets pose an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Vine substation is scheduled for 2015 to 2017. This project is required to be completed in 2015 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis, where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2015 St. Catharines XLPE Renewal
Budget Year	2015
Investment Category	System Renewal
Project Summary	This project involves the renewal of direct buried XLPE primary cable in the St. Catharines service territory.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$310,000
Customer Contribution	$0
Capital Investment (net)	$310,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

The customer and load impacted by this project will vary depending upon the final scope of the project.

Project Dates (5.4.5.2.A.iii)

Start Date 2015/01/01

In Service Date 2015/06/30

Expenditure Timing

Q1	Q2	Q3	Q4
50%	50%	0%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is part of a multi-year investment to renew XLPE primary cable. The 2015 investment in the XLPE Renewal Program is $2,567,000.

Comparable gross investments for the XLPE Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 1,572,090
2014 (MIFRS) - $ 893,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name** 2015 St. Catharines XLPE Renewal	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year XLPE Renewal Program. Horizon Utilities considered the four replacement philosophies for addressing risk inherent in the XLPE asset group: Area; Reactive; Selected; and Refurbishment. The area replacement philosophy will be utilized for selected areas of the service territory where the asset health analysis and the failure history indicates a substantial risk of continued failures. A reactive replacement philosophy will continue to be used for the remaining areas of the service territory. The St. Catharines operating area contains many small pockets of direct buried XLPE primary cable. The XLPE renewal projects in the St. Catharines operating area will involve the full renewal of each pocket of XLPE cable. Project selection will be guided by: asset health; operating history; and reliability of each of the underground pockets of XLPE.

Safety (5.4.5.2.B.2)

These projects are not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

n/a

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b) (where applicable)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a.

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name 2015 St. Catharines XLPE Renewal Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

XLPE primary cable is the asset group with the largest investment requirement as identified by the Kinectrics ACA. The current backlog volume of XLPE primary cable requiring renewal cannot be addressed in a single year and requires a multiple year investment strategy. The optimal level of renewal for XLPE cable, based on a 40-year useful life replacement cycle, is 50km/year. Horizon Utilities' proposed investment for the 2015 to 2019 Test Years is $36,014,000, which provides for the replacement of 180km of cable over those years. This represents a managed, gradual increase in investment in order to balance rate payer concerns and practical operational limitations.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

An analysis of all service interruptions, caused by material or equipment failure from 2010 to 2013, revealed that 50% of service interruptions, measured by customer minutes of outage, were due to failures of underground cable and equipment. Over 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration. These durations far exceed Horizon Utilities' corporate target of one hour and nine minutes of outage on average per customer.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

The number of customers impacted will vary depending upon the area.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

Varies; dependent on the final scope of the project.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets at risk of failure. Failures of XLPE primary cable result in extended service interruptions; 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

Proactive replacements are required because, as assets continue to age and degrade, the cable will fail at an exponential rate. In the worst case scenario, rate of failure will exceed Horizon Utilities' ability to keep pace with repairs. Reliability will also deteriorate to unacceptable levels. Reactive replacements will be considerably more costly than proactive renewal.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the XLPE primary cable, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the XLPE primary cable system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

Failure to invest in the proactive renewal of XLPE primary cable and associated underground assets would result in unacceptable levels of system failures and outages beyond the ability of Horizon Utilities to resolve within a reasonable timeframe as these assets continue to age and degrade. Reactive replacements will also be considerably more costly than the forecast expenditure required to execute the proposed proactive replacement.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

XLPE renewal projects will include the elimination of radial underground feeds; replacement of below grade transformers with padmount transformers; and the introduction of fusing on the underground distribution systems where applicable.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2015 Substation Infrastructure Renewal
Budget Year	2015
Investment Category	System Renewal
Project Summary	This program involves the renewal of substation infrastructure throughout Horizon Utilities' service territory. Substation maintenance and inspection programs annually identify a number of required investments for the continued safe and reliable operation of Horizon Utilities' substations. Investments under this program include: battery replacements; SCADA and communication upgrades; and grounding improvements.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$464,000
Customer Contribution	$0
Capital Investment (net)	$464,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2015/01/01

In Service Date 2015/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 146,477
2011 (CGAAP)- $ 326,000
2012 (MIFRS) - $ 305,000
2013 (MIFRS) - $ 168,507
2014 (MIFRS) - $ 455,503

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	Substation Infrastructure Renewal	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This program is required for the ongoing safe and reliable operation of Horizon Utilities' municipal substations. The 4kV and 8kV Renewal Program is structured to decommission Horizon Utilities' 28 substations over the next 34 years. There is no investment in the renewal of the major electrical assets (power transformers, switchgear and breakers) forecasted for the 2015 to 2019 Test Years. The investments provided above are required to maintain the ancillary substation assets in safe working order. Substation investment requirements are identified though preventative maintenance programs performed on both routine maintenance cycles and monthly inspections. Safety related investments include: installation of eye wash stations; end-of-life replacements of batteries and chargers for the emergency backup breaker operation circuits; and the replacement of end-of-life or obsolete station service transformers. These transformers are required to light and heat the substation and are the main source of power for the substation equipment. Miscellaneous investments include: reactive replacement of relays; communication equipment; and protection instrument transformers. Investments are required to address both electrical assets within the substation (e.g. replacement of switchgear components and instrument transformers), and ancillary equipment (e.g. SCADA, communication equipment, or backup batteries). All of these components are critical to the continued safe and reliable operation of the substation. A failure to undertake these required investments could lead to premature failure of substation components that would result in a service interruption and increased operating or reactive capital expenditure.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

n/a

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b) (where applicable)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a.

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name Substation Infrastructure Renewal Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

This project involves investment to replace substation infrastructure required for the continued safe and reliable operation of Horizon Utilities' substations.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

n/a

Number of Customers Impacted (5.4.5.2.C.b.i.3)

n/a.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

n/a

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

n/a

Value of Customer Impact (5.4.5.2.C.b.i.6)

Medium

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The timing of investments in this project is dependent upon the timing of substation maintenance programs and the infrastructure requiring renewal identified while performing maintenance.

Impact on System O&M Costs (5.4.5.2.C.b.iii)
This project will have no material impact on O&M expenditures.

Reliability and Safety Factors (5.4.5.2.C.b.iv)
n/a

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)
n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)
The assets renewed in this program are replaced on a like-for-like basis.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	Distribution Automation
Budget Year	2015
Investment Category	System Service
Project Summary	This project involves the deployment of automated switches, reclosers and fault indicators through Horizon Utilities' service territory.

Capital Investment (5.4.5.2.A.i)		
	Capital Investment (gross)	$1,250,000
	Customer Contribution	$0
	Capital Investment (net)	$1,250,000
	O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	n/a

Project Dates (5.4.5.2.A.iii)				
	Start Date	2015/04/01		
	In Service Date	2015/12/31		
	Expenditure Timing			
	Q1	Q2	Q3	Q4
	0%	25%	50%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the distribution automation for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 0
2014 (MIFRS) - $ 1,250,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	Distribution Automation	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Service (100%)

Secondary Driver (5.4.5.2.B.1.a)
n/a

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

Automation provides the ability to decrease the duration of service interruptions to offset the impact on the customer of an increasing volume of interruptions, due to equipment failures associated with the declining health of the distribution system. Distribution automation will also mitigate the impact of service interruptions resulting from significant weather events (e.g., the high volume of outages resulting from wind and ice storms). Horizon Utilities' worst performing feeders with the largest number of customer minutes of outage are the highest priority for automation.

Safety (5.4.5.2.B.2)

These projects are not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Horizon Utilities utilizes the Smart Meter communication infrastructure when communicating with automated switches. Horizon Utilities' Smart Meter and related AMI network have been procured through Elster. Elster's system supports a multi-layered security approach including: access control; authorization; authentication; and data integrity protocols. As part of its continuous improvement model, Horizon Utilities performs periodic security assessments to identify opportunities for enhanced system hardening.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that its policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

System Service Specific Requirements (5.4.5.2.C.c)	**Project Name**	Distribution Automation	Table 3

System Service Specific Requirements (5.4.5.2.C.c)

Benefit to Customers (5.4.5.2.C.c.i)

Distribution automation will provide the ability to decrease the duration of service interruptions to offset the impact on the customer of an increasing volume of interruptions due to equipment failures associated with the declining health of the distribution system. Distribution automation will also mitigate the impact of service interruptions resulting from significant weather events (i.e. the high volume of outages resulting from wind and ice storms). Horizon Utilities worst performing feeders with the largest number of customer minutes of outage are the highest priority for automation.

Regional Planning Requirements (5.4.5.2.C.c.i)

This project is not related or impacted by regional planning requirements.

Integration of Advance Technology (5.4.5.2.C.c.iii)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

System Benefits to Reliability, Efficiency and Safety (5.4.5.2.C.c.iv)

Automation, once fully deployed throughout the distribution system, is expected to improve reliability by 10%. Horizon Utilities' reliability is driven by a small number of large outages (1% of outages constitute 40% of the total customer of minutes annually). Analysis of the 2013 largest impact outages (excluding the July 2013 windstorm and December 2013 ice storm) indicated that automation would have reduced the impact of these outages by 25%. These results, when extrapolated across all outages, would result in a reduction of 10% annually.

Factors Affecting Implementing Timing/Priority (5.4.5.2.C.c.v)

n/a

Summary of Options Analysis (5.4.5.2.C.c.vi)

n/a.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	#6 Wire Removal - Eastmount
Budget Year	2015
Investment Category	System Service
Project Summary	This project involves the replacement of #6 solid copper wire in the east Hamilton Mountain area around Lawfield Dr.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$570,484
Customer Contribution	$0
Capital Investment (net)	$570,484
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

Project Dates (5.4.5.2.A.iii)

Start Date 2015/09/01

In Service Date 2015/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
0%	0%	25%	75%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

The size and volume of #6 wire replacement projects varies from year to year. The 2015 investment in the #6 Wire Replacement program is $570,000.

Comparable gross investments for the # 6 Wire Removal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 208,622
2011 (CGAAP)- $ 626,000
2012 (MIFRS) - $ 349,000
2013 (MIFRS) - $ 69,121
2014 (MIFRS) - $ 418,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	#6 Wire Removal - Eastmount	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Service (60%)

Secondary Driver (5.4.5.2.B.1.a)
System Renewal (40%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

The #6 Wire Replacement projects are primarily initiated to reduce risk to public safety due to the higher failure rates associated with #6 wire. Where possible, these projects are co-ordinated with 4kV and 8kV renewal projects.

Safety (5.4.5.2.B.2)

These projects are not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

n/a

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b) (where applicable)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Service Specific Requirements (5.4.5.2.C.c)

Project Name #6 Wire Removal - Eastmount Table 3

System Service Specific Requirements (5.4.5.2.C.c)

Benefit to Customers (5.4.5.2.C.c.i)

The #6 Wire Replacement projects provide a benefit to customers through the elimination of outages due to failure of #6 solid copper wire. Failure of #6 copper wire results in service interruptions to customers and presents a high risk to public safety.

Regional Planning Requirements (5.4.5.2.C.c.i)

This project is not related or impacted by regional planning requirements.

Integration of Advance Technology (5.4.5.2.C.c.iii)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

System Benefits to Reliability, Efficiency and Safety (5.4.5.2.C.c.iv)

Safer working conditions for personnel, renewed assets and improved system reliability are benefits of these projects. Where possible, #6 Wire replacement projects are co-ordinated with 4kV and 8KV renewal projects.

Factors Affecting Implementing Timing/Priority (5.4.5.2.C.c.v)

N/A

Summary of Options Analysis (5.4.5.2.C.c.vi)

Failure to renew #6 copper wire allows the operational and safety risk presented by #6 copper wire to persist. Where possible, replacement of #6 copper wire is co-ordinated with 4kV and 8kV renewal projects.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	Caroline and George Backup
Budget Year	2015
Investment Category	System Service
Project Summary	This project involves the construction of a full capacity backup to the redeveloped Caroline and George Street area of downtown Hamilton. The system currently does not have the ability to back up the full forecasted load for the area should a failure of the primary feed occur.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$951,557
Customer Contribution	$0
Capital Investment (net)	$951,557
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project will provide a full capacity backup to an area servicing over 7MVA of load.

Project Dates (5.4.5.2.A.iii)

Start Date 2015/09/01

In Service Date 2015/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
0%	0%	25%	75%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

This project must proceed in 2015 as failure to construct would leave this area of the Hamilton core with insufficient back up capacity.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There are no comparable projects in scope and nature for comparison.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	
	Project Name Caroline and George Backup Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Service (100%) **Secondary Driver (5.4.5.2.B.1.a)** n/a **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) The primary feed to this area involved the construction of a new dedicated feeder to the area. Construction of an additional dedicated feeder was considered but discounted. The proposed project to increase the inter-tie capacity with existing feeders in the area proved to be the lower cost option.
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b) (where applicable)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

System Service Specific Requirements (5.4.5.2.C.c)

Project Name	Caroline and George Backup	Table 3

System Service Specific Requirements (5.4.5.2.C.c)

Benefit to Customers (5.4.5.2.C.c.i)

Improved feeder security is a benefit of this project as the existing feeder designated to back-up the area does not have sufficient capacity under peak loading conditions.

Regional Planning Requirements (5.4.5.2.C.c.i)

This project is not related or impacted by regional planning requirements.

Integration of Advance Technology (5.4.5.2.C.c.iii)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

System Benefits to Reliability, Efficiency and Safety (5.4.5.2.C.c.iv)

System benefits include improved operability and redundancy within the Hamilton downtown core area.

Factors Affecting Implementing Timing/Priority (5.4.5.2.C.c.v)

This project must proceed in 2015 as failure to construct would leave this area of the Hamilton core with insufficient back up capacity.

Summary of Options Analysis (5.4.5.2.C.c.vi)

The primary feed to this area involved the construction of a new dedicated feeder to the area. Construction of an additional dedicated feeder was considered but discounted. The proposed project to increase the inter-tie capacity with existing feeders in the area proved to be the lower cost option.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	Waterdown 3rd Feeder – Upgrade York Road
Budget Year	2015
Investment Category	System Service
Project Summary	This project involves the construction of a 3rd feeder to improve the security for the Waterdown express feeders 2D12X and 2D13X.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$984,189
Customer Contribution	$0
Capital Investment (net)	$984,189
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2015/06/01

In Service Date 2015/10/31

Expenditure Timing

Q1	Q2	Q3	Q4
0%	20%	60%	20%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There are no comparable projects in scope and nature for comparison

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)		
	Project Name	Waterdown 3rd Feeder – Upgrade York Road Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Service (100%) **Secondary Driver (5.4.5.2.B.1.a)** n/a **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) No feasible project alternatives exist for providing a 3rd feed to the Waterdown area. An alternative feed is required to address load growth in the area and to address the lack of redundancy.	
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** This project is a prerequisite for the Highway 5 and Highway 6 grade separation. The project will require significant co-ordination with the Ministry of Transportation and the City of Hamilton. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b) (where applicable)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a	

System Service Specific Requirements (5.4.5.2.C.c)

Project Name	Waterdown 3rd Feeder – Upgrade York Road	Table 3

System Service Specific Requirements (5.4.5.2.C.c)

Benefit to Customers (5.4.5.2.C.c.i)

This project provides benefits to customers by providing improved security to the village of Waterdown. Waterdown has over 6,600 customers who are serviced by two feeders sharing a single pole line through a heavily treed section of the Niagara Escarpment. This project provides an alternate feed to this area, thereby eliminating the risk of outage to the entire village through a single point of failure.

Regional Planning Requirements (5.4.5.2.C.c.i)

This project is not related or impacted by regional planning requirements.

Integration of Advance Technology (5.4.5.2.C.c.iii)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

System Benefits to Reliability, Efficiency and Safety (5.4.5.2.C.c.iv)

System benefits include improved security and operability within the Waterdown area.

Factors Affecting Implementing Timing/Priority (5.4.5.2.C.c.v)

This project is a prerequisite for the Highway 5 and Highway 6 grade separation and must be completed in 2015. The project will require significant co-ordination with the Ministry of Transportation and the City of Hamilton.

Summary of Options Analysis (5.4.5.2.C.c.vi)

There are limited alternatives available to provide an alternative feed to service the village of Waterdown.

2015 General Plant Investments

Capital Project Summary

Project Name	Annual Corporate Computer Replacement
Budget Year	2015
Investment Category	General Plant
Project Summary	This project is part of an ongoing business requirement to refresh end user computers. Horizon Utilities utilizes a three-year lifecycle for replacement of end user computers. On an annual basis, approximately one third of all of Horizon Utilities' computers (~150 personal computers ("PCs")/year) are replaced.

Capital Investment (5.4.5.2.A.i)		
	Capital Investment (gross)	$318,000
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)	n/a

Project Dates (5.4.5.2.A.iii)				
	Start Date	Jan. 2015		
	In Service Date	Dec. 2015		
	Expenditure Timing			
	Q1	Q2	Q3	Q4
	25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Schedule - Implementation is phased throughout the year starting in January and ending in December, based on the age of the PCs being replaced.

Risk – The primary risk to this project is product availability from suppliers.
Risk Mitigation – Work closely with suppliers to schedule orders based on required delivery times.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the annual corporate computer replacement for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 336,000
2011 (CGAAP)- $ 227,000
2012 (MIFRS) - $ 312,000
2013 (MIFRS) - $ 364,947
2014 (MIFRS) - $ 366,200

	Total Capital and OM&A Costs Associated with REG Investments (5.4.5.2.A.vi) n/a **Leave to Construct Approval** (5.4.5.2.A.vii) n/a

Evaluation Criteria and Information	**Project Name**	Annual Corporate Computer Replacement	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant (100%) **Secondary Driver (5.4.5.2.B.1.a)** n/a **Investment Priority (5.4.5.2.B.1.b)** High Priority – Personal computers are treated as a strategic asset. They are Horizon Utilities' primary staff productivity tool. They are used to: maintain and deliver services to customers; improve staff productivity; cost-effectively manage total cost of PC ownership; and support investments in new applications, infrastructure and business capabilities.		
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) n/a		
	Safety (5.4.5.2.B.2) n/a		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a		
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Suppliers of enterprise systems such as: GIS; OMS; SCADA; AMI; and IFS ERP, are constantly upgrading their products to deliver new processes and functionality. As new versions are released, up-to-date hardware is required in order to perform necessary upgrades to maintain vendor support for the systems.		

	Economic Development (5.4.5.2.B.5) **(where applicable)** N/A
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** N/A

General Plant Specific Requirements	**Project Name**	Annual Corporate Computer Replacement	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

n/a

Business Case Justification Documentation (5.4.5.2.C.d.i)

Horizon Utilities' PCs are treated as a strategic asset, because they are the primary staff productivity tool. Horizon Utilities has streamlined its PC lifecycle management processes utilizing a PC refresh cycle of three years, in order to: deliver, maintain and improve services to customers; to improve staff productivity; to cost-effectively manage total cost of PC ownership; and to support investments in new applications, infrastructure and business capabilities.

A three-year PC refresh cycle reduces the total cost of ownership by reducing the number of models of PCs supported, which results in the reduction of the IST service desk effort required to deploy, secure, and manage new systems and applications. The reduction in the number of supported models has allowed Horizon Utilities to introduce mobile computing for remote field workers and to increase the number of supported PCs by over 100 devices since 2011, without an increase in IST service desk support staff.

A refresh lifecycle of three years reduces the likelihood of device failures that lead to a loss of staff productivity and increased IT support effort. Over 50% of Horizon Utilities' staff utilizes a mobile PC (laptop or tablet) in the performance of their daily activities, many in harsh operating environments outside the office, which increases the likelihood of failure due to operating environment and the age of the device.

Horizon Utilities has introduced several new enterprise business and engineering systems to: mitigate business risks related to aging systems (e.g. GIS); improve electricity system operation (i.e. GIS, OMS); and to address end of vendor support for systems (i.e. IFS ERP, Microsoft Windows XP). Maintaining a three-year PC lifecycle refresh program allows Horizon Utilities' to migrate to these applications without a need to make large one-time investments in PCs to meet the minimum operating requirements of new applications.

PCs are the primary productivity tool used by Horizon Utilities' staff. Unreliable and slow PCs impact productivity and customer service.

Minimizing the number of supported models reduces the IST support effort required to manage, order, configure, and deploy PCs and it reduces the total cost of ownership for PCs.

Capital Project Summary

Project Name	2015 IFS ERP Upgrade
Budget Year	2015
Investment Category	General Plant
Project Summary	This project is the third and final phase of an enterprise-wide project commencing in 2013 through to 2015 to upgrade Horizon Utilities' ERP system. This phase involves the redesign and optimization of existing business processes, and the implementation of new business processes using new features and functions available in the IFS version 8.1 to deliver operational efficiencies and staff productivity improvements. The estimated annual cost benefit for this phase is approximately $703,500.

Capital Investment (5.4.5.2.A.i)		
	Capital Investment (gross)	$1,382,607
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)	n/a

Project Dates (5.4.5.2.A.iii)				
	Start Date	Jan. 2015		
	In Service Date	Dec. 2015		
	Expenditure Timing			
	Q1	Q2	Q3	Q4
	20%	30%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Schedule - Implementation is being phased throughout the year, starting in January and ending in December. The project is being phased based on a combination of the potential benefit value of the process improvement and the business unit resource availability to define, configure, and test the process change.

Risk – The primary risk to this project is internal resource availability.
Risk Mitigation – Utilization of Horizon Utilities' Project Management Framework to effectively manage project to budget and schedule.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Horizon Utilities has no recently completed project which is comparable in scope and scale which can be used as a reasonable comparator.

Total Capital and OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)
n/a

Leave to Construct Approval (5.4.5.2.A.vii)

n/a

Evaluation Criteria and Information

Project Name 2015 IFS ERP Upgrade	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)

General Plant (100%)

Secondary Driver (5.4.5.2.B.1.a)
n/a

Investment Priority (5.4.5.2.B.1.b)

High Priority – The IFS ERP System is an enterprise-wide system used to manage business processes in Finance, Human Resources, Supply Chain, and Engineering Project Management. Optimization of business processes in IFS will delivery annual staff productivity/capacity improvements estimated at $603,500 and annual cost reductions/future cost avoidance estimated at $100,000.

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

n/a

Safety (5.4.5.2.B.2)

n/a

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

n/a

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
n/a

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

n/a

Economic Development (5.4.5.2.B.5) **(where applicable)**

n/a

	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

General Plant Specific Requirements	**Project Name**	2015 IFS ERP Upgrade	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

n/a

Business Case Justification Documentation (5.4.5.2.C.d.i)

The 2015 capital investment $1,382,600 consisting of $750,000 of capitalized internal labour and $632,600 in software add-ons and third-party consulting support.

The estimated annual cost benefit for this phase is approximately $703,500. These benefits will be realized in the following areas:

- Staff productivity improvements – This phase of the project is estimated to deliver approximately 6,965 hours of staff productivity improvements annually for an annual productivity improvement of $603,500. These improvements will be realized through reductions in transaction processing times and automation of manual tasks.

- Cost Reductions and Cost Avoidance - For some processes it is estimated that process changes will deliver reduction in costs related to transaction completion and elimination of fees currently being incurred. The automation of some of processes will allow existing staff to process more transactions, avoiding future cost increases related to incremental headcount to support transaction volumes. The estimated annual total of these cost reduction and cost avoidance improvements is $100,000.

Capital Project Summary

Project Name	Enterprise Phone System Upgrade
Budget Year	2015
Investment Category	General Plant
Project Summary	This project is a required planned lifecycle upgrade to mitigate risk related to end of vendor support for Horizon Utilities' phone system and phone system management software installed in 2010. The phone system is a key communications vehicle used by customers to contact Horizon Utilities. This involves replacement of the phone system and call centre software in Hamilton and the redundant backup phone system in St. Catharines. The two phone systems are configured to provide disaster recovery capabilities for automatic failover in the event of loss of service at either site.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$400,000
Customer Contribution	n/a
Capital Investment (net)	n/a
O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date Aug. 2015

In Service Date Nov. 2015

Expenditure Timing

Q1	Q2	Q3	Q4
0%	0%	0%	100%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Schedule - Planning Aug. 2015, Configuration Sep. 2015, Testing Oct. 2015, Go Live Nov. 2015

Risk – The primary risk to this project is internal resource availability.

Risk Mitigation – Utilization of Horizon Utilities' Project Management Framework to effectively manage project to budget and schedule.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Horizon Utilities has no recently completed project which is comparable in scope and scale that can be used as a reasonable comparator.

	Total Capital and OM&A Costs Associated with REG Investments (5.4.5.2.A.vi) n/a **Leave to Construct Approval** (5.4.5.2.A.vii) n/a

Evaluation Criteria and Information	**Project Name**	Enterprise Phone System Upgrade	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant 100% **Secondary Driver (5.4.5.2.B.1.a)** n/a **Investment Priority (5.4.5.2.B.1.b)** High Priority – This is a risk mitigation project to ensure continued vendor support for the primary method of communications with Horizon Utilities' customers. **Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)** n/a		
	Safety (5.4.5.2.B.2) n/a		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a		
	Co-ordination and Interoperability (5.4.5.2.B.4) **(where applicable)** **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** n/a		
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a		
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a		

General Plant Specific Requirements	**Project Name** Enterprise Phone System Upgrade Table 3
	General Plant Specific Requirements (5.4.5.2.C.d) **Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)** n/a **Business Case Justification Documentation (5.4.5.2.C.d.i)** The Horizon Utilities' phone system is a critical IT infrastructure component that is the primary method of communication with customers and as such needs to be at vendor supported levels to maintain optimum customer service levels.

Capital Project Summary

Project Name	[redacted]
Budget Year	2015
Investment Category	General Plant

Project Summary

The objective of this 3 year project starting in 2014 [redacted]

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$300,000
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a
Customer Attachments / Load (5.4.5.2.A.ii)	n/a	
Project Dates (5.4.5.2.A.iii)	Start Date	March 2015
	In Service Date	December 2015

Expenditure Timing

Q1	Q2	Q3	Q4
0%	33%	33%	34%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Project timelines and costs exceeding the budget are risks. The project manager will report regularly on project timelines and adherence to budget and escalates issues for resolution.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

n/a

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)

n/a

Evaluation Criteria and Information	**Project Name:** [redacted] Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant (100%) **Secondary Driver (5.4.5.2.B.1.a)** n/a
	Investment Priority (5.4.5.2.B.1.b) High
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Horizon Utilities engaged CAPSYS Integrated Technology Consulting in 2013 to [redacted]
	Safety (5.4.5.2.B.2) [redacted]
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** n/a
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

General Plant Specific Requirements

Project Name	Building Security Replacement	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

Horizon Utilities engaged CAPSYS Integrated Technology Consulting in [redacted]

Business Case Justification Documentation (5.4.5.2.C.d.i)

[redacted]

Capital Project Summary

Project Name	2015 John St. Building Roof Replacement
Budget Year	2015
Investment Category	General Plant

Project Summary

This project involves the replacement of John Street and Hughson Street rooves. This project will:

- Reduce the risk of water damage to assets and sustain daily operations;
- Improve the structural integrity of the buildings;
- Improved energy performance of buildings including systems and infrastructure; and
- Decreased maintenance and operating costs.

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$900,000
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	OM&A Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)	n/a
Project Dates (5.4.5.2.A.iii)	Start Date March 2015 In Service Date November 2015

Expenditure Timing

Q1	Q2	Q3	Q4
0%	40%	60%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Project timelines and costs exceeding the budget are risks. The project manager will report regularly on project timelines and adherence to budget and escalates issues for resolution.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

n/a

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)

n/a

Evaluation Criteria and Information	
	Project Name: 2015 John St. Building Roof Replacement Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant 100% **Secondary Driver (5.4.5.2.B.1.a)** n/a
	Investment Priority (5.4.5.2.B.1.b) High
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) An asset condition roof assessment conducted by Garland Canada Inc. in 2013 provided Horizon Utilities with the findings and recommendations for improvement and forecasted costs.
	Safety (5.4.5.2.B.2) n/a
	Cyber-Security and Privacy (5.4.5.2.B.3) n/a
	Co-ordination and Interoperability (5.4.5.2.B.4) **(where applicable)** **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** n/a
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a.
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** Horizon Utilities will explore sustainable roof options such as a green roof and solar panels to improve energy efficiencies.

General Plant Specific Requirements

Project Name	2015 John St. Building Roof Replacement	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

In 2013 Horizon Utilities engaged Garland Canada Inc. to conduct an asset condition roof assessment to determine the condition of the roof and provide recommendations for improvement as well as the related costs.

Business Case Justification Documentation (5.4.5.2.C.d.i)

The rooves at the John St. building, Hughson Street building, Hughson Substation building and parking garage, have reached end-of-life and were identified to be in poor condition. The rooves were originally installed in 1999.

There are visible signs of deterioration. The roof membrane is starting to de-granulate, reducing the strength and UV resistance of the roof. Some walls are in very poor condition and require new cladding, stucco or coating. There are some blisters on the roof area that are caused when air and/or air vapour is trapped. Previous repairs to the roof have degraded and water leaks have damaged the windows and floor walls below.

Capital Project Summary

Project Name	2015 John Street Windows Replacement
Budget Year	2015
Investment Category	General Plant

Project Summary;

This project is scheduled to take place between 2015 to 2017 to replace the existing windows of the John Street building as they have reached the end-of-life with the objective to:

- Improve energy performance as the windows are no longer weather resistant;
- Prevent further damage to interior walls and facilities related components;
- Prevent further damage to the building exterior structure;
- Prevent damage to operational systems; and
- Reduce operational related costs.

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$300,000
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a
Customer Attachments / Load (5.4.5.2.A.ii)	n/a	
Project Dates (5.4.5.2.A.iii)	Start Date	April 2015
	In Service Date	December 2015

Expenditure Timing			
Q1	Q2	Q3	Q4
0%	35%	65%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Project timelines and costs exceeding the budget are risks. The project manager will report regularly on project timelines and adherence to budget and will escalate issues for resolution.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

n/a

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)

n/a

Evaluation Criteria and Information	
	Project Name: 2015 John Street Windows Replacement Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant – 100% **Secondary Driver (5.4.5.2.B.1.a)** n/a
	Investment Priority (5.4.5.2.B.1.b) High
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Horizon Utilities engaged the MMM Group Limited in 2013 to conduct a window condition assessment using visual inspections, air leakage testing and building energy simulation air testing. Recommendations are based on the results of the tests and inspections.
	Safety (5.4.5.2.B.2) n/a
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** n/a
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a **Environmental Benefits** (5.4.5.2.B.6) **(where applicable)** n/a

General Plant Specific Requirements

Project Name	2015 John Street Windows Replacement	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

Horizon Utilities engaged the MMM Group Limited in 2013 to conduct a window condition assessment using visual inspections, air leakage testing and building energy simulation air testing. Recommendations are based on the results of the tests and inspections.

Business Case Justification Documentation (5.4.5.2.C.d.i)

The windows are no longer weather resistant or energy efficient and allow cold drafts to enter the building. The windows collect frost on the inside in the winter which melts and damages interior walls and carpeting. The assessment was conducted using visual inspections, air leakage testing and building energy simulations. The testing concluded that the condition of the operable windows in the John Street office building is poor. The windows, installed in 1994, have reached end-of-life and require replacement in order to reduce energy costs and to maintain the comfort of the employees from a climate and noise perspective. Weather stripping was determined to be insufficient as identified through air leakage tests.

Capital Project Summary

Project Name	2015 Vehicle Replacement
Budget Year	2015
Investment Category	General Plant

Project Summary;

Between 2015 and 2019 Horizon Utilities has identified a number of current vehicles that will require replacement as they have reached end-of-life as per the criteria within Horizon Utilities' Fleet Replacement Plan.

Other expected objectives and outcomes are to:

- Maintain vehicle reliability and availability;
- Reduce fuel consumption;
- Reduce emissions;
- Reduce down time required to conduct maintenance and repairs; and
- Maintain customer response time.

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$778,000
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)	n/a

Project Dates (5.4.5.2.A.iii)

Start Date	March 2015
In Service Date	December 2015

Expenditure Timing

Q1	Q2	Q3	Q4
0%	0%	50%	50%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Risk – The primary risk to this project is product availability and adherence to delivery schedules from suppliers.

Risk Mitigation – Work closely with suppliers to schedule orders based on required delivery times.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for vehicle replacements for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 1,590,516
2011 (CGAAP)- $ 1,033,975
2012 (MIFRS) - $ 1,057,410
2013 (MIFRS) - $ 36,365
2014 (MIFRS) - $ 785,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)
n/a

Evaluation Criteria and Information

Project Name: 2015 Vehicle Replacement Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)

General Plant – 100%

Secondary Driver (5.4.5.2.B.1.a)
n/a

Investment Priority (5.4.5.2.B.1.b)

High

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

n/a

Safety (5.4.5.2.B.2)

n/a

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

N/A

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

n/a

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

n/a

Economic Development (5.4.5.2.B.5) **(where applicable)**

n/a

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**
n/a

General Plant Specific Requirements

Project Name 2015 Vehicle Replacement Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)
Horizon Utilities uses the data collected from electronic fleet and fuel management system, the Global Positional System ("GPS") data which includes engine hours, power take-off ("PTO"), engine idling hours, traffic patterns, utilization, and mileage to determine the optimal maintenance schedule and vehicle maintenance and repairs activities in order to determine the optimal maintenance plan and vehicles replacements.

Business Case Justification Documentation (5.4.5.2.C.d.i)

To maintain the quality, reliability and availability of Horizon Utilities' vehicle fleet for the Construction and Maintenance, Metering Services and corporate group activities, vehicles are assessed annually based on a replacement criteria matrix defined within the Fleet Replacement Plan.

Replacement strategies also ensure that Horizon Utilities maintains safe vehicles for employees, while targeting reduced emissions, as well as reduced fuel, operating and maintenance costs. During the next six years, Horizon Utilities will not be procuring any net new vehicles and instead will focus on the replacement of end of life vehicles.

Due to budget mitigation efforts in 2011, 2012, and 2013 a number of vehicles scheduled for replacement were kept in operation and rescheduled for replacement in 2014. It is now critical that these vehicles be replaced as maintenance and repairs costs have increased and the vehicles no longer operate at full capacity, reducing vehicle availability and impacting service delivery.

Regular vehicle replacement is necessary to avoid undue vehicle down and associated negative impacts to customer response time and employee productivity.

Capital Project Summary

Project Name	2015 Tools, Shop and Garage Equipment
Budget Year	2015
Investment Category	General Plant

Project Summary
This program includes capital expenditures pertaining to the replacement of tools, shop and garage equipment, which are either worn, have come to the end of their useful life, or the continued use of such creates health and safety risks.

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$556,000
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a
Customer Attachments / Load (5.4.5.2.A.ii)	n/a	
Project Dates (5.4.5.2.A.iii)	Start Date	January 2015
	In Service Date	December 2015

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Risk – n/a

Risk Mitigation – n/a

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for tools shop, and garage equipment for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 515,236
2011 (CGAAP)- $ 493,820
2012 (MIFRS) - $ 279,587
2013 (MIFRS) - $ 417,572
2014 (MIFRS) - $ 511,300

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)
n/a

Evaluation Criteria and Information

Project Name:	2015 Tools, Shop and Garage Equipment	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)

General Plant (100%)

Secondary Driver (5.4.5.2.B.1.a)
n/a

Investment Priority (5.4.5.2.B.1.b)

High

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

Tools and equipment over $5000 are procured through a competitive process and alternatives are considered at the time of requisition.

Safety (5.4.5.2.B.2)

Tools and equipment meet Canadian Standards Association ("CSA") requirements and are reviewed for conformance to requirements by Horizon Utilities' Tool & Equipment Committee.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

N/A

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

n/a

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

n/a

Economic Development (5.4.5.2.B.5) **(where applicable)**

n/a

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

General Plant Specific Requirements

Project Name 2015 Tools, Shop and Garage Equipment Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

Each year a condition assessment is conducted on the inventory of tools and equipment in use, to determine a forecast for expected replacements. Feedback from the crews that use the tools and equipment, together with feedback from the Fleet Mechanics who maintain the tools and equipment on each vehicle, is used to establish the annual budgets. It becomes unsafe, costly and inefficient to use or maintain this type of equipment which has reached the end of its useful life.

New tools become available on the market, on a periodic basis, that offer improved safety, ergonomics and productivity features which Horizon Utilities evaluates for use. Changes in regulations, which require a different standard of equipment, may necessitate a replacement of tools and equipment. Fall arrest equipment for example, needs to be exchanged when new standards come into effect, and any required new equipment is included in the budget.

Business Case Justification Documentation (5.4.5.2.C.d.i)

n/a

Capital Project Summary

Project Name	Nebo Road Business Continuity
Budget Year	2015
Investment Category	General Plant

Project Summary

This project covers the installation of a 300kW permanent backup generator at Nebo Road service center to allow the facility to function and operate independent of the electrical distribution grid during power outages.

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$300,000	
	Customer Contribution	n/a	
	Capital Investment (net)	n/a	
	O&M Expenditure	n/a	
Customer Attachments / Load (5.4.5.2.A.ii)	n/a		
Project Dates (5.4.5.2.A.iii)	Start Date	April 2015	
	In Service Date	September 2015	

Expenditure Timing

Q1	Q2	Q3	Q4
	35%	65%	

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Project timelines and costs exceeding the budget are risks. The project manager will report regularly on project timelines and adherence to budget and escalates issues for resolution.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Horizon Utilities has no recently completed project which is comparable in scope and scale which can be used as a reasonable comparator.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)

n/a

Evaluation Criteria and Information	
	Project Name: Nebo Road Business Continuity Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant (100%) **Secondary Driver (5.4.5.2.B.1.a)** n/a **Investment Priority (5.4.5.2.B.1.b)** High
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) The evaluation and recommendations for this project was conducted by T. Lloyd Electric Ontario Ltd. (T. Lloyd Electric").
	Safety (5.4.5.2.B.2) n/a
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) N/A
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Maintain continuous uninterrupted supply of power for continued operations of the service centre.
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

General Plant Specific Requirements

Project Name	Nebo Road Business Continuity	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

The evaluation and recommendations for this project was conducted by T. Lloyd Electric.

Business Case Justification Documentation (5.4.5.2.C.d.i)

Nebo Road, Horizon Utilities' largest Service Center, supports all customers in the Hamilton service area and is the Emergency Control Centre for the outside operations during emergencies. Horizon Utilities has experienced outages to the Nebo Service Centre during large scale outages, and the dispatching of emergency crews and contractors was hindered as a result. Portable generators did supply partial power to the building for lights and gas pumps, but major electrical equipment such as overhead cranes and fleet hoists were not in service. The use of portable generators is no longer an option due to their non-conformance with safety regulations.

The Nebo Road electrical service was evaluated in 2013 by T. Lloyd Electric, a leading full service electrical contractor. Their findings were that a new generator is required in order to power up the Service Centre in the event of a power failure and that the current mobile generator unit was not manufactured to safely support this type of service connection.

Capital Project Summary

Project Name	2015 Building Renovations
Budget Year	2015
Investment Category	General Plant

Project Summary

The objective of this project planned for 2015 is to reclaim the Hughson Substation decommissioned in 2014 to relocate the current training/meeting room facilities on the 5th floor of John St to build space capacity for the IT, HR, Health and Safety and Communication groups employees that are currently located on different floors.

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$2,000,000	
	Customer Contribution	n/a	
	Capital Investment (net)	n/a	
	O&M Expenditure	n/a	

Customer Attachments / Load (5.4.5.2.A.ii)	n/a

Project Dates (5.4.5.2.A.iii)

Start Date	March 2015
In Service Date	December 2015

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Project timelines and costs exceeding the budget are risks. The project manager will report regularly on project timelines and adherence to budget and escalates issues for resolution.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for building renovations for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:
2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 1,767,000
2013 (MIFRS) - $ 5,490,000
2014 (MIFRS) - $ 3,700,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)
This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information	
	Project Name: 2015 Building Renovations Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant – 100% **Secondary Driver (5.4.5.2.B.1.a)** n/a
	Investment Priority (5.4.5.2.B.1.b) High
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Horizon Utilities' building renovation plans were developed through a facilities planning process that utilized the outputs of a space planning study and multiple building assessments.
	Safety (5.4.5.2.B.2) [redacted] safety of all facilities, employees, assets, critical for supporting life and safety systems.
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Installation of high efficiency lighting systems and HVAC units to reduce electricity consumption and operating costs.
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

General Plant Specific Requirements

Project Name	2015 Building Renovations	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

n/a

Business Case Justification Documentation (5.4.5.2.C.d.i)

The Hughson Substation built in early 1900 is being decommissioned during 2013-2014 and reclaimed as the future location of the corporate training room. The corporate training room is being relocated from the John St 5th floor, creating the much needed office space to bring the IT, HR, Health and Safety and Communications groups together from other floors.

These projects were identified as part of the multiyear building renewal & renovation plan in 2012. It included: reclaiming substation space for office space; replacing aging and end-of-life equipment; relocating business units; improving air and climate levels; and removing hazardous materials.

John St. – Partial renovation of the 5th floor in an effort to consolidate all IT, HR. Health and Safety and Communications employees into one workspace.

Hughson Substation – Reclamation of the Hughson Substation building as office space and the site of the relocated main corporate training room, reducing employee travel time that was necessary to drive to the Stoney Creek service center and improving productivity.

2016 System Access Investments

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2016 Meters
Budget Year	2016
Investment Category	System Access
Project Summary	This program includes the installation of Horizon Utilities' metering assets, in compliance with Measurement Canada standards. The work includes: • installation of complex and commercial meters at new service locations; • upgrade of metering installations for expanded service requirements; • inspection and replacement of defective meters; • installation of new and replacement metering for residential and multi-residential metered customers; and • Smart Meter gatekeepers for replacement and growth.

Capital Investment (5.4.5.2.A.i)		
	Capital Investment	$ 2,101,174
	Total	$ 2,101,174
	O&M Expenditure	$ 0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	n/a
Project Dates (5.4.5.2.A.iii)	Start Date 2016/01/01 In Service Date 2016/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Schedule risk for the installation of meters at new service locations may be caused by customer delays or restricted access to work sites. Horizon Utilities co-ordinates the connection of new services with customers to mitigate this risk.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)
Metering investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP) - $1,715,716
2011 (CGAAP)- $3,467,413
2012 (MIFRS) - $25,168,043
2013 (MIFRS) - $1,658,707
2014 (MIFRS) - $2,499,104

The increased investment in 2012 was due to the implementation of Smart Meters at a cumulative capital cost of $23,277,588. Horizon Utilities substantially completed its mass deployment of Smart Meters in 2009 and, as at the end of 2011, had installed Smart Meters for 229,322 customers or 98.0% of all metering points.

	Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi) This project is not associated with an REG investment and as such no associated OM&A costs related to REG will be incurred.
	Leave to Construct Approval (5.4.5.2.A.vii) This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name** 2016 Meters	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Access (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Renewal (20%) Replacement of commercial meters with Smart Meters. **Investment Priority (5.4.5.2.B.1.b)** 5 – Mandatory Project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Metering asset management is governed by Measurement Canada regulation and customer requirements for new and upgraded services.	
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Horizon Utilities' Smart Meter and related AMI network have been procured through Elster. Elster's system supports a multi-layered security approach including: access control; authorization; authentication; and data integrity protocols. As part of its continuous improvement model, Horizon Utilities performs periodic security assessments to identify opportunities for enhanced system hardening.	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Co-ordination with utilities and regional planning is not required. Horizon Utilities coordinates with customers as required by the scope of the work involved.	

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)
A component of this investment supports the capital investment required for the ongoing operation, maintenance, and installation of the Smart Meter infrastructure.

Economic Development (5.4.5.2.B.5)
Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6)
The Smart Meter infrastructure supports the province's conservation culture. Smart metering also provides environmental benefits through reduction in field visits associated with manual meter reading.

System Access Specific Requirements (5.4.5.2.C.a)

Project Name 2016 Meters Table 3

System Access Specific Requirements (5.4.5.2.C.a)

Factors Affecting Implementing Project Timing/Priority (5.4.5.2.C.a.i)
Compliance sampling work completed to comply with Measurement Canada regulations may impact project timing. The schedule is created to smooth the annual sampling requirements from the original Smart Meter mass deployments.

New and replacement meters are provided on demand to address new load growth and meter failures.

Factors Related to Customer Preference or 3rd Party Input (5.4.5.2.C.a.ii)

Metering for new and upgraded connection projects are customer initiated and are designed to meet customer identified requirements.

Factors Affecting Final Project Cost (5.4.5.2.C.a.iii)
Please refer to Note I for an explanation on the factors affecting the final project cost.

Controllable Cost Minimization (5.4.5.2.C.a.iv)

Please refer to Note I for an explanation regarding controllable cost mitigation.

Other Planning Objectives (5.4.5.2.C.a.v)

Horizon Utilities combines work from multiple work groups to reduce costs and increase efficiency. The line work and meter work is combined when connecting new customers to allow the work to be completed by a single work group.

Assessment of Technical or Implementation Options (5.4.5.2.C.a.vi)

Metering work is Measurement Canada and customer driven and the technology is primarily based on the metering products available from a sole source supplier.

	Summary of Options Analysis (5.4.5.2.C.a.vii) Metering supplier selected as part of the Smart Meter implementation program. **Final Economic Evaluation Results (5.4.5.2.C.a.viii)** Horizon Utilities completes the economic evaluation for any customer system access project which requires the construction of new facilities to the main distribution system or an increase in the existing capacity of distribution facilities. For further details please see Appendix E of Horizon Utilities' Conditions of Service. The economic evaluation is completed in accordance with section 3.2 of the Distribution System Code (DSC). For the 2015-2019 forecast period, Horizon Utilities has no known projects for which to provide the final economic evaluation. When a road authority requests a relocation of Horizon Utilities' plant located on the public road allowance, the costs shall be shared, as outlined in the Ontario *Public Service Works on Highways Act*. Other projects within this category will have an economic evaluation completed where applicable in accordance with both the DSC and Appendix E of Horizon Utilities' Conditions of Service.
	Identification of System Impacts (5.4.5.2.C.a.ix) System expansion, if required, to connect customers within this category are governed by Horizon Utilities' Conditions of Service Section 2.1.2.1.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2016 Road Relocations
Budget Year	2016
Investment Category	System Access
Project Description	Projects in this category involve the relocation of Horizon Utilities' assets to support road relocation and road reconstruction projects at the request of the City of Hamilton, the City of St. Catharines, the Ministry of Transportation, and the Region of Niagara.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$3,244,035
Customer Contribution	$ $904,359
Capital Investment (net)	$ 2,339,675
O&M Expenditure	n/a

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date	Various – driven by road authority schedules
In Service Date	Various – driven by road authority schedules

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

The initiation and timing of these projects are dictated by the City of Hamilton, City of St. Catharines, the Ministry of Transportation, or the Region of Niagara. Consequently, the timing and value of investment required by Horizon Utilities is subject to change.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Road relocations for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP) - $ 2,889,575
2011 (CGAAP)- $ 895,524
2012 (MIFRS) - $ 3,151,887
2013 (MIFRS) - $ 340,491
2014 (MIFRS) - $ 977,024

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

	Leave to Construct Approval (5.4.5.2.A.vii) This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name**	2016 Road Relocations	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Access (90%) **Secondary Driver (5.4.5.2.B.1.a)** System Renewal (5%) System Service (5%) **Investment Priority (5.4.5.2.B.1.b)** 5 – Mandatory Project **Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)** Horizon Utilities co-ordinates project design and discusses design alternatives for each project with the organization (City, Region, Ministry of Transportation) originating the request to relocate distribution assets.		
	Safety (5.4.5.2.B.2) These projects are not intended to address safety concerns with the distribution system.		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a		
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Timelines for the execution of these projects are dictated by the City of Hamilton, City of St. Catharines, the Ministry of Transportation or the Region of Niagara. Horizon Utilities coordinates work with these stakeholders, wherever possible, on the road relocations with planned distribution projects. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.		
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.		

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Access Specific Requirements (5.4.5.2.C.a)

Project Name 2016 Road Relocations Table 3

System Access Specific Requirements (5.4.5.2.C.a)

Factors Affecting Implementing Project Timing/Priority (5.4.5.2.C.a.i)

The road authority's schedule and timing of the road project will affect Horizon Utilities' project implementation and timing.

Factors Related to Customer Preference or 3rd Party Input (5.4.5.2.C.a.ii)

Road relocation projects involve a co-ordinated design process and the initiating organization (City, Municipality, or Ministry of Transportation) has input into the design of the project.
The designs for all projects within the public right-of-way are reviewed with the City as Municipal Consents are required prior to construction. Consideration is given by the road authority to coordinate all utilities within the right-of-way in the least disruptive manner.

Factors Affecting Final Project Cost (5.4.5.2.C.a.iii)

Please refer to Note I for an explanation on the factors that can affect the final project cost.

Controllable Cost Minimization (5.4.5.2.C.a.iv)

50% of Labour, Labour saving devices and Equipment rentals are recovered from the road authority. Please refer to Note I for an explanation on controllable cost minimization.

Other Planning Objectives (5.4.5.2.C.a.v)

Horizon Utilities combines work to reduce overall costs and increase efficiency. The most common opportunity is during city road relocation projects where a new water main is being installed. Horizon Utilities may be able to take advantage of the fact that installing duct structure is less costly since the road is already excavated. Horizon Utilities may also be able to change the schedule of a renewal project to align with the road authority's work to maximize these benefits. The cost of the additional work is allocated to either system service or system renewal where applicable. Horizon Utilities can maximize the amount of work that can be completed at the lowest cost to benefit ratepayers in these cases.

Assessment of Technical or Implementation Options (5.4.5.2.C.a.vi)

Horizon Utilities co-ordinates project design and discusses design alternatives for each project with the road authority (City, Municipality, Ministry of Transportation) originating the request to relocate distribution assets.

Summary of Options Analysis (5.4.5.2.C.a.vii)

Horizon Utilities reviews proposed design with municipalities and the Ministry of Transportation, as applicable, in an effort to determine the most cost effective solution.

Final Economic Evaluation Results (5.4.5.2.C.a.viii)

This is not applicable to road relocations projects.

Identification of System Impacts (5.4.5.2.C.a.ix)

Horizon Utilities follows the *Public Service Works on Highways Act*, 1990 and associated regulations governing the recovery of costs related to road reconstruction work by collecting contributed capital for 50% of the labour; labour saving devices, and equipment rentals. Capital contributions toward the cost of all customer demand projects are collected by Horizon Utilities in accordance with the DSC and the provisions of its Conditions of Service.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2016 Customer Connections
Budget Year	2016
Investment Category	System Access

Project Summary	Projects in this category include multiple projects required to connect, upgrade, or disconnect customers to the distribution system. Horizon Utilities' obligation to connect new customers is governed by the *Electricity Act, 1998, Schedule 28.*		
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$ 4,781,689	
	Customer Contribution	$ 750,586	
	Capital Investment (net)	$ 4,031,103	
	O&M Expenditure	$0	
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	Horizon Utilities completes approximately 1800 connections annually; 1500 through subdivisions and 300 customer projects, contributing approximately 25MVA in system load growth.		
Project Dates (5.4.5.2.A.iii)	Start Date	Various – as driven by the customer	
	In Service Date	Various – as driven by the customer	

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable investments, net of capital contributions, for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 1,023,336
2011 (CGAAP)- $ 2,030,541
2012 (MIFRS) - $ 1,652,000
2013 (MIFRS) - $ 3,541,455
2014 (MIFRS) - $ 4,063,471

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2016 Customer Connections	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Access (100%)

Secondary Driver (5.4.5.2.B.1.a)
N/A

Investment Priority (5.4.5.2.B.1.b)
5 – Mandatory Project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

Customer connection projects are driven by customer requests and the customer's specific technical requirements. To build efficiencies into the process, Horizon Utilities utilizes a set of design standards that have been engineered and approved. Customer connections requests are fulfilled consistent with Horizon Utilities' Conditions of Service, designed to meet the customer requirements and maintain system reliability.

Safety (5.4.5.2.B.2)

These projects are not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

This is not applicable for these projects.

Economic Development (5.4.5.2.B.5)

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6)

n/a

System Access Specific Requirements (5.4.5.2.C.a)

Project Name 2016 Customer Connections Table 3

System Access Specific Requirements (5.4.5.2.C.a)

Factors Affecting Implementing Project Timing/Priority (5.4.5.2.C.a.i)

Schedule of work based on customer expectations; customer request may not be standard design.

Factors Related to Customer Preference or 3rd Party Input (5.4.5.2.C.a.ii)

There projects are customer initiated and are designed to meet customer identified requirements.

Factors Affecting Final Project Cost (5.4.5.2.C.a.iii)

Please refer to Note I for an explanation on the factors affecting final project cost.

Controllable Cost Minimization (5.4.5.2.C.a.iv)

Please refer to Note I for an explanation on the factors affecting controllable cost.

Other Planning Objectives (5.4.5.2.C.a.v)

n/a

Assessment of Technical or Implementation Options (5.4.5.2.C.a.vi)

Please refer to Note III for information on the technical and implementation options.

Summary of Options Analysis (5.4.5.2.C.a.vii)

Please refer to Note III for information on the technical and implementation options.

Final Economic Evaluation Results (5.4.5.2.C.a.viii)

Horizon Utilities completes the economic evaluation for any customer system access project which requires the construction of new facilities to the main distribution system or an increase in the existing capacity of distribution facilities. For further details please see Appendix E of Horizon Utilities' Conditions of Service. The economic evaluation is completed in accordance with section 3.2 of the Distribution System Code (DSC). For the 2015-2019 forecast period, Horizon Utilities has no known projects for which to provide the final economic evaluation. When a road authority requests a relocation of Horizon Utilities' plant located on the public road allowance, the costs shall be shared, as outlined in the *Ontario Public Service Works on Highways Act*. Other projects within this category will have an economic evaluation completed where applicable in accordance with both

	the DSC and Appendix E of Horizon Utilities' Conditions of Service. **Identification of System Impacts (5.4.5.2.C.a.ix)** System expansion, if required, to connect customers within this category are governed by Horizon Utilities' Conditions of Service Section 2.1.2.1.

2016 System Renewal Investments

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	CE-F4 Renewal – Hunter/Stinson St
Budget Year	2016
Investment Category	System Renewal

Project Summary	This project involves the renewal of the Central Substation F4 feeder in central Hamilton.		
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$ 1,556,498	
	Customer Contribution	$ 0	
	Capital Investment (net)	$ 1,556,498	
	O&M Expenditure	$0	
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project affects 756 customers and 2,520kVA of transformation.		
Project Dates (5.4.5.2.A.iii)	Start Date	2016/03/01	
	In Service Date	2016/10/18	

Expenditure Timing			
Q1	Q2	Q3	Q4
12.5%	37.5%	37.5%	12.5%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Central substation as part of the 4kV and 8kV Renewal Program. The 2016 investment for the renewal of Central substation is $1,556,498. The 2016 investment in the 4kV and 8kV Renewal Program is $10,160,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	CE-F4 Renewal – Hunter/Stinson St	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)

System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)

System Service (20%)

Investment Priority (5.4.5.2.B.1.b)

3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of the distribution assets at the current 4kV level was not a feasible alternative.

The renewal of the area serviced by Central substation starts in 2016 and is scheduled to be completed in 2022.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	CE-F4 Renewal – Hunter/Stinson St	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The two substations servicing the downtown Hamilton operating area service a total of 7,400 customers and were constructed in 1950 and 1960. The overall Station Health Index for Aberdeen and Central substations is 53% and 56% respectively. The Central substation has ten feeders; six of which are obsolete, oil-filled breakers are at end-of-life. The Health Index for these breakers is "very poor" and Kinectrics forecasted that these circuit breakers have a high risk of failure within three years. Two of the six feeders are radial feeders with no backup. Failure of the breakers for these feeders would result in the loss of service for over 50 commercial customers in downtown Hamilton for a minimum of several hours to several days. Central substation has limited interconnection with other substations. The loss of the entire substation would affect all 3,100 customers who would be out of power until the substation assets were repaired.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project affects 756 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.039

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Central substation is scheduled for 2016 to 2022. This project is required to be completed in 2016 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Renewal of this area will allow for the decommissioning of the substation assets by 2022, thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2016 Reactive Renewal
Budget Year	2016
Investment Category	System Renewal
Project Summary	This category includes all projects required for the reactive renewal or repairs driven by emergency equipment failures and associated corrective action. Projects arise from trouble calls or inspection programs identifying an urgent need to replace system assets and the scope of the equipment replacement requires engineering. Also included in this category are projects to address customer power quality issues and Electrical Safety Authority ("ESA") due diligence inspection outcomes.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$4,339,000
Customer Contribution	n/a
Capital Investment (net)	n/a
O&M Expenditure	n/a

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date January 1, 2016

In Service Date December 31, 2016

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 8,745,125
2011 (CGAAP)- $ 8,230,970
2012 (MIFRS) - $ 4,032,000
2013 (MIFRS) - $ 6.069,566
2014 (MIFRS) - $ 4,840,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)n	
	Project Name 2016 Reactive Renewal Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 5 – Mandatory project
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) No alternatives are considered for these projects as they involve the emergency replacement of failed equipment required to restore service.
	Safety (5.4.5.2.B.2) These projects are intended to primarily address failed assets however investments required to address immediate safety issues, including issues presenting a potential risk to public safety identified by the ESA, are included in this project.
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

System Renewal Specific Requirements (5.4.5.2.C.b)	**Project Name** 2016 Reactive Renewal Table 3
	System Renewal Specific Requirements (5.4.5.2.C.b) **Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)** These projects are reactive in nature and are initiated from equipment that has failed or that have a high risk of failure resulting in a service interruption. These projects have a very high probability of impact on Horizon Utilities' reliability targets. **Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)** These projects address failed assets or assets with a high risk of imminent failure and as such, these assets are at the end of their useful life. The asset condition relative to their typical life cycle varies in each incident or outage. **Number of Customers Impacted (5.4.5.2.C.b.i.3)** The number of customers impacted varies in each incident or outage. **Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)** The quantitative customer impact varies in each incident or outage. **Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)** These projects address customer satisfaction as they are required to address failed assets that have either caused a system interruption, or have a high probability of causing a service interruption. **Value of Customer Impact (5.4.5.2.C.b.i.6)** The value of the customer impact varies in each incident or outage. **Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)** These projects are reactive in nature and address failed assets, or assets at risk of imminent failure. Investments must be performed when identified. **Impact on System O&M Costs (5.4.5.2.C.b.iii)** These projects do not materially impact system O&M costs. **Reliability and Safety Factors (5.4.5.2.C.b.iv)** Improvements to reliability and security are expected as secondary benefits to this project. **Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)** Investment for this project addresses failed assets, or assets at risk of imminent failure. Investments are not subject to project prioritization as they are reactive and non-discretionary. **Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)** Assets replaced reactively to replace failed assets, or assets at risk of imminent failure are performed on a like-for-like basis. No extra costs to address other distributor planning objectives are incurred with these projects.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	Gage TS Egress Feeder Renewal
Budget Year	2016
Investment Category	System Renewal
Project Summary	This project involves relocating the station egress cables from the existing location at Gage TS to the new location of the switchgear to facilitate Hydro One's renewal of Gage TS.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$ 4,793,056
Customer Contribution	$0
Capital Investment (net)	$ 4,793,056
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This affects all customers served from Gage TS.

Project Dates (5.4.5.2.A.iii)

Start Date 2016/04/01

In Service Date 2016/11/30

Expenditure Timing

Q1	Q2	Q3	Q4
0%	37.5%	37.5%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There are no equivalent projects for comparison.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)		
	Project Name	Gage TS Egress Feeder Renewal Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (100%) **Secondary Driver (5.4.5.2.B.1.a)** N/A **Investment Priority (5.4.5.2.B.1.b)** 5 – Mandatory Project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) The design of the project will be co-ordinated with Hydro One. The scope of this project is dependent on Hydro One's final design and staging for the renewal of the station.	
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a	

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	Gage TS Egress Feeder Renewal	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

Gage TS is one of the oldest transformer stations within Hydro One's inventory and the oldest station in Horizon Utilities' service territory. This station services Horizon Utilities' two largest industrial customers, and has experienced a number of major equipment failures that have affected these customers.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Asset condition is not considered a driver for this project, however many assets connected to Gage TS are nearing their end of useful life.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

Three large industrial customers are impacted by this project.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

n/a

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project is required to maintain service continuity for these three large industrial customers.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

Horizon Utilities has been in constant contact with its customers that are impacted by the work being performed by Hydro One and has endeavoured to ensure that their needs are met by Hydro One.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

n/a

Reliability and Safety Factors (5.4.5.2.C.b.iv)

n/a

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

Before Horizon Utilities can complete a like-for-like analysis, Hydro One needs to provide information on the type of connection for the feeder cables. This has not occurred yet but is expected to be completed once the station upgrade design is finalized

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2016 Hamilton Mountain XLPE Renewal
Budget Year	2016
Investment Category	System Renewal

Project Summary	This project involves the renewal of XLPE primary cable and underground distribution assets in the Hamilton Mountain operating area. The area between Upper Sherman and Upper Wentworth south of the Lincoln Alexander Parkway will be renewed in 2016.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$ 1,996,215
	Customer Contribution	$0
	Capital Investment (net)	$1,996,215
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	Approximately 1,600 customers will be impacted by this project.	

Project Dates (5.4.5.2.A.iii)

Start Date 2016/03/01

In Service Date 2016/11/01

Expenditure Timing

Q1	Q2	Q3	Q4
10%	40%	40%	10%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is part of a multi-year investment to renew the XLPE primary cable. The 2016 investment in the XLPE Renewal Program is $4,926,000.

Comparable gross investments for the XLPE Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 1,572,090
2014 (MIFRS) - $ 893,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2016 Hamilton Mountain XLPE Renewal	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (60%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (40%)

Investment Priority (5.4.5.2.B.1.b)
4 – Required Project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year XLPE Renewal Program. Horizon Utilities considered the four replacement philosophies for addressing risk inherent in the XLPE asset group: Area; Reactive; Selected; and Refurbishment. The area replacement philosophy will be utilized for selected areas of the service territory where the asset health analysis and the failure history indicates a substantial risk of continued failures. A reactive replacement philosophy will continued to be used for the remaining areas of the service territory.

The area replacement philosophy will be employed for the Hamilton Mountain operating area due to the high volume of XLPE primary cable. The underground XLPE cable in this area comprises approximately 33% of the total installed XLPE and is the primary cause for 65% of the outages caused by failure of underground assets.

Safety (5.4.5.2.B.2)

These projects are not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

n/a

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	2016 Hamilton Mountain XLPE Renewal	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

XLPE primary cable is the asset group with the largest investment requirement as identified by the Kinectrics ACA. The current backlog volume of XLPE primary cable requiring renewal cannot be addressed in a single year and requires a multiple year investment strategy. The optimal level of renewal for XLPE cable, based on a 40-year useful life replacement cycle, is 50km/year. Horizon Utilities' proposed investment for the 2015 to 2019 Test Years is $36,014,000, which provides for the replacement of 180km of cable over the 2015 to 2019 Test Years. This represents a managed, gradual increase in investment in order to balance rate payer concerns and practical operational limitations.

The Hamilton Mountain operating area has 225km of XLPE primary cable with a Health Index of either "very poor" or "poor". Due to the exponential nature of failures experienced as the 50+ year old cables experience material breakdown, the future cost of required investments will dramatically increase in the short term if not addressed in a systematic manner.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

An analysis of all service interruptions, caused by material or equipment failure from 2010 to 2013, revealed that 50% of service interruptions, measured by customer minutes of outage, were due to failures of underground cable and equipment. Over 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration. These durations far exceed Horizon Utilities' corporate target of one hour and nine minutes of outage on average per customer.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

Approximately 1,600 customers will be impacted by this project.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

The quantitative customer impact varies for customers affected by this project.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets at risk of failure. Failures of XLPE primary cable result in extended service interruptions; 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

Proactive replacements are required because, as assets continue to age and degrade, the cable will fail at an exponential rate. In the worst case scenario it will exceed Horizon Utilities' ability to keep pace with repairs. Reliability will also deteriorate to unacceptable levels. Reactive replacements will be considerably more costly than proactive renewal.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the XLPE primary cable, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the XLPE primary cable system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

Failure to invest in the proactive renewal of XLPE primary cable and associated underground assets would result in unacceptable levels of system failures and outages beyond the ability of Horizon Utilities to resolve within a reasonable timeframe. Reactive replacements will also be considerably more costly than the forecast expenditure required to execute the proposed proactive replacement.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

XLPE renewal projects will include: the elimination of radial underground feeds; the replacement of below grade transformers with padmount transformers; and the introduction of fusing on the underground distribution systems where applicable.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	HI-F1 Renewal - U/G conversion to 2D14X
Budget Year	2016
Investment Category	System Renewal
Project Summary	This project involves the renewal of the Highland Substation F1 feeder in Dundas.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$ 1,269,165
Customer Contribution	$0
Capital Investment (net)	$1,269,165
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project impacts 745 customers and 2,793 kVA of transformation.

Project Dates (5.4.5.2.A.iii)

Start Date	2016/04/01
In Service Date	2016/09/30

Expenditure Timing

Q1	Q2	Q3	Q4
0%	50%	50%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv)

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is part of a multi-year investment to renew XLPE primary cable. The 2016 investment in the XLPE Renewal Program is $4,926,000.

Comparable gross investments for the XLPE Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 1,572,090
2014 (MIFRS) - $ 893,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

	Leave to Construct Approval (5.4.5.2.A.vii) This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name**	HI-F1 Renewal - U/G conversion to 2D14X	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (60%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (40%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project		
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Renewal of assets at 4kV would not allow for the eventual decommissioning of Highland Substation. Horizon Utilities' Substation assets are being decommissioned over the life of the 4kV and 8kV Renewal Program to avoid capital investment required for the renewal of substation assets that are nearing the end of their useful lives.		
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.		
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.		
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.		
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a		

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	HI-F1 Renewal - U/G conversion to 2D14X	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

XLPE primary cable is the asset group with the largest investment requirement as identified by the Kinectrics ACA. The current backlog volume of XLPE primary cable requiring renewal cannot be addressed in a single year and requires a multiple year investment strategy. The optimal level of renewal for XLPE cable, based on a 40-year useful life replacement cycle, is 50km/year. Horizon Utilities' proposed investment for the 2015 to 2019 Test Years is $36,014,000, which provides for the replacement of 180km of cable over the 2015 to 2019 Test Years. This represents a managed, gradual increase in investment in order to balance rate payer concerns and practical operational limitations

The Dundas operating area has 13.5km of XLPE cable with a Health Index of either "very poor" or "poor".

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

An analysis of all service interruptions, caused by material or equipment failure from 2010 to 2013, revealed that 50% of service interruptions, measured by customer minutes of outage, were due to failures of underground cable and equipment. Over 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration. These durations far exceed Horizon Utilities' corporate target of one hour and nine minutes of outage on average per customer.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 745 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.025

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The timing of this project is necessary to co-ordinate with the 4kV and 8kV Renewal Program as it involves both the renewal of XLPE primary cable and the renewal of the underground section of the Highland substation F1 feeder.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of XLPE primary cable will provide reliability improvements through reduced service interruptions caused by failed equipment. The cable renewed by this project is direct buried and therefore subject to extended outages, requiring multiple hours to repair, upon failure.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project is required to co-ordinate with the 4kV and 8kV Renewal Program as it involves both the renewal of XLPE primary cable and the renewal of the underground section of the Highland substation F1 feeder.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2016 Pole Residual Replacements
Budget Year	2016
Investment Category	System renewal
Project Summary	This project involves the replacement of wood poles identified by pole residual testing as having a high risk of failure.

Capital Investment (5.4.5.2.A.i)		
	Capital Investment (gross)	$1,261,663
	Customer Contribution	$0
	Capital Investment (net)	$1,261,663
	O&M Expenditure	$0.

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	n/a

Project Dates (5.4.5.2.A.iii)				
Start Date	2016/01/01			
In Service Date	2016/07/01			
	Expenditure Timing			
	Q1	Q2	Q3	Q4
	50%	50%	0%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 1,326,407
2011 (CGAAP)- $ 895,000
2012 (MIFRS) - $ 930,000
2013 (MIFRS) - $ 718,074
2014 (MIFRS) - $ 1,190,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)		
	Project Name	2016 Pole Residual Replacements — Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (100%) **Secondary Driver (5.4.5.2.B.1.a)** N/A **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) The replacement of wood poles in this project is identified through Horizon Utilities' pole testing maintenance program. The pole testing categorizes the poles requiring replacement into two categories: 1) requiring immediate replacement; and 2) requiring replacement within five years. Horizon Utilities replaces poles requiring immediate replacement as soon as possible to mitigate the risk of service interruptions and the risk to public safety resulting from a failure of the pole. Horizon Utilities replaces poles requiring replacement within five years in the following year. Failure to replace in the following year compounds the volume of work in subsequent years resulting in cascading delays and compounded volumes in subsequent years. Poles replaced in this project are replaced on a like-for-like basis where possible.	
	Safety (5.4.5.2.B.2) This project will address wood poles requiring replacement as identified through testing. Renewal of these assets prior to failure avoids the potential risk to public safety that would result from a failure of a wood pole.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b) (where applicable)** n/a	
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.	

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	2016 Pole Residual Replacements	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

This project is reactive in nature. The work required is initiated through Horizon Utilities' maintenance and inspection programs. This project has a very high probability of impacting Horizon Utilities' reliability targets if the poles are not replaced.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

This project addresses wood poles that have been identified as having a high risk of failure and as such, these assets are at the end of their useful life. The asset condition relative to their typical life cycle varies in case.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

The number of customers impacted varies in each incident or outage.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

The quantitative customer impact varies in each incident or outage.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

These projects address customer satisfaction as they are required to address assets at risk of failure which would result in a service interruption.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each incident or outage.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

These projects are reactive in nature and address assets at risk of failure. Horizon Utilities replaces poles requiring immediate replacement as soon as possible to mitigate the risk of service interruptions and the risk to public safety resulting from a failure of the pole.

Horizon Utilities replaces poles requiring replacement within five years in the following year. Failure to replace in the following year compounds the volume of work in subsequent years resulting in cascading delays and compounded volumes in subsequent years.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

This project will provide reliability and safety benefits as the project involves the replacement of wood poles that are at risk of failure. Failure of the asset would result in a service interruption and a potential risk to public safety.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

Poles replaced in this project are replaced on a like-for-like basis where possible as this presents the lowest cost option. No additional costs are incurred to address other distributor planning objectives.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	ST-F7 Renewal - Part 2
Budget Year	2016
Investment Category	System Renewal
Project Summary	The project involves the renewal of the Strouds Substation F7 feeder in the Hamilton West operating area. This project is part of the 4kV and 8kV Renewal Program.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$1,533,308
Customer Contribution	$0
Capital Investment (net)	$1,533,308
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project impacts 1,818kVA of transformation.

Project Dates (5.4.5.2.A.iii)

Start Date	2016/03/01
In Service Date	2016/10/31

Expenditure Timing

Q1	Q2	Q3	Q4
12.5%	37.5%	37.5%	12.5%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Strouds substation as part of the 4kV and 8kV Renewal Program. The 2016 investment for the renewal of Strouds substation is $1,533,000. The 2015 investment in the 4kV and 8kV Renewal Program is $8,160,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	ST-F7 Renewal – Part 2	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
4 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of the distribution assets at the current 4kV level was not a feasible alternative.

The renewal of the area serviced by the Strouds substation started in 2014 and is scheduled to be completed in 2018. Strouds substation was constructed in 1938. The switchgear at this substation is 44 years old and has a Health Index of 'very poor' as identified in the Substation Asset Condition Assessment ("SACA") and confirmed by the Kinectrics ACA.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name ST-F7 Renewal – Part 2 Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The distribution assets in the Hamilton West operating area are in poor health and the switchgear in both substations servicing this area has switchgear with a 'very poor' Health Index.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 474 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.024

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by the Strouds substation is scheduled for 2014 to 2018. This project is required to be completed in 2016 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Kinectrics identified that both substations' switchgear had a high probability of failure within one to three years. Failure of both substations would leave the 5400 customers serviced by these substations without power until the substation assets were repaired. Renewal of this area will allow for the decommissioning of the substation assets by 2018 thereby avoiding the need for capital investment into these substations

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	WH-F5 Renewal - Main St W
Budget Year	2016
Investment Category	System Renewal

Project Summary	This project involves the renewal of Whitney substation F3 feeder in the Hamilton West operating area. This project is part of the 4kV and 8kV Renewal Program.		
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$ 1,966,071	
	Customer Contribution	0	
	Capital Investment (net)	$1,966,071	
	O&M Expenditure	$0	
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project impacts 2,971 customers and 3,000 kVA of transformation.		

Project Dates (5.4.5.2.A.iii)

Start Date 2016/02/01

In Service Date 2016/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
18.18%	27.7%	27.7%	27.7%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Whitney substation as part of the 4kV and 8kV Renewal Program. The 2016 investment for the renewal of Whitney substation is $1,966,000. The 2016 investment in the 4kV and 8kV Renewal Program is $10,160,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	WH-F5 Renewal - Main St W	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of these distribution assets at the current 4kV level was not a feasible alternative.

The renewal of the area serviced by the Whitney substation started in 2014 and is scheduled to be completed in 2018. Whitney substation was constructed in 1962. The switchgear at this substation is 46 years old and has a Health Index of 'very poor' as identified in the Substation Asset Condition Assessment ("SACA") and confirmed by the Kinectrics ACA.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	WH-F5 Renewal - Main St W	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The distribution assets in the Hamilton West operating area are in poor health and the switchgear in both substations servicing this area have switchgear with a 'very poor' Health Index

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 2,971 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.102

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by the Whitney substation is scheduled for 2014 to 2018. This project is required to be completed in 2016 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Kinectrics identified that both substations' switchgear had a high probability of failure within one to three years. Failure of both substations would leave the 5400 customers serviced by these substations without power until the substation assets were repaired. Renewal of this area will allow for the decommissioning of the substation assets by 2018 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	GR-F1 Renewal – South of Facer St
Budget Year	2016
Investment Category	System Renewal
Project Summary	This project involves the renewal of the Grantham Substation F1 feeder in St. Catharines south of Facer St.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$ 1,570,191
Customer Contribution	$0
Capital Investment (net)	$1,570,191
O&M Expenditure	$0.

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project affects 2,250 kVA of transformation

Project Dates (5.4.5.2.A.iii)

Start Date 2016/03/01

In Service Date 2016/10/31

Expenditure Timing

Q1	Q2	Q3	Q4
12.5%	37.5%	37.5%	12.5%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Grantham substation as part of the 4kV and 8kV Renewal Program. The 2016 investment for the renewal of Grantham substation is $2,633,000. The 2016 investment in the 4kV and 8kV Renewal Program is $10,160,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

	Leave to Construct Approval (5.4.5.2.A.vii) This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name**	GR-F1 Renewal – South of Facer St	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project		
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of these distribution assets at the current 4kV level was not a feasible alternative. This is the second year of the multi-year project to renew the area serviced by Grantham substation. Renewal of this area is schedule to be completed in 2017.		
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.		
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.		

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a.

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name GR-F1 Renewal – South of Facer St Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The 4kV distribution assets and substations assets in the St. Catharines operating area are in poor health and require renewal. The overall substation Health Index for Vine, Welland and Grantham substations is 57%, 59%, 58% respectively. There is limited back-up between these substations. The loss of the Grantham or Vine substations would result in 900 and 1,100 customers respectively being without service for several days, at a minimum. The SAIDI for these customers is 28% higher than for the customers served by the 13.8kV system in St. Catharines and 100% higher than Horizon Utilities' corporate target.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project will impact 300 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.010

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by the Grantham substation is scheduled for 2015 to 2017. This project is required to be completed in 2016 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. There is limited back-up between these substations. The loss of the Grantham or Vine substations would result in 900 and 1,100 customers respectively being without service for several days, at a minimum. Restoration of power to these customers would require the costly and unplanned emergency construction of new distribution assets all the while customers are without service. This situation is untenable and must be rectified as soon as possible. Renewal of this area will allow for the decommissioning of the substation assets by 2017 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	GR-F2 Renewal - Roehampton XLPE
Budget Year	2016
Investment Category	System Renewal
Project Summary	This project involves the renewal of the Grantham Substation F2 feeder in St. Catharines. This project deals with a section of XLPE cable serving customers in the Roehampton Avenue area of St. Catharines.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$911,383
Customer Contribution	$0
Capital Investment (net)	$911,383
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project impacts 100 customers and 375 kVA of transformation.

Project Dates (5.4.5.2.A.iii)

Start Date	2016/05/01
In Service Date	2016/10/31

Expenditure Timing

Q1	Q2	Q3	Q4
0%	30%	50%	20%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project supports both the 4kV and 8kV Renewal Program and the XLPE Renewal Program.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)		
	Project Name GR-F2 Renewal - Roehampton URD	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project **Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)** This is currently a 4kV underground distribution and Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore, the renewal of the distribution assets at the current 4kV level was not a feasible alternative.	
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a	

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	GR-F2 Renewal - Roehampton URD	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The 4kV distribution assets and substations assets in the St. Catharines operating area are in poor health and require renewal. The overall substation Health Index for Vine, Welland and Grantham substations is 57%, 59%, 58% respectively. There is limited back-up between these substations. The loss of the Grantham or Vine substations would result in 900 and 1,100 customers respectively being without service for several days, at a minimum. The SAIDI for these customers is 28% higher than for the customers served by the 13.8kV system in St. Catharines and 100% higher than Horizon Utilities' corporate target.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are of the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 100 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.003

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Grantham substation is schedule for 2015 to 2017. This project is required to be completed in 2016 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. There is limited back-up between these substations. The loss of the Grantham or Vine substations would result in 900 and 1,100 customers respectively being without service for several days, at a minimum. Restoration of power to these customers would require the costly and unplanned emergency construction of new distribution assets all the while customers are without service. This situation is untenable and must be rectified as soon as possible. Renewal of this area will allow for the decommissioning of the substation assets by 2017 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	GR-F2 Renewal – West of Vine Ave
Budget Year	2016
Investment Category	System Renewal

Project Summary	This project involves the renewal of the Grantham substation F2 feeder in St. Catharines, west of Vine Ave.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$1,063,220
	Customer Contribution	$0
	Capital Investment (net)	$1,063,220
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project impacts 300 customers and 2,250 kVA of transformation.	
Project Dates (5.4.5.2.A.iii)	Start Date	2016/04/01
	In Service Date	2016/11/30

Expenditure Timing			
Q1	Q2	Q3	Q4
0%	37.5%	37.5%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Grantham substation as part of the 4kV and 8kV Renewal Program. The 2016 investment for the renewal of Grantham substation is $2,633,000. The 2016 investment in the 4kV and 8kV Renewal Program is $10,160,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)		
	Project Name GR-F2 Renewal – West of Vine Ave	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore, the renewal of the distribution assets at the current 4kV level was not a feasible alternative. This is the initial year of the multi-year project to renewal the area serviced by Grantham substation. Renewal of this area is schedule to be completed in 2017.	
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a	

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	GR-F2 Renewal – West of Vine Ave	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The 4kV distribution assets and substations assets in the St. Catharines operating area are in poor health and require renewal. The overall substation Health Index for Vine, Welland and Grantham substations is 57%, 59%, 58% respectively. There is limited back-up between these substations. The loss of the Grantham or Vine substations would result in 900 and 1,100 customers respectively being without service for several days, at a minimum. The SAIDI for these customers is 28% higher than for the customers served by the 13.8kV system in St. Catharines and 100% higher than Horizon Utilities' corporate target.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 300 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.010

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Grantham substation is schedule for 2015 to 2017. This project is required to be completed in 2016 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. There is limited back-up between these substations. The loss of the Grantham or Vine substations would result in 900 and 1,100 customers respectively being without service for several days, at a minimum. Restoration of power to these customers would require the costly and unplanned emergency construction of new distribution assets all the while customers are without service. This situation is untenable and must be rectified as soon as possible. Renewal of this area will allow for the decommissioning of the substation assets by 2017 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2016 Rear Lot Conversion
Budget Year	2016
Investment Category	System Renewal

Project Summary	This project involves the replacement of rear lot overhead construction. Replacement options include relocating primary only, or relocating all assets to either overhead or underground in the front lot. Options are dependent on many factors (e.g. presence of trees and availability of room in the road allowance) and are assessed on a case by case basis. This project will involve the renewal of end of life rear lot overhead distribution assets serviced at 13.8kV and therefore not included in the 4kV and 8kV renewal programs.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$1,342,000
Customer Contribution	$0
Capital Investment (net)	$1,342,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	The customer and load impacted by this project will vary depending upon the final scope of the project.

Project Dates (5.4.5.2.A.iii)

Start Date 2016/05/01

In Service Date 2016/09/30

Expenditure Timing

Q1	Q2	Q3	Q4
0%	40%	60%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There are no equivalent projects for comparison.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2016 Rear Lot Conversion	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (60%)

Secondary Driver (5.4.5.2.B.1.a)

System Service (40%)

Investment Priority (5.4.5.2.B.1.b)

3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

Replacement options considered on a project by project basis include relocating primary only, or relocating all assets to either overhead or underground in the front lot. Options are dependent on many factors (e.g., presence of trees and availability of room in the road allowance).

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a.

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name 2016 Rear Lot Conversion Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

Horizon Utilities has identified several residential areas serviced by a rear lot overhead distribution system. Horizon Utilities has experienced a dramatic increase in reliability issues surrounding rear lot distribution systems due to damaged caused from customer owned trees and lack of access for utility crews to repair or replace equipment. The poles are a mix of wood and concrete that, by design, are unsafe to scale to repair, and replacement of poles and equipment is labour intensive and requires specialized equipment access rear yards. Access is poor and therefore failure restoration time is significantly extended. These identified assets are nearing or beyond end of life and should be replaced. In the past several years, storm related failures in these areas have increased and have resulted in long outage durations (in excess of 24 hours).

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Overhead distribution assets located in rear lots typically do not perform as well as assets of similar age resulting in a shorter life cycle.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project will impact a varying number of customers depending upon the scope of the rear lot conversion.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

n/a

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will improve the service received by the customers impacted. Service interruptions of rear lot distribution systems involve longer restoration times due to the difficulty in accessing the assets. The service interruption restoration times will be reduced once the assets have been relocated.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

n/a

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will not have a material impact on system O&M costs in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

Reliability will be improved through the relocation of these assets through reduced service interruption restoration times. Safety will be improved due to improved and easier access to the assets and the ability to work on the assets from aerial bucket trucks versus having to manually climb poles when located in the rear lot.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The cost of this project is required to remove rear lot assets and is specifically designed not to renew using a like-for-like methodology. Horizon Utilities will determine whether to relocate the primary only to the front lot or to relocate all plant to either underground and/or overhead front lot. The decision will be made on a project by project basis.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2016 St. Catharines XLPE Renewal
Budget Year	2016
Investment Category	System Renewal

Project Summary	Renewal of end-of-life XLPE cable assets in the St. Catharines area.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$ 1,661,000
	Customer Contribution	$0
	Capital Investment (net)	$1,661,000
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	The customer and load impacted by this project will vary depending upon the final scope of the project.	
Project Dates (5.4.5.2.A.iii)	Start Date 2016/03/01 In Service Date 2016/11/30	

Expenditure Timing

Q1	Q2	Q3	Q4
10%	40%	40%	10%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is part of a multi-year investment to renewal XLPE primary cable. The 2016 investment in the XLPE Renewal Program is $4,926,000.

Comparable gross investments for the XLPE Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 1,572,090
2014 (MIFRS) - $ 893,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2016 St. Catharines XLPE Renewal	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
4 – Required Project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year XLPE Renewal Program. Horizon Utilities considered the four replacement philosophies for addressing risk inherent in the XLPE asset group: Area; Reactive; Selected; and Refurbishment. The area replacement philosophy will be utilized for selected areas of the service territory where the asset health analysis and the failure history indicates a substantial risk of continued failures. A reactive replacement philosophy will continued to be used for the remaining areas of the service territory. The St. Catharines operating area contains many small pockets of direct buried XLPE primary cable. The XLPE renewal projects in the St. Catharines operating area will involve the full renewal of each pocket of XLPE cable. Project selection will be guided by: asset health; operating history; and reliability of each of the underground pockets of XLPE.

Safety (5.4.5.2.B.2)

These projects are not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

n/a

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	2016 St. Catharines XLPE Renewal	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

XLPE primary cable is the asset group with the largest investment requirement as identified by the Kinectrics ACA. The current backlog volume of XLPE primary cable requiring renewal cannot be addressed in a single year and requires a multiple year investment strategy. The optimal level of renewal for XLPE cable, based on a 40-year useful life replacement cycle, is 50km/year. Horizon Utilities' proposed investment for the 2015 to 2019 Test Years is $36,014,000, which provides for the replacement of 180km of cable over the 2015 to 2019 Test Years. This represents a managed, gradual increase in investment in order to balance rate payer concerns and practical operational limitations.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

An analysis of all service interruptions, caused by material or equipment failure from 2010 to 2013, revealed that 50% of service interruptions, measured by customer minutes of outage, were due to failures of underground cable and equipment. Over 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration. These durations far exceed Horizon Utilities' corporate target of one hour and nine minutes of outage on average per customer.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

The number of customers impacted will vary depending upon the area.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

Varies

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets at risk of failure. Failures of XLPE primary cable result in extended service interruptions; 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

Proactive replacements are required because, as assets continue to age and degrade, the cable will fail at an exponential rate. In the worst case, it would exceed Horizon Utilities' ability to keep pace with repairs. Reliability will also deteriorate to unacceptable levels. Reactive replacements will be considerably more costly than proactive renewal.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the XLPE primary cable, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the XLPE primary cable system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

Failure to invest in the proactive renewal of XLPE primary cable and associated underground assets would result in unacceptable levels of system failures and outages beyond the ability of Horizon Utilities to resolve within a reasonable timeframe as these assets continue to age and degrade. Reactive replacements will also be considerably more costly than the forecast expenditure required to execute the proposed proactive replacement.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

XLPE renewal projects will include: the elimination of radial underground feeds; replacement of below grade transformers with padmount transformers; and the introduction of fusing on the underground distribution systems where applicable.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	VE-F1 Renewal – Queenston St
Budget Year	2016
Investment Category	System Renewal

Project Summary	This project involves the renewal of the Vine Substation F1 feeder in St. Catharines along Queenston St.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$ 1,057,505
	Customer Contribution	$0
	Capital Investment (net)	$1,057,505
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project impacts 1500 kVA of transformation.	
Project Dates (5.4.5.2.A.iii)	Start Date	2016/02/01
	In Service Date	2016/08/31

Expenditure Timing

Q1	Q2	Q3	Q4
25%	30%	45%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Vine substation as part of the 4kV and 8kV Renewal Program. The 2016 investment for the renewal of Vine substation is $2,472,000. The 2016 investment in the 4kV and 8kV Renewal Program is $10,160,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	VE-F1 Conversion – Queenston St	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of the distribution assets at the current 4kV level was not a feasible alternative.

Safety (5.4.5.2.B.2)

These projects are not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

System Renewal Specific Requirements (5.4.5.2.C.b)	**Project Name**	VE-F1 Conversion – Queenston St	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The 4kV distribution assets and substations assets in the St. Catharines operating area are in poor health and require renewal. The overall substation Health Index for Vine, Welland and Grantham substations is 57%, 59%, 58% respectively. There is limited back-up between these substations. The loss of the Grantham or Vine substations would result in 900 and 1,100 customers respectively being without service for several days, at a minimum. The SAIDI for these customers is 28% higher than for the customers served by the 13.8kV system in St. Catharines and 100% higher than Horizon Utilities' corporate target.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are of the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

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Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 430 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.015

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Vine substation is scheduled for 2015 to 2017. This project is required to be completed in 2016 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	VE-F5 Renewal – West of Haynes Ave
Budget Year	2016
Investment Category	System Renewal

Project Summary	This project involves the renewal of the Vine Substation F5 feeder in St. Catharines west of Haynes Ave.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$ 1,414,741
	Customer Contribution	$0
	Capital Investment (net)	$1,414,741
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project impacts 2,000 kVA of transformation	
Project Dates (5.4.5.2.A.iii)	Start Date	2016/01/01
	In Service Date	2016/09/30

Expenditure Timing			
Q1	Q2	Q3	Q4
30%	35%	35%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Vine substation as part of the 4kV and 8kV Renewal Program. The 2016 investment for the renewal of Vine substation is $2,472,000. The 2016 investment in the 4kV and 8kV Renewal Program is $10,160,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	VE-F5 Renewal – West of Haynes Ave	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of the distribution assets at the current 4kV level was not a feasible alternative.

Safety (5.4.5.2.B.2)

These projects are not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name VE-F5 Renewal – West of Haynes Ave Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The 4kV distribution assets and substations assets in the St. Catharines operating area are in poor health and require renewal. The overall substation Health Index for Vine, Welland and Grantham substations is 57%, 59%, 58% respectively. There is limited back-up between these substations. The loss of the Grantham or Vine substations would result in 900 and 1,100 customers respectively being without service for several days, at a minimum. The SAIDI for these customers is 28% higher than for the customers served by the 13.8kV system in St. Catharines and 100% higher than Horizon Utilities' corporate target.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 592 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.020

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Vine substation is scheduled for 2015 to 2017. This project is required to be completed in 2016 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2016 Substation Infrastructure Renewal
Budget Year	2016
Investment Category	System Renewal
Project Summary	This program involves the renewal of substation infrastructure throughout Horizon Utilities' service territory. Substation maintenance and inspection programs annually identify a number of required investments for the continued safe and reliable operation of Horizon Utilities' substations. Investments under this program include battery replacements, SCADA and communication upgrades, and grounding improvements .

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$473,000
Customer Contribution	$0
Capital Investment (net)	$473,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2016/01/01

In Service Date 2016/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 146,477
2011 (CGAAP)- $ 326,000
2012 (MIFRS) - $ 305,000
2013 (MIFRS) - $ 168,507
2014 (MIFRS) - $ 455,503

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2016 Substation Infrastructure Renewal	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This program is required for the ongoing safe and reliable operation of Horizon Utilities' municipal substations. The 4kV and 8kV Renewal Program is structured to decommission Horizon Utilities' 28 substations over the next 34 years. There is no investment in the renewal of the major electrical assets (power transformers, switchgear and breakers) forecasted for the 2015 to 2019 Test Years. The investments provided above are required to maintain the ancillary substation assets in safe working order. Substation investment requirements are identified though preventative maintenance programs performed on both routine maintenance cycles and monthly inspections. Safety related investments include: installation of eye wash stations; end-of-life replacements of batteries and chargers for the emergency backup breaker operation circuits; and the replacement of end-of-life or obsolete station service transformers. These transformers are required to light and heat the substation and are the main source of power for the substation equipment. Miscellaneous investments include reactive replacement of relays, communication equipment and protection instrument transformers. Investments are required to address both electrical assets within the substation (e.g. replacement of switchgear components and instrument transformers), and ancillary equipment (e.g. SCADA, communication equipment, or backup batteries). All of these components are critical to the continued safe and reliable operation of the substation. A failure to undertake these required investments could lead to premature failure of substation components that would result in a service interruption and increased operating or reactive capital expenditure.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

n/a

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	2016 Substation Infrastructure Renewal	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

This project involves investment to replace substation infrastructure required for the continued safe and reliable operation of Horizon Utilities' substations.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

n/a

Number of Customers Impacted (5.4.5.2.C.b.i.3)

n/a

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

n/a

Value of Customer Impact (5.4.5.2.C.b.i.6)

Medium

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The timing of investments in this project is dependent upon the timing of substation maintenance programs and the infrastructure requiring renewal identified while performing maintenance.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on O&M expenditures.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

n/a

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The assets renewed in this program are replaced on a like-for-like basis.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2016 Load Break Disconnect Switch ("LBDS") Replacement
Budget Year	2016
Investment Category	System Renewal
Project Summary	This project involves the replacement of LBDS found to be either inoperable or beyond economic repair (where the cost of maintenance is not warranted) as found through Horizon Utilities' maintenance and inspection programs. Such switches will be replaced with automated switches where an operational benefit can be realized. This is a multi-year program based on 16 replacements per year.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$324,000
Customer Contribution	$0
Capital Investment (net)	$324,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2016/06/01

In Service Date 2016/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
0%	0%	50%	50%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 212,000
2014 (MIFRS) - $ 312,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

	Leave to Construct Approval (5.4.5.2.A.vii) This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name**	2016 LBDS Replacement	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project		
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This project involves the replacement of LBDS switches identified as requiring replacement through Horizon Utilities' maintenance and inspection programs. When feasible, the switches are refurbished rather than replaced. Where refurbishment is not possible, the switches will be replaced with an automated switch where an operational benefit can be realized.		
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Horizon Utilities utilizes the Smart Meter communication infrastructure when communicating with automated switches. Horizon Utilities' Smart Meter and related AMI network have been procured through Elster. Elster's system supports a multi-layered security approach including: access control, authorization, authentication and data integrity protocols. As part of its continuous improvement model, Horizon Utilities performs periodic security assessments to identify opportunities for enhanced system hardening.		
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** This is not applicable to this project.		
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.		
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)**		

	n/a

System Renewal Specific Requirements (5.4.5.2.C.b)	**Project Name** 2016 LBDS Replacement Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

LBDS are critical devices for the operation of the distribution system and are installed at key operating points (e.g. feeder tie points, feeder sectionalizing). Unplanned failures of these devices would impact Horizon Utilities' ability to restore power, resulting in extended outages.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

The asset condition of LBDS relative to their typical lifecycle varies from switch to switch depending upon the operational stresses experienced by the switch. LBDS that are identified for replacement are replaced because they would not operate properly when required and are beyond economical repair.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

No customer impact if the project is planned.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

n/a

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

Failure of a LBDS to operate when required can impact Horizon Utilities' operational ability which can adversely affect the service experienced by customers.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each instance.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The timing of this project is dependent upon the timing of Horizon Utilities' LBDS maintenance program.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

Reliability can be adversely affected when a LBDS fails to operate when required as part of switching to restore service.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

LDBS are replaced with an automated switch where an operational benefit can be realized. Otherwise they are replaced on a like-for-like basis.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2016 Proactive Transformer Replacement
Budget Year	2016
Investment Category	System Renewal
Project Summary	This project was established to proactively replace distribution transformers as required. Renewal of distribution transformers in the past has either been reactive upon failure or proactive when included in the 4kV & 8KV Renewal or XLPE Primary Cable renewal programs. There are instances where proactive replacement of transformers is required even when the replacement is outside of the scope of the programs mentioned above. This is a multi-year project, based on 25 replacements per year.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$361,000
Customer Contribution	$0
Capital Investment (net)	$361,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2016/06/01

In Service Date 2016/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
0%	0%	50%	50%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 104,447
2012 (MIFRS) - $ 185,523
2013 (MIFRS) - $ 276,978
2014 (MIFRS) - $ 339,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2016 Proactive Transformer Replacement	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (100%)

Secondary Driver (5.4.5.2.B.1.a)
N/A

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

Proactive transformer replacements are identified through Horizon Utilities' visual inspection programs and PCB testing programs. Proactive replacement criteria include:

- Transformers that have visibly deteriorated and have a high risk of imminent failure;
- Obsolete Transformers that do not have replacement units in inventory and, in a reactive replacement scenario, the customer(s) may be subject to an extended outage duration;
- Transformers that have visible oil leaks; and
- Transformers that have been identified through testing as containing PCBs.

These criteria were selected due to the level of associated risk. Transformers with visible oil leaks or containing PCBs represent a significant environmental risk. All oil spills must be tracked, reported, and the oil reclaimed where possible. Obsolete transformers, where a replacement is not available in inventory, represent a risk of prolonged service interruption upon failure and are replaced to reduce the risk of outage to the customer.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

n/a

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

This is not applicable to this project.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name 2016 Proactive Transformer Replacement Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The transformers selected for proactive replacement represent a level of risk to Horizon Utilities and this project provides risk mitigation consistent with Horizon Utilities' asset management objectives.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

The asset condition of these transformers relative to their typical lifecycle varies from transformer to transformer. Transformers selected for replacement present a level of risk to Horizon Utilities either through imminent failure of the transformer or through the need to address environmental risk associated with PCBs; or through the risks associated with transformers that have visible oil leaks.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

Varies and is project dependent.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

n/a

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

These criteria were selected due to the level of associated risk. Transformers with visible oil leaks or containing PCBs represent a significant environmental risk. All oil spills must be tracked, reported, and the oil reclaimed where possible. Obsolete transformers, where a replacement is not available in inventory, represent a risk of prolonged service interruption upon failure and are replaced to reduce the risk of outage to the customer.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each instance.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

n/a

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

n/a

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

n/a

2016 General Plant Investments

Capital Project Summary

Project Name	2016 Annual Corporate Computer Replacement
Budget Year	2016
Investment Category	General Plant
Project Summary	This project is part of an ongoing business requirement to refresh end user computers. Horizon Utilities utilizes a three-year lifecycle for replacement of end user computers. On an annual basis, approximately one third of all Horizon Utilities' computers (~150 PCs/year) are replaced.

Capital Investment (5.4.5.2.A.i)		
	Capital Investment (gross)	$323,500
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)	n/a

Project Dates (5.4.5.2.A.iii)				
	Start Date	Jan. 2016		
	In Service Date	Dec. 2016		
	Expenditure Timing			
	Q1	Q2	Q3	Q4
	25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Schedule - Implementation is phased throughout the year starting in January and ending in December based on the age of PCs being replaced.

Risk – The primary risk to this project is product availability from suppliers.
Risk Mitigation – Work closely with suppliers to schedule orders based on required delivery times.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the annual corporate computer replacement for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 336,000
2011 (CGAAP)- $ 227,000
2012 (MIFRS) - $ 312,000
2013 (MIFRS) - $ 364,947
2014 (MIFRS) - $ 366,200

Total Capital and OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)
n/a

Leave to Construct Approval (5.4.5.2.A.vii)
n/a

Evaluation Criteria and Information

Project Name	2016 Annual Corporate Computer Replacement	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
General Plant (100%)

Secondary Driver (5.4.5.2.B.1.a)
n/a

Investment Priority (5.4.5.2.B.1.b)

High Priority – Personal computers are treated as a strategic asset. They are Horizon Utilities' primary staff productivity tool. They are used to: maintain and deliver services to customers; improve staff productivity; cost-effectively manage total cost of PC ownership; and support investments in new applications, infrastructure and business capabilities.

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)
n/a

Safety (5.4.5.2.B.2)
n/a

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)
n/a

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
n/a

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Suppliers of enterprise systems such as: GIS; OMS; SCADA; AMI; and IFS ERP, are constantly upgrading their products to deliver new processes and functionality. As new versions are released, up-to-date hardware is required in order to perform necessary upgrades to maintain vendor support for the systems.

	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

General Plant Specific Requirements	**Project Name**	2016 Annual Corporate Computer Replacement	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

n/a

Business Case Justification Documentation (5.4.5.2.C.d.i)

Horizon Utilities' PCs are treated as a strategic asset, because they are the primary staff productivity tool. Horizon Utilities has streamlined its PC lifecycle management processes utilizing a PC refresh cycle of three years, in order to: deliver, maintain and improve services to customers; to improve staff productivity; to cost-effectively manage total cost of PC ownership; and to support investments in new applications, infrastructure and business capabilities.

A three-year PC refresh cycle reduces the total cost of ownership by reducing the number of models of PCs supported, which results in the reduction of the IST service desk effort required to deploy, secure, and manage new systems and applications. The reduction in the number of supported models has allowed Horizon Utilities to introduce mobile computing for remote field workers and to increase the number of supported PCs by over 100 devices since 2011, without an increase in IST service desk support staff.

A refresh lifecycle of three years reduces the likelihood of device failures that lead to a loss of staff productivity and increased IT support effort. Over 50% of Horizon Utilities' staff utilizes a mobile PC (laptop or tablet) in the performance of their daily activities, many in harsh operating environments outside the office, which increases the likelihood of failure due to operating environment and the age of the device.

Horizon Utilities has introduced several new enterprise business and engineering systems to: mitigate business risks related to aging systems (e.g. GIS); improve electricity system operation (i.e. GIS, OMS); and to address end of vendor support for systems (i.e. IFS ERP, Microsoft Windows XP). Maintaining a three-year PC lifecycle refresh program allows Horizon Utilities' to migrate to these applications without a need to make large one-time investments in PCs to meet the minimum operating requirements of new applications.

PCs are the primary productivity tool used by Horizon Utilities' staff. Unreliable and slow PCs impact productivity and customer service.

Minimizing the number of supported models reduces the IST support effort required to manage, order, configure, and deploy PCs and it reduces the total cost of ownership for PCs.

Capital Project Summary

Project Name	2016 Capital Lease – IBM
Budget Year	2016
Investment Category	General Plant
Project Summary	This project is the end of lease replacement of the IBM iSeries server hardware environment used to run the Daffron Customer Information System ("CIS") which supports Horizon Utilities' customer management and meter-to-cash processes. The hardware is a three-year lease with planned renewals in 2016 and 2019. The environment includes a production IBM iSeries server in Hamilton and an identical IBM iSeries server at the Disaster Recovery Data Centre in St. Catharines.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$900,000
Customer Contribution	n/a
Capital Investment (net)	n/a
O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)

N/A

Project Dates (5.4.5.2.A.iii)

Start Date Jan. 2016

In Service Date Jan. 2016

Expenditure Timing

Q1	Q2	Q3	Q4
100%	0%	0%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Schedule - Implementation Jan. 2016

Risk – The primary risk to this project is product availability from suppliers.

Risk Mitigation – Work closely with suppliers to schedule orders based on required delivery times.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There are no comparable projects in scope and nature for comparison.

Total Capital and OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)
n/a

Leave to Construct Approval (5.4.5.2.A.vii)
n/a

Evaluation Criteria and Information		
	Project Name 2016 Capital Lease – IBM	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant (100%) **Secondary Driver (5.4.5.2.B.1.a)** n/a **Investment Priority (5.4.5.2.B.1.b)** High Priority – This project is required for the continued operation of Horizon Utilities' CIS system.	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) n/a	
	Safety (5.4.5.2.B.2) n/a	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)**	
	n/a **Economic Development** (5.4.5.2.B.5) **(where applicable)**	
	n/a **Environmental Benefits** (5.4.5.2.B.6) **(where applicable)** n/a	

General Plant Specific Requirements	**Project Name** 2016 Capital Lease – IBM Table 3
	General Plant Specific Requirements (5.4.5.2.C.d) **Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)** N/A **Business Case Justification Documentation (5.4.5.2.C.d.i)** The IBM iSeries hardware lease will expire December 31, 2015 and December 31, 2018. This environment is required to maintain the continued operation of Horizon Utilities' Daffron CIS system to ensure appropriate technology for the customer management and meter-to-cash processes. Replacement of the IBM iSeries hardware at end-of-life reduces the likelihood of hardware failures that could disrupt normal business operations, impacting Horizon Utilities' ability to: read Smart Meters; bill customers; apply customer payments; manage customer interactions; and manage customer work orders.

Capital Project Summary

Project Name	2016 John Street Windows Replacement
Budget Year	2016
Investment Category	General Plant

Project Summary;

This project is scheduled to take place between 2015 to 2017 to replace the existing windows of the John Street building as they have reached the end-of-lie with the objective to:

- Improve energy performance as the windows are no longer weather resistant;
- Prevent further damage to interior walls and facilities related components;
- Prevent further damage to the building exterior stricture;
- Prevent damage to operational systems; and
- Reduce operational related costs.

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$300,000
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a
Customer Attachments / Load (5.4.5.2.A.ii)	n/a	
Project Dates (5.4.5.2.A.iii)	Start Date	April 2016
	In Service Date	December 2016

Expenditure Timing

Q1	Q2	Q3	Q4
	35%	65%	

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Project timelines and costs exceeding the budget are risks. The project manager will report regularly on project timelines and adherence to budget and escalates issues for resolution.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

n/a

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)

n/a

Evaluation Criteria and Information	**Project Name:**	2016 John Street Windows Replacement	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant – 100% **Secondary Driver (5.4.5.2.B.1.a)** n/a **Investment Priority (5.4.5.2.B.1.b)** High		
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Horizon Utilities engaged the MMM Group Limited in 2013 to conduct a condition assessment using visual inspections, air leakage testing and building energy simulations air test. Recommendations are based on the results of the tests and inspections.		
	Safety (5.4.5.2.B.2) n/a		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) N/A		
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** n/a		
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a **Environmental Benefits** (5.4.5.2.B.6) **(where applicable)** n/a		
Gener	**Project Name**	2016 John Street Windows Replacement	Table 3
	General Plant Specific Requirements (5.4.5.2.C.d)		

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

Horizon Utilities engaged the MMM Group Limited in 2013 to conduct a condition assessment using visual inspections, air leakage testing and building energy simulations air test. Recommendations are based on the results of the tests and inspections.

Business Case Justification Documentation (5.4.5.2.C.d.i)

The windows are no longer weather resistant or energy efficient and they allow cold drafts to enter the building. The windows collect frost on the inside in the winter which melts and damages interior walls and carpeting. The assessment was conducted using visual inspections, air leakage testing and building energy simulations. The testing concluded that the condition of the operable windows in the John Street office building is poor. The windows, installed in 1994, have reached end-of-life and require replacement in order to reduce energy costs and to maintain the comfort of the employees from a climate and noise perspective. Weather stripping was determined to be insufficient as identified through air leakage tests.

Capital Project Summary

Project Name	2016 Vehicle Replacement
Budget Year	2016
Investment Category	General Plant

Project Summary;

Between 2015 and 2019, Horizon Utilities has identified a number of current vehicles that required replacement as they have reached end-of-life as per the criteria within Horizon Utilities' Fleet Replacement Plan.

Other expected objectives and outcomes are to:

- Maintain vehicle reliability and availability;
- Reduce fuel consumption;
- Reduce emissions;
- Reduce down time required to conduct maintenance and repairs; and
- Maintain customer response time.

O

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$780,000	
	Customer Contribution	n/a	
	Capital Investment (net)	n/a	
	O&M Expenditure	n/a	
Customer Attachments / Load (5.4.5.2.A.ii)			
Project Dates (5.4.5.2.A.iii)	Start Date	March 2016	
	In Service Date	December 2016	

Expenditure Timing

Q1	Q2	Q3	Q4
0%	0%	50%	50%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv)

Risk – The primary risk to this project is product availability and adherence to delivery schedules from suppliers.
Risk Mitigation – Work closely with suppliers to schedule orders based on required delivery times.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for vehicle replacements for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 1,590,516
2011 (CGAAP)- $ 1,033,975
2012 (MIFRS) - $ 1,057,410
2013 (MIFRS) - $ 36,365
2014 (MIFRS) - $ 785,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)
n/a

Leave to Construct Approval (5.4.5.2.A.vii)
n/a

Evaluation Criteria and Information

Project Name: 2016 Vehicle Replacement	Table 2
Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver** (5.4.5.2.B.1.a) General Plant – 100% **Secondary Driver** (5.4.5.2.B.1.a) n/a	
Investment Priority (5.4.5.2.B.1.b) High	
Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) n/a	
Safety (5.4.5.2.B.2) n/a	

	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** n/a
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a **Environmental Benefits** (5.4.5.2.B.6) **(where applicable)** n/a

General Plant Specific Requirements	**Project Name**	2016 Vehicle Replacement	Table 3
	General Plant Specific Requirements (5.4.5.2.C.d) **Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)** Horizon Utilities uses the data collected from electronic fleet and fuel management system, the Global Positional System ("GPS") data which includes engine hours, power take-off ("PTO"), engine idling hours, traffic patterns, utilization, and mileage to determine the optimal maintenance scheduling and vehicle maintenance and repairs activities to determine the optimal maintenance scheduling and vehicles replacements. **Business Case Justification Documentation (5.4.5.2.C.d.i)**		
	To maintain the quality, reliability and availability of Horizon Utilities' vehicle fleet for Construction and Maintenance, Metering Services and corporate group activities, vehicles are assessed annually based on a replacement criteria matrix defined within the Fleet Replacement Plan. Replacement strategies also ensure that Horizon Utilities maintains safe vehicles for employees, while targeting reduced emissions, as well as reduced fuel, operating and maintenance costs. During the next six years, Horizon Utilities will not be procuring any net new vehicles and instead will focus on the replacement of end of life vehicles. Due to budget mitigation efforts in 2011, 2012, and 2013 a number of vehicles that were scheduled for replacement were kept in operation and rescheduled for replacement in 2014. It is now critical that these vehicles be replaced as maintenance and repairs costs have increased and the vehicles no longer operate at full capacity, reducing vehicle availability and impacting service delivery. Regular vehicle replacement is necessary to avoid undue vehicle down and associated negative impacts to customer response time and employee productivity.		

Capital Project Summary

Project Name	2016 Tools, Shop and Garage Equipment
Budget Year	2016
Investment Category	General Plant

Project Summary
This program includes capital expenditures pertaining to the replacement of tools, shop and garage equipment, which are either worn, have come to the end of their useful life, or the continued use of such creates health and safety risks.

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$566,000
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)	n/a

Project Dates (5.4.5.2.A.iii)

Start Date	January 2016
In Service Date	December 2016

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Risk – n/a

Risk Mitigation – n/a

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

n/a

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)

n/a

Evaluation Criteria and Information	
	Project Name: 2016 Tools, Shop and Garage Equipment Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant (100%) **Secondary Driver (5.4.5.2.B.1.a)** n/a
	Investment Priority (5.4.5.2.B.1.b) High **Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)** Tools and equipment over $5000 are procured through a competitive process and alternatives are considered at the time of requisition.
	Safety (5.4.5.2.B.2) Tools and equipment meet CSA requirements and are reviewed for conformance to requirements by Horizon Utilities' Tool & Equipment Committee.
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) N/A
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** n/a
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

General Plant Specific Requirements

Project Name	2016 Tools, Shop and Garage Equipment	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Su**mmary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)**

Each year a condition assessment is conducted on the inventory of tools and equipment in use, to determine a forecast for expected replacements. Feedback from the crews that use the tools and equipment, together with feedback from the Fleet Mechanics who maintain the tools and equipment on each vehicle, are used to establish the annual budgets. It becomes unsafe, costly and inefficient to use or maintain this type of equipment which has reached the end of its useful life.

New tools become available on the market, on a periodic basis, that offer improved safety, ergonomics and productivity features which Horizon Utilities evaluates for use. Changes in regulations, which require a different standard of equipment, may necessitate a replacement of tools and equipment. Fall arrest equipment for example, needs to be exchanged when new standards come into effect, and any required new equipment is included in the budget

Business Case Justification Documentation (5.4.5.2.C.d.i)

n/a

Capital Project Summary

Project Name	[redacted]
Budget Year	2016
Investment Category	General Plant

Project Summary

The objective of this 3 year project that started in 2014 is to [redacted]

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$200,000	
	Customer Contribution	n/a	
	Capital Investment (net)	n/a	
	O&M Expenditure	n/a	
Customer Attachments / Load (5.4.5.2.A.ii)	n/a		
Project Dates (5.4.5.2.A.iii)	Start Date	March 2016	
	In Service Date	September 2016	

Expenditure Timing

Q1	Q2	Q3	Q4
0%	50%	50%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**
Project timelines and costs exceeding the budget are risks. The project manager will report regularly on project timelines and adherence to budget and escalates issues for resolution.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

n/a.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)

n/a

Evaluation Criteria and Information

Project Name	2016 Building Security Systems Replacement	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)

General Plant 100%

Secondary Driver (5.4.5.2.B.1.a)
n/a

Investment Priority (5.4.5.2.B.1.b)

High

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

[redacted]

Safety (5.4.5.2.B.2)
n/a.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

n/a

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
n/a

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

n/a

Economic Development (5.4.5.2.B.5) **(where applicable)**

N/A

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

General Plant Specific Requirements

Project Name	2016 Building Security Systems Replacement	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

[redacted]

Business Case Justification Documentation (5.4.5.2.C.d.i)

[redacted]

Capital Project Summary

Project Name	2016 Building Renovations – John St
Budget Year	2016
Investment Category	General Plant

Project Summary

This project involves the renovation of the second floor at the John Street location to consolidate Customer Service and CDM employees into contiguous workgroups for organizational efficiency and to improve employee security and safety by relocating Customer Service cashiers from the area adjacent to the customer lobby on the first floor.

The fire and life safety and electrical systems will be updated to comply with current fire codes and the Ontario Building Code ("OBC"). All Heating, Ventilation and Air Conditioning ("HVAC") components will be replaced and redirected as required to ensure air quality meets appropriate standards.

The second floor is largely original to the 1950 building and much of the infrastructure, equipment and systems have reach end-of-life.

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$1,600,000
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a
Customer Attachments / Load (5.4.5.2.A.ii)	n/a	
Project Dates (5.4.5.2.A.iii)	Start Date	March 2016
	In Service Date	December 2016

Expenditure Timing

Q1	Q2	Q3	Q4
0%	30%	30%	40%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Project timelines and costs exceeding the budget are risks. The project manager will report regularly on project timelines and adherence to budget and escalates issues for resolution.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for building renovations for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 1,767,000
2013 (MIFRS) - $ 5,490,000
2014 (MIFRS) - $ 3,700,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)
n/a

Evaluation Criteria and Information

Project Name: 2016 Building Renovations – John St Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)

General Plant – 100%

Secondary Driver (5.4.5.2.B.1.a)
n/a

Investment Priority (5.4.5.2.B.1.b)

High

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

Horizon Utilities' building renovation plans were developed through a facilities planning process that utilized the outputs of a space planning study and multiple building assessments.

Safety (5.4.5.2.B.2)

n/a

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

n/a

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

n/a

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

n/a

Economic Development (5.4.5.2.B.5) (where applicable)

n/a

Environmental Benefits (5.4.5.2.B.6) (where applicable)

n/a

General Plant Specific Requirements

Project Name 2016 Building Renovations – John St Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

n/a

Business Case Justification Documentation (5.4.5.2.C.d.i)

The second floor of the Head Office will be renovated to consolidate Customer Service and CDM employees into contiguous workgroups for organizational efficiency and to improve employee security and safety by relocating certain Customer Service staff from the area adjacent to the customer lobby on the first floor. The fire and life safety and electrical systems will be updated to comply with current fire codes and the OBC. All HVAC components will be replaced and redirected as required to ensure air quality meets appropriate standards.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2017 Meters			
Budget Year	2017			
Investment Category	System Access			
Capital Investment (5.4.5.2.A.i)	Capital Investment	$ 2,046,000		
	Total	$ 2,046,000		
	O&M Expenditure	$0		
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	n/a			
Project Dates (5.4.5.2.A.iii)	Start Date	2017/01/01		
	In Service Date	2017/12/31		
	Expenditure Timing			
	Q1	Q2	Q3	Q4
	25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Schedule risk for the installation of meters at new service locations is due to customer delays or restricted access to work sites. Horizon Utilities co-ordinates the connection of new services with customers to mitigate this risk.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Metering investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP) - $1,715,716
2011 (CGAAP)- $3,467,413
2012 (MIFRS) - $25,168,043
2013 (MIFRS) - $1,658,707
2014 (MIFRS) - $2,499,104

The increased investment in 2012 was due to the implementation of Smart Meters at a cumulative capital cost of $23,277,588. Horizon Utilities substantially completed its mass deployment of Smart Meters in 2009 and, as at the end of 2011, had installed Smart Meters for 229,322 customers or 98.0% of all metering points.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and as such no associated OM&A costs related to REG will be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name 2017 Meters Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Access (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Renewal (20%)

Replacement of commercial meters with Smart Meters.

Investment Priority (5.4.5.2.B.1.b)
5 – Mandatory Project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

Metering asset management is governed by Measurement Management regulation and customer requirements new and upgraded services.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Horizon Utilities' Smart Meter and related AMI network have been procured through Elster. Elster's system supports a multi-layered security approach including: access control, authorization, authentication and data integrity protocols. As part of its continuous improvement model, Horizon Utilities performs periodic security assessments to identify opportunities for enhanced system hardening.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

The Smart Meter infrastructure supports the provinces' conservation culture. Smart metering also provides environmental benefits through reduction in field visits associated with manual meter reading.

System Access Specific Requirements (5.4.5.2.C.a)

Project Name 2017 Meters Table 3

System Access Specific Requirements (5.4.5.2.C.a)

Factors Affecting Implementing Project Timing/Priority (5.4.5.2.C.a.i)
Compliance sampling work is completed to comply with Measurement Canada regulations. The schedule is created to smooth the annual sampling requirements from the original Smart Meter mass deployments.

New and replacement metering is provided on demand to address new load growth and meter failures.

Factors Related to Customer Preference or 3rd Party Input (5.4.5.2.C.a.ii)

Metering for new and upgraded connection projects are customer initiated and are designed to meet customer identified requirements.

Factors Affecting Final Project Cost (5.4.5.2.C.a.iii)
Please refer to Note I for an explanation on the factors affecting the final project cost.

Controllable Cost Minimization (5.4.5.2.C.a.iv)

Please refer to Note I for an explanation regarding controllable cost mitigation.

Other Planning Objectives (5.4.5.2.C.a.v)

Horizon Utilities combines work from multiple work groups to reduce costs and increase efficiency. The line work and meter work is combined when connecting new customers to allow the work to be completed by a single work group.

Assessment of Technical or Implementation Options (5.4.5.2.C.a.vi)

Metering work is Measurement Canada and customer driven and the technology is primarily based on the metering products available from a sole source supplier.

Summary of Options Analysis (5.4.5.2.C.a.vii)

The meter supplier was selected as part of the Smart Meter implementation program.

Final Economic Evaluation Results (5.4.5.2.C.a.viii)

n/a

	Identification of System Impacts (5.4.5.2.C.a.ix) System expansion, if required, to connect customers within this category, is governed by Horizon Utilities' Conditions of Service Section 2.1.2.1.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2017 Road Relocations
Budget Year	2017
Investment Category	System Access

Project Description	Projects in this category involve the relocation of Horizon Utilities' assets to support road relocation and road reconstruction projects at the request of the City of Hamilton, the City of St. Catharines, the Ministry of Transportation, and the Region of Niagara	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$2,615,311
	Customer Contribution	$ 904,360
	Capital Investment (net)	$1,710,951
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	n/a.	
Project Dates (5.4.5.2.A.iii)	Start Date	Various – driven by road authority schedules
	In Service Date	Various – driven by road authority schedules

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

The initiation and timing of these projects are dictated by the City of Hamilton, City of St. Catharines, the Ministry of Transportation, or the Region of Niagara. Consequently, the timing and value of investment required by Horizon Utilities is subject to change.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Road relocations for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP) - $ 2,889,575
2011 (CGAAP)- $ 895,524
2012 (MIFRS) - $ 3,151,887
2013 (MIFRS) - $ 340,491
2014 (MIFRS) - $ 977,024

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	
	Project Name 2017 Road Relocations Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Access (90%) **Secondary Driver (5.4.5.2.B.1.a)** System Renewal (5%) System Service (5%) **Investment Priority (5.4.5.2.B.1.b)** 5 – Mandatory Project
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Horizon Utilities co-ordinates project design and discusses design alternatives for each project with the organization (City, Municipality, Ministry of Transportation) originating the request to relocate distribution assets.
	Safety (5.4.5.2.B.2) These projects are not intended to address safety concerns with the distribution system.
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Timelines for the execution of these projects are dictated by the City of Hamilton, City of St. Catharines, the Ministry of Transportation or the Region of Niagara. Horizon Utilities coordinates work with these stakeholders, wherever possible, on the road relocations with planned distribution projects. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

System Access Specific Requirements (5.4.5.2.C.a)

Project Name 2017 Road Relocations Table 3

System Access Specific Requirements (5.4.5.2.C.a)

Factors Affecting Implementing Project Timing/Priority (5.4.5.2.C.a.i)

The road authority's schedule and timing of the road project will affect the Horizon Utilities' project implementation and timing.

Factors Related to Customer Preference or 3rd Party Input (5.4.5.2.C.a.ii)

Road relocation projects involve a co-ordinated design process and the initiating organization (City, Municipality, or Ministry of Transportation) has input into the design of the project.
The designs for all projects within the public right-of-way are reviewed with the City as Municipal Consents are required prior to construction. Consideration is given by the road authority to coordinate all utilities within the right–of-way in the least disruptive manner.

Factors Affecting Final Project Cost (5.4.5.2.C.a.iii)

Please refer to Note I for an explanation on the factors that can affect the final project cost.

Controllable Cost Minimization (5.4.5.2.C.a.iv)

50% of Labour, Labour saving devices and Equipment rentals are recovered from the road authority. Please refer to Note I for an explanation on controllable cost minimization.

Other Planning Objectives (5.4.5.2.C.a.v)

Horizon Utilities combines work to reduce overall costs and increase efficiency. The most common opportunity is during city road relocation projects where a new water main is being installed. Horizon Utilities may be able to take advantage of the fact that installing duct structure is less costly since the road is already excavated. Horizon Utilities may also be able to change the schedule of a renewal project to align with the road authority's work to maximize these benefits. The cost of the additional work is allocated either to system service or system renewal where applicable. Horizon Utilities can maximize the amount of work that can be completed at the lowest cost to benefit ratepayers in these cases.

Assessment of Technical or Implementation Options (5.4.5.2.C.a.vi)

Horizon Utilities co-ordinates project design and discusses design alternatives for each project with the road authority (City, Municipality, Ministry of Transportation) originating the request to relocate distribution assets.

Summary of Options Analysis (5.4.5.2.C.a.vii)

Horizon Utilities reviews proposed design with municipalities and the Ministry of Transportation, as applicable, in an effort to determine the most cost effective solution

Final Economic Evaluation Results (5.4.5.2.C.a.viii)

This is not applicable to road relocations projects.

Identification of System Impacts (5.4.5.2.C.a.ix)

Horizon Utilities follows the *Public Service Works on Highways Act*, 1990 and associated regulations governing the recovery of costs related to road reconstruction work by collecting contributed capital for 50% of the labour; labour saving devices, and equipment rentals. Capital contributions toward the cost of all customer demand projects are collected by Horizon Utilities in accordance with the DSC and the provisions of its Conditions of Service.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2017 Customer Connections
Budget Year	2017
Investment Category	System Access
Project Summary	Projects in this category include multiple projects required to connect, upgrade, or disconnect customers to the distribution system. Horizon Utilities' obligation to connect new customers is governed by the *Electricity Act, 1998, Schedule 28.*

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$4,912,181
Customer Contribution	$773,104
Capital Investment (net)	$4,139,076
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

Horizon Utilities completes approximately 1800 connections annually; 1500 through subdivisions and 300 customer projects, contributing approximately 25MVA in system load growth.

Project Dates (5.4.5.2.A.iii)

Start Date	Various – as driven by the customer
In Service Date	Various – as driven by the customer

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable investments, net of capital contributions, for the 2010 and 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 1,023,336
2011 (CGAAP)- $ 2,030,541
2012 (MIFRS) - $ 1,652,000
2013 (MIFRS) - $ 3,541,455
2014 (MIFRS) - $ 4,063,471

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name** 2017 Customer Connections Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Access (100%) **Secondary Driver (5.4.5.2.B.1.a)** N/A **Investment Priority (5.4.5.2.B.1.b)** 5 – Mandatory Project
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Customer connection projects are driven by customer requests and the customer's specific technical requirements. To build efficiencies into the process, Horizon Utilities utilizes a set of design standards that have been engineered and approved. Customer connections requests are fulfilled consistent with Horizon Utilities' Conditions of Service, designed to meet the customer requirements and maintain system reliability.
	Safety (5.4.5.2.B.2) These projects are not intended to address safety concerns with the distribution system.
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** This is not applicable for these projects.
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

System Access Specific Requirements (5.4.5.2.C.a)

Project Name	2017 Customer Connections	Table 3

System Access Specific Requirements (5.4.5.2.C.a)

Factors Affecting Implementing Project Timing/Priority (5.4.5.2.C.a.i)

Schedule of work based on customer expectations, customer request may not be standard design

Factors Related to Customer Preference or 3rd Party Input (5.4.5.2.C.a.ii)

There projects are customer initiated and are designed to meet customer identified requirements.

Factors Affecting Final Project Cost (5.4.5.2.C.a.iii)

Please refer to Note I for an explanation on the factors affecting final project cost.

Controllable Cost Minimization (5.4.5.2.C.a.iv)

Please refer to Note I for an explanation on the factors affecting controllable cost.

Other Planning Objectives (5.4.5.2.C.a.v)

n/a

Assessment of Technical or Implementation Options (5.4.5.2.C.a.vi)

Please refer to Note III for information on the technical and implementation options.

Summary of Options Analysis (5.4.5.2.C.a.vii)

Please refer to Note III for information on the technical and implementation options.

Final Economic Evaluation Results (5.4.5.2.C.a.viii)

Horizon Utilities completes the economic evaluation for any customer system access project which requires the construction of new facilities to the main distribution system or an increase in the existing capacity of distribution facilities. For further details please see Appendix E of Horizon Utilities' Conditions of Service. The economic evaluation is completed in accordance with section 3.2 of the Distribution System Code ("DSC"). For the 2015-2019 Test Year period, Horizon Utilities has no known projects for which to provide the final economic evaluation. When a road authority requests a relocation of Horizon Utilities' plant located on the public road allowance, the costs shall be shared, as outlined in the *Ontario Public Service Works on Highways Act*. Other projects within this category will have an economic evaluation completed where applicable in accordance with both the DSC and Appendix E of Horizon Utilities' Conditions of Service.

Identification of System Impacts (5.4.5.2.C.a.ix)

System expansion, if required, to connect customers within this category are governed by Horizon Utilities Conditions of Service Section 2.1.2.1.

2017 System Renewal Investments

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	AB-F5 Renewal – Dundurn St
Budget Year	2017
Investment Category	System Renewal
Project Summary	The project involves the renewal of the Aberdeen Substation F5 feeder in the Hamilton Downtown operating area. This project is part of the 4kV and 8kV Renewal Program.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$2,418,419
Customer Contribution	$0
Capital Investment (net)	$2,418,419
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project impacts 2,673 customers and 2,000kVA of transformation.

Project Dates (5.4.5.2.A.iii)

Start Date 2017/04/02

In Service Date 2017/11/30

Expenditure Timing

Q1	Q2	Q3	Q4
	37.5%	37.5%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Aberdeen substation as part of the 4kV and 8kV Renewal Program. The 2017 investment for the renewal of Aberdeen substation is $2,418,000. The 2017 investment in the 4kV and 8kV Renewal Program is $15,764,000.

Comparable gross investments for the 4kV and 8kV Renewal Program for the 2010 and 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	AB-F5 Renewal – Dundurn St	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. It is necessary to renew both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore, the renewal of the distribution assets at the current 4kV level was not a feasible alternative.

The renewal of the area serviced by Aberdeen substation starts in 2017 and is scheduled to be completed in 2021.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensure that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name AB-F5 Renewal – Dundurn St Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The two substations servicing the downtown Hamilton operating area service a total of 7,400 customers and were constructed in 1950 and 1960. The overall Station Health Index for Aberdeen and Central substations is 53% and 56% respectively. The switchgear at the Aberdeen substation is 40 years old; Kinectrics determined its effective age is 54 years old.
Kinectrics analysis determined that this switchgear has a high risk of failure within five years. Aberdeen substation, which services 2,600 customers, has inadequate backup for all feeders. The failure of the switchgear at this substation will leave customers without power or subject them to rotating blackouts.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts approximately 2,673 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.137

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Aberdeen substation is scheduled for 2017 to 2021. This project is required to be completed in 2017 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Renewal of this area will allow for the decommissioning of the substation assets by 2021 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	CE-F5 Renewal – Forest Ave
Budget Year	2017
Investment Category	System Renewal

Project Summary	The project involves the renewal of the Central Substation F5 feeder in the Hamilton Downtown operating area. This project is part of the 4kV and 8kV Renewal Program.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$1,876,203
	Customer Contribution	$0
	Capital Investment (net)	$1,876,203
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project impacts approximately 300 customers and 1,200kVA of transformation	
Project Dates (5.4.5.2.A.iii)	Start Date	2017/04/02
	In Service Date	2017/11/30

Expenditure Timing

Q1	Q2	Q3	Q4
0%	37.5%	37.5%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Central substation as part of the 4kV and 8kV Renewal Program. The 2017 investment for the renewal of Central substation is $1,876,000. The 2017 investment in the 4kV and 8kV Renewal Program is $15,764,000.

Comparable gross investments for the 4kV and 8kV Renewal Program for the 2010 and 2013 Historical Year and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

	Leave to Construct Approval (5.4.5.2.A.vii) This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name**	CE-F5 Renewal – Forest Ave	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project		
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This project is part of the multi-year 4kV and 8kV Renewal Program. It is necessary to renew both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of the distribution assets at the current 4kV level was not a feasible alternative The renewal of the area serviced by Central substation started in 2016 and is scheduled to be completed in 2022.		
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.		
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.		
	Economic Development (5.4.5.2.B.5) Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.		

Environmental Benefits (5.4.5.2.B.6)

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name CE-F5 Renewal – Forest Ave Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The two substations servicing the downtown Hamilton operating area service a total of 7,400 customers and were constructed in 1950 and 1960. The overall Station Health Index for Aberdeen and Central substations is 53% and 56% respectively. Central substation has ten feeders; six of which are obsolete, oil-filled breakers that are at end-of-life. The Health Index for these breakers is "very poor" and Kinectrics forecasted that these circuit breakers have a high risk of failure within three years. Two of the six feeders are radial feeders with no backup. Failure of the breakers for these feeders would result in the loss of service for over 50 commercial customers in downtown Hamilton for a minimum of several hours to several days. Central substation has limited interconnection with other substations. The loss of the entire substation would affect all 3,100 customers who would be out of power until the substation assets were repaired.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts approximately 300 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.242

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Central substation is scheduled for 2016 to 2022. This project is required to be completed in 2017 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Renewal of this area will allow for the decommissioning of the substation assets by 2022 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2017 Reactive Renewal
Budget Year	2017
Investment Category	System Renewal
Project Summary	This category includes all projects required for the reactive renewal or repairs driven by emergency equipment failures and associated corrective action. Projects arise from trouble calls or inspection programs identifying an urgent need to replace system assets and the scope of the equipment replacement requires engineering. Also included in this category are projects to address customer power quality issues, and Electrical Safety Authority ("ESA") due diligence inspection outcomes.

Capital Investment (5.4.5.2.A.i)		
	Capital Investment (gross)	$1,508,241
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	n/a
Project Dates (5.4.5.2.A.iii)	Start Date January 1, 2017 In Service Date December 31, 2017

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv)

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable investments for the 2010 and 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 8,745,125
2011 (CGAAP)- $ 8,230,970
2012 (MIFRS) - $ 4,032,000
2013 (MIFRS) - $ 6.069,566
2014 (MIFRS) - $ 4,840,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

	Leave to Construct Approval (5.4.5.2.A.vii) This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name**	2017 Reactive Renewal	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project		
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) No alternatives are considered for these projects as they involve the emergency replacement of failed equipment required to restore service.		
	Safety (5.4.5.2.B.2) These projects are intended to primarily address failed assets however investments required to address immediate safety issues, including issues presenting a potential risk to public safety identified by the ESA, are included in this project.		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a		
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.		
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.		

	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

System Renewal Specific Requirements (5.4.5.2.C.b)	**Project Name** 2017 Reactive Renewal	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

These projects are reactive in nature and are initiated from equipment that has failed or that has a high risk of failure resulting in a service interruption. These projects have a very high probability of impacting Horizon Utilities' reliability targets.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

These projects address failed assets or assets with a high risk of imminent failure and as such, these assets are at the end of their useful life. The asset condition relative to their typical life cycle varies in each incident or outage.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

The number of customers impacted varies in each incident or outage.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

The quantitative customer impact varies in each incident or outage.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

These projects address customer satisfaction as they are required to address failed assets that have either caused a system interruption, or have a high probability of causing a service interruption.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each incident or outage.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

These projects are reactive in nature and address failed assets, or assets at risk of imminent failure. Investments must be performed when identified.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

Improvements to reliability and security are expected as secondary benefits to this project.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

Investment for this project address failed assets, or assets at risk of imminent failure. Investments are not subject to project prioritization as they are reactive and non-discretionary.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

Assets replaced reactively to replace failed assets, or assets at risk of imminent failure are performed on a like-for-like basis. No extra costs to address other distributor planning objectives are incurred with these projects.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2017 Hamilton Mountain XLPE Renewal
Budget Year	2017
Investment Category	System Renewal

Project Summary	This project involves the renewal of XLPE primary cable and underground distribution assets in the Hamilton Mountain operating area. The area between Upper Sherman and Upper Gage south of the Lincoln Alexander Parkway will be renewed in 2017 and in the Upper Ottawa and Rymal area as well as the replacement of underground infrastructure at various locations surrounding this area.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$6,606,889
Customer Contribution	$0
Capital Investment (net)	$6,606,889
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

The customer and load impacted by this project will vary depending upon the final scope of the project.

Project Dates (5.4.5.2.A.iii)

Start Date 2016/03/01

In Service Date 2016/11/30

Expenditure Timing

Q1	Q2	Q3	Q4
10%	40%	10%	40%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is part of a multi-year investment to renewal XLPE primary cable. The 2017 investment in the XLPE Renewal Program is $8,866,000.

Comparable gross investments for the XLPE Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 1,572,090
2014 (MIFRS) - $ 893,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2017 Hamilton Mountain XLPE Renewal	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
5 – Mandatory Project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year XLPE Renewal Program. Horizon Utilities considered the four replacement philosophies for addressing risk inherent in the XLPE asset group: Area; Reactive; Selected; and Refurbishment. The area replacement philosophy will be utilized for selected areas of the service territory where the asset health analysis and the failure history indicate a substantial risk of continued failures. A reactive replacement philosophy will continued to be used for the remaining areas of the service territory.

The area replacement philosophy will be employed for the Hamilton Mountain operating area due to the high volume of XLPE primary cable. The underground XLPE cable in this area comprises approximately 33% of the total installed XLPE and is the primary cause for 65% of the outages caused by failure of underground assets.

Safety (5.4.5.2.B.2)

These projects are not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name 2017 Hamilton Mountain XLPE Renewal Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

XLPE primary cable is the asset group with the largest investment requirement as identified by the Kinectrics ACA. The current backlog volume of XLPE primary cable requiring renewal cannot be addressed in a single year and requires a multiple year investment strategy. The optimal level of renewal for XLPE cable, based on a 40-year useful life replacement cycle, is 50km/year. Horizon Utilities' proposed investment for the 2015 to 2019 Test Years is $36,014,000, which provides for the replacement of 180km of cable over the 2015 to 2019 Test Years. This represents a managed, gradual increase in investment in order to balance rate payer concerns and practical operational limitations.

The Hamilton Mountain operating area has 225km of XLPE primary cable with a Health Index of either "very poor" or "poor". Due to the exponential nature of failures experienced as the 50+ year old cables experience material breakdown, the future cost of required investments will dramatically increase in the short term if they are not addressed in a systematic manner.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

An analysis of all service interruptions, caused by material or equipment failure from 2010 to 2013, revealed that 50% of service interruptions, measured by customer minutes of outage, were due to failures of underground cable and equipment. Over 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration. These durations far exceed Horizon Utilities' corporate target of one hour and nine minutes of outage on average per customer.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

Approximately 1000 customers will be impacted by this project.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

The quantitative customer impact varies for customers affected by this project.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets at risk of failure. Failure of XLPE primary cable results in extended service interruptions; 30% of these outages have exceeded four hours in duration, while 5% of these outages have exceeded twelve hours in duration.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

Proactive replacements are required because, as assets continue to age and degrade, the cable will fail at an exponential rate. In the worst case scenario, it will exceed Horizon Utilities' ability to keep pace with repairs. Reliability will also deteriorate to unacceptable levels. Reactive replacements will be considerably more costly than proactive renewal.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the XLPE primary cable, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the XLPE primary cable system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

Failure to invest in the proactive renewal of XLPE primary cable and associated underground assets would result in unacceptable levels of system failures and outages beyond Horizon Utilities' ability to resolve within a reasonable timeframe as these assets continue to age and degrade. Reactive replacements will also be considerably more costly than the forecast expenditure required to execute the proposed proactive replacement.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

XLPE renewal projects will include the elimination of radial underground feeds; replacement of below grade transformers with padmount transformers; and the introduction of fusing on the underground distribution systems where applicable.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	HI-F2 Renewal conversion to 2D7X
Budget Year	2017
Investment Category	System Renewal
Project Summary	This project involves the renewal of the Highland F2 feeder in the Dundas area and connecting the new assets to the existing 2D7X, 27.6kV feeder.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$657,602
Customer Contribution	$0
Capital Investment (net)	$657,602
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project impacts 100 customers and 300 kVA of transformation.

Project Dates (5.4.5.2.A.iii)

Start Date 2017/03/01

In Service Date 2017/10/31

Expenditure Timing

Q1	Q2	Q3	Q4
12.5%	37.5%	37.5%	12.5%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Highland substation as part of the 4kV and 8kV Renewal Program. The 2017 investment for the renewal of Highland substation is $658,000. The 2017 investment in the 4kV and 8kV Renewal Program is $15,764,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	HI-F2 Renewal conversion to 2D7X	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of the distribution assets at the current 4kV level was not a feasible alternative.

This project is one of multiple projects required to renew the service territory serviced by Highland substation.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name HI-F2 Renewal conversion to 2D7X Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The distribution assets in the Dundas operating area are in poor health and have significant operating constraints. The Dundas operating area also contains 25% of the 4kV XLPE cable. The 4kV XLPE cable is in poor health with 38% of the assets having a Health Index of either 'very poor' or 'poor'.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 100 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.003

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Highland substation is scheduled for renewal in 2015, 2016 and 2017.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Renewal of this area will allow for the decommissioning of the substation assets by 2017 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2017 Pole Residual Replacements
Budget Year	2017
Investment Category	System Renewal
Project Summary	This project involves the replacement of wood poles that are identified by pole residual testing as having a high risk of failure.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$1,297,407
Customer Contribution	$0
Capital Investment (net)	$1,297,407
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2017/01/01

In Service Date 2017/06/30

Expenditure Timing

Q1	Q2	Q3	Q4
50%	50%	0%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 1,326,407
2011 (CGAAP)- $ 895,000
2012 (MIFRS) - $ 930,000
2013 (MIFRS) - $ 718,074
2014 (MIFRS) - $ 1,190,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2017 Pole Residual Replacements	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (100%)

Secondary Driver (5.4.5.2.B.1.a)
N/A

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

The replacement of wood poles in this project is identified through Horizon Utilities' pole testing maintenance program. The pole testing categorized the poles requiring replacement into two categories: 1) requiring immediate replacement; and 2) requiring replacement within five years.

Horizon Utilities replaces poles requiring immediate replacement as soon as possible to mitigate the risk of service interruptions and the risk to public safety resulting from a failure of the pole.

Horizon Utilities replace poles requiring replacement within five years in the following year. Failure to replace in the following year compounds the volume of work in subsequent years resulting in cascading delays and compounded volumes in subsequent years.

Poles replaced in this project are replaced on a like-for-like basis where possible.

Safety (5.4.5.2.B.2)

This project will address wood poles requiring replacement as identified through testing. Renewal of these assets prior to failure avoids the potential risk to public safety that would result from a failure of a wood pole.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b) (where applicable)
This is not applicable to this project.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that its policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	2017 Pole Residual Replacements	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

This project is reactive in nature; the work required is initiated through Horizon Utilities' maintenance and inspection programs. This project has a very high probability of impacting Horizon Utilities' reliability targets if the poles are not replaced.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

This project addresses wood poles that have been identified as having a high risk of failure and as such, these assets are at the end of their useful life. The asset condition relative to their typical life cycle varies in case.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

The number of customers impacted varies in each incident or outage.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

The quantitative customer impact varies in each incident or outage.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

These projects address customer satisfaction as they are required to address assets at risk of failure which would result in a service interruption.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each incident or outage.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

These projects are reactive in nature and address assets at risk of failure. Horizon Utilities replaces poles requiring immediate replacement as soon as possible to mitigate the risk of service interruptions and the risk to public safety resulting from a failure of the pole.

Horizon Utilities replaces poles requiring replacement within five years in the following year. Failure to replace in the following year compounds the volume of work in subsequent years resulting in cascading delays and compounded volumes in subsequent years.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

This project will provide reliability and safety benefits as the project involves the replacement of wood poles that are at risk of failure. Failure of the asset would result in a service interruption and a potential risk to public safety.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

Poles replaced in this project are replaced on a like-for-like basis where possible as this presents the lowest cost option. No additional costs are incurred to address other distributor planning objectives.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2017 Load Break Disconnect Switch ("LBDS") Replacement
Budget Year	2017
Investment Category	System Renewal
Project Summary	This project involves the replacement of LBDS found to be either inoperable or beyond economic repair (where the cost of maintenance is not warranted) as found through Horizon Utilities' maintenance and inspection programs. Such switches will be replaced with automated switches where an operational benefit can be realized. This is a multi-year program based on 16 replacements per year.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$345,000
Customer Contribution	$0
Capital Investment (net)	$345,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2017/06/01

In Service Date 2017/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
0%	0%	50%	50%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 212,000
2014 (MIFRS) - $ 312,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2017 LBDS Replacement	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project involves the replacement of LBDS identified as requiring replacement through Horizon Utilities' maintenance and inspection programs. When feasible, the switches are refurbished rather than replaced. Where refurbishment is not possible, the switches will be replaced with an automated switch where an operational benefit can be realized.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Horizon Utilities utilizes the Smart Meter communication infrastructure when communicating with automated switches. Horizon Utilities' Smart Meter and related AMI network have been procured through Elster. Elster's system supports a multi-layered security approach including: access control, authorization, authentication and data integrity protocols. As part of its continuous improvement model, Horizon Utilities performs periodic security assessments to identify opportunities for enhanced system hardening.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

This is not applicable to this project.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name 2017 LBDS Replacement Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

LBDS are critical devices for the operation of the distribution system and are installed at key operating points (e.g. feeder tie points, feeder sectionalizing). Unplanned failures of these devices would impact Horizon Utilities' ability to restore power, resulting in extended outages.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

The asset condition of LBDS relative to their typical lifecycle varies from switch to switch depending upon the operational stresses experienced by the switch. LBDS that are identified for replacement are replaced because they would not operate properly when required and are beyond economical repair.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

None if project is planned.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

n/a

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

Failure of a LBDS to operate when required can impact Horizon Utilities' operational ability which can adversely affect the service experienced by customers.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each instance.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The timing of this project is dependent upon the timing of Horizon Utilities' LBDS maintenance program.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

Reliability can be adversely affected when an LBDS fails to operate when required as part of switching to restore service.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

LDBS are replaced with an automated switch where an operational benefit can be realized. Otherwise they are replaced on a like-for-like basis.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2017 Proactive Transformer Replacement
Budget Year	2017
Investment Category	System Renewal
Project Summary	This project was established to proactively replace distribution transformers as required. Renewal of distribution transformers in the past has either been reactive upon failure or proactive when included in the 4kV & 8KV Renewal or XLPE Primary Cable Renewal Programs. There are instances where proactive replacement of transformers is required even when the replacement is outside of the scope of the programs mentioned above. This is a multi-year project, based on 25 replacements per year

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$361,000
Customer Contribution	$0
Capital Investment (net)	$361,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2017/06/01

In Service Date 2017/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
0%	0%	50%	50%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv)

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 104,447
2012 (MIFRS) - $ 185,523
2013 (MIFRS) - $ 276,978
2014 (MIFRS) - $ 339,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2017 Proactive Transformer Replacement	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (100%)

Secondary Driver (5.4.5.2.B.1.a)
N/A

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

Proactive transformer replacements are identified through Horizon Utilities' visual inspection programs and PCB testing programs. Proactive replacement criteria include:

- Transformers that have visibly deteriorated and have a high risk of imminent failure;
- Obsolete Transformers that do not have replacement units in inventory and, in a reactive replacement scenario, the customer(s) may be subject to an extended outage duration;
- Transformers that have visible oil leaks; and
- Transformers that have been identified through testing as containing PCBs.

These criteria were selected due to the level of associated risk. Transformers with visible oil leaks or containing PCBs represent a significant environmental risk. All oil spills must be tracked, reported, and the oil reclaimed where possible. Obsolete transformers, where a replacement is not available in inventory, represent a risk of prolonged service interruption upon failure and are replaced to reduce the risk of outage to the customer.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

This is not applicable to this project.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name 2017 Proactive Transformer Replacement Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The transformers selected for proactive replacement represent a level of risk to Horizon Utilities and this project provides risk mitigation consistent with Horizon Utilities' asset management objectives.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

The asset condition of these transformers relative to their typical lifecycle varies from transformer to transformer. Transformers selected for replacement present a level of risk to Horizon Utilities either through imminent failure of the transformer or through the need to address environmental risk associated with PCBs; or through the risks associated with transformers that have visible oil leaks.

Number of Customers Impacted (5.4.5.2.C.b.i.3)
Varies depending on the project.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

n/a

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

These criteria were selected due to the level of associated risk. Transformers with visible oil leaks or containing PCBs represent a significant environmental risk. All oil spills must be tracked, reported, and the oil reclaimed where possible. Obsolete transformers, where a replacement is not available in inventory, represent a risk of prolonged service interruption upon failure and are replaced to reduce the risk of outage to the customer.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each instance.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

n/a

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

n/a.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

n/a.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2017 Substation Infrastructure Renewal
Budget Year	2017
Investment Category	System Renewal
Project Summary	This program involves the renewal of substation infrastructure throughout Horizon Utilities' service territory. Substation maintenance and inspection programs annually identify a number of required investments for the continued safe and reliable operation of Horizon Utilities' substations. Investments under this program include battery replacements, SCADA and communication upgrades, and grounding improvements .

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$482,000
Customer Contribution	$0
Capital Investment (net)	$482,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2017/01/01

In Service Date 2017/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 146,477
2011 (CGAAP)- $ 326,000
2012 (MIFRS) - $ 305,000
2013 (MIFRS) - $ 168,507
2014 (MIFRS) - $ 455,503

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2017 Substation Infrastructure Renewal	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This program is required for the ongoing safe and reliable operation of Horizon Utilities' municipal substations. The 4kV and 8kV Renewal Program is structured to decommission Horizon Utilities' 28 substations over the next 34 years. There is no investment in the renewal of the major electrical assets (power transformers, switchgear and breakers) forecasted for the 2015 to 2019 Test Years. The investments provided above are required to maintain the ancillary substation assets in safe working order. Substation investment requirements are identified though preventative maintenance programs performed on both routine maintenance cycles and monthly inspections. Safety related investments include installation of eye wash stations, end-of-life replacements of batteries and chargers for the emergency backup breaker operation circuits, and the replacement of end-of-life or obsolete station service transformers. These transformers are required to light and heat the substation and are the main source of power for the substation equipment. Miscellaneous investments include reactive replacement of relays, communication equipment and protection instrument transformers. Investments are required to address both electrical assets within the substation (e.g. replacement of switchgear components and instrument transformers), and ancillary equipment (e.g. SCADA, communication equipment, or backup batteries). All of these components are critical to the continued safe and reliable operation of the substation. A failure to undertake these required investments could lead to premature failure of substation components that would result in a service interruption and increased operating or reactive capital expenditure.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a.

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	2017 Substation Infrastructure Renewal	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

This project involves investment to replace substation infrastructure required for the continued safe and reliable operation of Horizon Utilities' substations.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

n/a

Number of Customers Impacted (5.4.5.2.C.b.i.3)

n/a.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

n/a

Value of Customer Impact (5.4.5.2.C.b.i.6)

Medium

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The timing of investments in this project is dependent upon the timing of substation maintenance programs and the infrastructure requiring renewal identified while performing maintenance.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on O&M expenditures.

Reliability and Safety Factors (5.4.5.2.C.b.iv)
n/a

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)
n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi).
The assets renewed in this program are replaced on a like-for-like basis.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2017 Rear Lot Conversion
Budget Year	2017
Investment Category	System Renewal

Project Summary	This project involves the replacement of rear lot overhead construction. Replacement options include relocating primary only, or relocating all assets to either overhead or underground in the front lot. Options are dependent on many factors (e.g. presence of trees and availability of room in the road allowance) and are assessed on a case by case basis. This project will involve the renewal of end of life rear lot overhead distribution assets serviced at 13.8kV and therefore not included in the 4kV and 8kV renewal programs.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$1,382,000
	Customer Contribution	$0
	Capital Investment (net)	$1,382,000
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	The customer and load impacted by this project will vary depending upon the final scope of the project.	
Project Dates (5.4.5.2.A.iii)	Start Date 2017/05/01 In Service Date 2017/09/30	

Expenditure Timing

Q1	Q2	Q3	Q4
0%	40%	60%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There are no equivalent projects for comparison.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name** 2017 Rear Lot Conversion Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (60%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (40%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Replacement options considered on a project by project basis include relocating primary only, or relocating all assets to either overhead or underground in the front lot. Options are dependent on many factors (e.g. presence of trees and availability of room in the road allowance).
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a.

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	2017 Rear Lot Conversion	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

Horizon Utilities has identified several residential areas serviced by a rear lot overhead distribution system. Horizon Utilities has experienced a dramatic increase in reliability issues surrounding rear lot distribution systems due to damaged caused from customer owned trees and lack of access for utility crews to repair or replace equipment. The poles are a mix of wood and concrete that, by design, are unsafe to scale to repair, and replacement of poles and equipment is labour intensive and requires specialized equipment access rear yards. Access is poor and therefore failure restoration time is significantly extended. These identified assets are nearing or beyond end of life and should be replaced. In the past several years, storm related failures in these areas have increased and with corresponding long outage durations (in excess of 24 hours).

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Overhead distribution assets located in rear lots typically do not perform as well as well as similar assets of similar age resulting in a shorter life cycle.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project will impact a varying number of customers depending upon the scope of the rear lot conversion.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

n/a

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will improve the service received by the customers impacted. Service interruptions of rear lot distribution systems involve longer restoration times due to the difficulty in accessing the assets. The service interruption restoration times will be reduced once the assets have been relocated.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

n/a

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will not have a material impact on system O&M costs in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

Reliability will be improved through the relocation of these assets through reduced service interruption restoration times. Safety will be improved due to improved and easier access to the assets and the ability to work on the assets from aerial bucket trucks versus having to manually climb poles when located in the rear lot.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

This project is required to remove rear lot assets and is specifically designed not to renew using a like-for-like methodology. Horizon Utilities will determine whether to relocate the primary only to the front lot or to relocate all plant to either underground and/or overhead front lot. The decision will be made on a project by project basis.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	ST-F2 & ST-F6 Renewal
Budget Year	2017
Investment Category	System Renewal
Project Summary	This project involves the renewal of the Strouds Substation F2 and F6 feeders in the Hamilton West operating area. This project is part of the 4kV and 8kV Renewal Program.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$1,787,341
Customer Contribution	$0
Capital Investment (net)	$1,787,341
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project impacts 973 customers and 3,300kVA of transformation

Project Dates (5.4.5.2.A.iii)

Start Date 2017/03/01

In Service Date 2017/10/31

Expenditure Timing

Q1	Q2	Q3	Q4
12.5%	37.5%	37.5%	12.5%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Strouds substation as part of the 4kV and 8kV Renewal Program. The 2017 investment for the renewal of Strouds substation is $1,787,000. The 2017 investment in the 4kV and 8kV Renewal Program is $15,764,000.

Comparable gross investments for the 4kV and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	ST-2 & ST-6 Renewal	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of the distribution assets at the current 4kV level was not a feasible alternative.

The renewal of the area serviced by the Strouds substation started in 2014 and is scheduled to be completed in 2018. Strouds substation was constructed in 1938. The switchgear at this substation is 44 years old and has a Health Index of 'very poor' as identified in the Substation Asset Condition Assessment ("SACA") and confirmed by the Kinectrics ACA.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name ST-2 & ST-6 Renewal Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The distribution assets in the Hamilton West operating area are in poor health and the switchgear in both substations servicing this area has switchgear with a 'very poor' Health Index.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 973 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.050

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by the Strouds substation is scheduled for 2014 to 2018. This project is required to be completed in 2017 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Kinectrics identified that both substations' switchgear had a high probability of failure within one to three years. Switchgear failure will result in the complete loss of the substation. A loss of both substations would result in an outage that would affect all 5,400 customers. These customers would be without power until the substation assets were repaired. Renewal of this area will allow for the decommissioning of the substation assets by 2018 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2017 Stoney Creek XLPE Renewal
Budget Year	2017
Investment Category	System Renewal

Project Summary	Renewal of end-of-life XLPE cable assets in the Stoney Creek area.		
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$500,000	
	Customer Contribution	$0	
	Capital Investment (net)	$500,000	
	O&M Expenditure	$0	
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	The customer and load impacted by this project will vary depending upon the final scope of the project		
Project Dates (5.4.5.2.A.iii)	Start Date	2017/03/01	
	In Service Date	2017/11/30	

Expenditure Timing

Q1	Q2	Q3	Q4
10%	40%	10%	40%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is part of a multi-year investment to renewal XLPE primary cable. The 2017 investment in the XLPE Renewal Program is $8,866,000.

Comparable gross investments for the XLPE Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 1,572,090
2014 (MIFRS) - $ 893,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2017 Stoney Creek XLPE Renewal	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
4 – Required Project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year XLPE Renewal Program. Horizon Utilities considered the four replacement philosophies for addressing risk inherent in the XLPE asset group: Area; Reactive; Selected; and Refurbishment. The area replacement philosophy for will be utilized for selected areas of the service territory where the asset health analysis and the failure history indicates a substantial risk of continued failures. A reactive replacement philosophy will continued to be used for the remaining areas of the service territory. The Stoney Creek operating area contains many small pockets of direct buried XLPE primary cable. The XLPE renewal projects in the Stoney Creek operating area will involve the full renewal of each pocket of XLPE cable. Project selection will be guided by asset health, operating history, and reliability of each of the underground pockets of XLPE.

Safety (5.4.5.2.B.2)

These projects are not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name 2017 Stoney Creek XLPE Renewal Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

XLPE primary cable is the asset group with the largest investment requirement as identified by the Kinectrics ACA. The current backlog volume of XLPE primary cable requiring renewal cannot be addressed in a single year and requires a multiple year investment strategy. The optimal level of renewal for XLPE cable, based on a 40-year useful life replacement cycle, is 50km/year. Horizon Utilities' proposed investment for the 2015 to 2019 Test Years is $36,014,000, which provides for the replacement of 180km of cable over the 2015 to 2019 Test Years. This represents a managed, gradual increase in investment in order to balance rate payer concerns and practical operational limitations

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

An analysis of all service interruptions, caused by material or equipment failure from 2010 to 2013, revealed that 50% of service interruptions, measured by customer minutes of outage, were due to failures of underground cable and equipment. Over 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration. These durations far exceed Horizon Utilities' corporate target of one hour and nine minutes of outage on average per customer.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

The number of customers impacted will vary depending upon the area

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets at risk of failure. Failure of XLPE primary cable results in extended service interruptions; 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

Proactive replacements are required because, as assets continue to age and degrade, the cable will fail at an exponential rate and in the worst case scenario overrunning Horizon Utilities' ability to keep pace with repairs. Reliability will also deteriorate to unacceptable levels. Reactive replacements will be considerably more costly than proactive renewal.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the XLPE primary cable, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the XLPE primary cable system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

Failure to invest in the proactive renewal of XLPE primary cable and associated underground assets would result in unacceptable levels of system failures and outages beyond Horizon Utilities' ability to resolve within a reasonable timeframe as these assets continue to age and degrade. Reactive replacements will also be considerably more costly than the forecast expenditure required to execute the proposed proactive replacement.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

XLPE renewal projects will include the elimination of radial underground feeds; the replacement of below grade transformers with padmount transformers; and the introduction of fusing on the underground distribution systems where applicable.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	WH-F6 - Ewen St
Budget Year	2017
Investment Category	System Renewal
Project Summary	The project involves the renewal of the Whitney substation F6 feeder in the West Hamilton operating area along Ewen St. This project is part of the 4kV and 8kV Renewal Program.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$1,508,763
Customer Contribution	$0
Capital Investment (net)	$1,508,763
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project impacts 234 customers and 850KVA of transformation

Project Dates (5.4.5.2.A.iii)

Start Date 2017/04/01

In Service Date 2017/11/30

Expenditure Timing

Q1	Q2	Q3	Q4
	37.5%	37.5%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Whitney substation as part of the 4kV and 8kV Renewal Program. The 2017 investment for the renewal of Whitney substation is $1,509,000. The 2017 investment in the 4kV and 8kV Renewal Program is $15,764,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	WH-F6 - Ewen St	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of these distribution assets at the current 4kV level was not a feasible alternative.

The renewal of the area serviced by the Whitney substation started in 2014 and is scheduled to be completed in 2018. Whitney substation was constructed in 1962. The switchgear at this substation is 46 years old and has a Health Index of 'very poor' as identified in Substation Asset Condition Assessment ("SACA") and confirmed by the Kinectrics ACA.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

n/a

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name WH-F6 - Ewen St Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The distribution assets in the Hamilton West operating area are in poor health and the switchgear in both substations servicing this area have switchgear with a 'very poor' Health Index.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 234 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.008

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

Renewal of assets at 4kV would not allow for the eventual decommissioning of Whitney Substation. Horizon Utilities' substation assets are being decommissioned over the life of the 4kV and 8kV Renewal Plan to avoid capital investment required for the renewal of substation assets that are nearing the end of their useful lives.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by the Whitney substation is schedule for 2014 to 2018. This project is required to be completed in 2017 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	GR-F2 Renewal – East of Vine Ave
Budget Year	2017
Investment Category	System Renewal
Project Summary	The project involves the renewal of the Grantham Substation feeder in the St. Catharines operating area on the Grantham F2 feeder specifically for portions East of Vine Ave. This project is part of the 4kV and 8kV Renewal Program.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$1,871,452
Customer Contribution	$0
Capital Investment (net)	$1,871,452
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project affects 737 customers and 2,000kVA of transformation.

Project Dates (5.4.5.2.A.iii)

Start Date 2017/03/01

In Service Date 2017/10/31

Expenditure Timing

Q1	Q2	Q3	Q4
12.5%	37.5%	37.5%	12.5%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Grantham substation as part of the 4kV and 8kV Renewal Program. The 2017 investment for the renewal of Grantham substation is $1,871,000. The 2017 investment in the 4kV and 8kV Renewal Program is $15,764,000.

Comparable gross investments for the 4kV and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	GR-F2 Renewal – East of Vine Ave	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of these distribution assets at the current 4kV level was not a feasible alternative.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a.

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name GR-F2 Renewal – East of Vine Ave Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The 4kV distribution assets and substations assets in the St. Catharines operating area are in poor health and require renewal. The overall substation Health Index for Vine, Welland and Grantham substations is 57%, 59%, 58% respectively. There is limited back-up between these substations. The loss of the Grantham or Vine substations would result in 900 and 1,100 customers respectively being without service for several days, at a minimum. The SAIDI for these customers is 28% higher than for the customers served by the 13.8kV system in St. Catharines and 100% higher than Horizon Utilities' corporate target.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project will impact 737 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.025

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by the Grantham substation is scheduled for 2015 to 2017.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. The overall substation Health Index for Vine, Welland and Grantham substations is 57%, 59%, 58%, respectively, as identified in the 4kV and 8kV Renewal Program included in Appendix F. There is limited back-up between these substations. The loss of the Grantham or Vine substations would result in 900 and 1,100 customers respectively being without service for several days, at a minimum. Restoration of power to these customers would require the costly and unplanned emergency construction of new distribution assets all the while customers are without service.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2017 St. Catharines XLPE Renewal
Budget Year	2017
Investment Category	System Renewal
Project Summary	Renewal of end-of-life XLPE cable assets in the St. Catharines operating area.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$1,758,558
Customer Contribution	$0
Capital Investment (net)	$1,758,558
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

The customer and load impacted by this project will vary depending upon the final scope of the project.

Project Dates (5.4.5.2.A.iii)

Start Date 2017/03/01

In Service Date 2017/11/30

Expenditure Timing

Q1	Q2	Q3	Q4
10%	40%	10%	40%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv)

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is part of a multi-year investment to renewal XLPE primary cable. The 2017 investment in the XLPE Renewal Program is $8,866,000.

Comparable gross investments for the XLPE Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:
2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 1,572,090
2014 (MIFRS) - $ 893,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)		
	Project Name 2017 St. Catharines XLPE Renewal	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 4 – Required Project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This project is part of the multi-year XLPE Renewal Program. Horizon Utilities considered the four replacement philosophies for addressing risk inherent in the XLPE asset group: Area; Reactive; Selected; and Refurbishment. The area replacement philosophy for will be utilized for selected areas of the service territory where the asset health analysis and the failure history indicates a substantial risk of continued failures. A reactive replacement philosophy will continued to be used for the remaining areas of the service territory. The St. Catharines operating area contains many small pockets of direct buried XLPE primary cable. The XLPE renewal projects in the St. Catharines operating area will involve the full renewal of each pocket of XLPE cable. Project selection will be guided by asset health, operating history, and reliability of each of the underground pockets of XLPE.	
	Safety (5.4.5.2.B.2) These projects are not intended to address safety concerns with the distribution system.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a	

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	2017 St. Catharines XLPE Renewal	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

XLPE primary cable is the asset group with the largest investment requirement as identified by the Kinectrics ACA. The current backlog volume of XLPE primary cable requiring renewal cannot be addressed in a single year and requires a multiple year investment strategy. The optimal level of renewal for XLPE cable, based on a 40-year useful life replacement cycle, is 50km/year. Horizon Utilities' proposed investment for the 2015 to 2019 Test Years is $36,014,000, which provides for the replacement of 180km of cable over the 2015 to 2019 Test Years. This represents a managed, gradual increase in investment in order to balance rate payer concerns and practical operational limitations

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

An analysis of all service interruptions, caused by material or equipment failure from 2010 to 2013, revealed that 50% of service interruptions, measured by customer minutes of outage, were due to failures of underground cable and equipment. Over 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration. These durations far exceed Horizon Utilities' corporate target of one hour and nine minutes of outage on average per customer.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

The number of customers impacted will vary depending upon the area.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets at risk of failure. Failure of XLPE primary cable results in extended service interruptions; 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

Proactive replacements are required because, as assets continue to age and degrade, the cable will fail at an exponential rate. In the worst case scenario, it will exceed Horizon Utilities' ability to keep pace with repairs. Reliability will also deteriorate to unacceptable levels. Reactive replacements will be considerably more costly than proactive renewal.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the XLPE primary cable, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the XLPE primary cable system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

Failure to invest in the proactive renewal of XLPE primary cable and associated underground assets would result in unacceptable levels of system failures and outages beyond Horizon Utilities' ability to resolve within a reasonable timeframe as these assets continue to age and degrade. Reactive replacements will also be considerably more costly than the forecast expenditure required to execute the proposed proactive replacement

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

XLPE renewal projects will include the elimination of radial underground feeds, replace below grade transformers with padmount transformers, and introduce fusing on the underground distribution systems where applicable.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	VE-F1 Renewal – North of Queenston St
Budget Year	2017
Investment Category	System Renewal

Project Summary	This project involves the renewal of the Vine substation F1 feeder in the St. Catharines operating area North of Queenston St.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$1,883,830
	Customer Contribution	$0
	Capital Investment (net)	$1,883,830
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project impacts approximately 430 customers and 1500kVA of transformation.	
Project Dates (5.4.5.2.A.iii)	Start Date 2017/05/01 In Service Date 2017/11/30	

Expenditure Timing

Q1	Q2	Q3	Q4
	30%	40%	30%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Vine substation as part of the 4kV and 8kV Renewal Program. The 2017 investment for the renewal of Vine substation is $5,645,000. The 2017 investment in the 4kV and 8kV Renewal Program is $15,764,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 to 2013 Historical Year and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	VE-F1 Renewal – North of Queenston St	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of this project at the current 4kV level was not a feasible alternative.

Safety (5.4.5.2.B.2)

These projects are not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name VE-F1 Renewal – North of Queenston St Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The 4kV distribution assets and substations assets in the St. Catharines operating area are in poor health and require renewal. The overall substation Health Index for Vine, Welland and Grantham substations is 57%, 59%, 58% respectively. There is limited back-up between these substations. The loss of the Grantham or Vine substations would result in 900 and 1,100 customers respectively being without service for several days, at a minimum. The SAIDI for these customers is 28% higher than for the customers served by the 13.8kV system in St. Catharines and 100% higher than Horizon Utilities' corporate target.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 430 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.015

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Vine substation is scheduled for 2015 to 2017.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	VE-F3 Renewal
Budget Year	2017
Investment Category	System Renewal

Project Summary	This project involves the renewal of the Vine Substation F3 feeder in the St. Catharines operating area North of Queenston St.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$1,624,436
	Customer Contribution	$0
	Capital Investment (net)	$1,624,436
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project impacts approximately 470 customers and 2000kVA of transformation.	
Project Dates (5.4.5.2.A.iii)	Start Date 2017/03/01 In Service Date 2017/09/30	

Expenditure Timing

Q1	Q2	Q3	Q4
15%	45%	40%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Vine substation as part of the 4kV and 8kV Renewal Program. The 2017 investment for the renewal of Vine substation is $5,645,000. The 2017 investment in the 4kV and 8kV Renewal Program is $15,764,000.

Comparable gross investments for the 4kV and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	VE-F3 Renewal	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of these distribution assets at the current 4kV level was not a feasible alternative.

Safety (5.4.5.2.B.2)

These projects are not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

n/a

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name VE-F3 Renewal Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The 4kV distribution assets and substations assets in the St. Catharines operating area are in poor health and require renewal. The overall substation Health Index for Vine, Welland and Grantham substations is 57%, 59%, 58% respectively. There is limited back-up between these substations. The loss of the Grantham or Vine substations would result in 900 and 1,100 customers respectively being without service for several days, at a minimum. The SAIDI for these customers is 28% higher than for the customers served by the 13.8kV system in St. Catharines and 100% higher than Horizon Utilities' corporate target.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts approximately 470 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.073

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Vine substation is scheduled for 2015 to 2017.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	VE-F4 Renewal – Welland Ave and North St
Budget Year	2017
Investment Category	System Renewal

Project Summary	This project involves the renewal of the Vine Substation F4 feeder in the St. Catharines operating area north of Welland Ave.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$2,136,914
	Customer Contribution	$0
	Capital Investment (net)	$2,136,914
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project impacts approximately 600 customers and 2000kVA of transformation.	
Project Dates (5.4.5.2.A.iii)	Start Date 2017/04/01 In Service Date 2017/10/31	

Expenditure Timing

Q1	Q2	Q3	Q4
10%	45%	45%	10%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Vine substation as part of the 4kV and 8kV Renewal Plan. The 2017 investment for the renewal of Vine substation is $5,645,000. The 2017 investment in the 4kV and 8kV Renewal Program is $15,764,000.

Comparable gross investments for the 4kV and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	VE-F4 Renewal – Welland Ave and North St	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of the distribution assets at the current 4kV level was not a feasible alternative.

Safety (5.4.5.2.B.2)

These projects are not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

n/a

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name VE-F4 Renewal – Welland Ave and North St Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The 4kV distribution assets and substations assets in the St. Catharines operating area are in poor health and require renewal. The overall substation Health Index for Vine, Welland and Grantham substations is 57%, 59%, 58% respectively. There is limited back-up between these substations. The loss of the Grantham or Vine substations would result in 900 and 1,100 customers respectively being without service for several days, at a minimum. The SAIDI for these customers is 28% higher than for the customers served by the 13.8kV system in St. Catharines and 100% higher than Horizon Utilities' corporate target.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts approximately 600 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.022

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Vine substation is scheduled for 2015 to 2017.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	Duct Structure – Elgin TS to King St
Budget Year	2017
Investment Category	System Service
Project Summary	This project is involves the addition of civil capacity to support the renewal of the 4kV in this area and to address general load growth in the Hamilton downtown operating area.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$535,135
Customer Contribution	$0
Capital Investment (net)	$535,135
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2017/05/01

In Service Date 2017/09/30

Expenditure Timing

Q1	Q2	Q3	Q4
0%	40%	60%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There are no equivalent projects for comparison.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)		
	Project Name	Duct Structure – Elgin TS to King St Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Service (60%) **Secondary Driver (5.4.5.2.B.1.a)** System Renewal (40%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) No feasible alternatives exist to provide this civil capacity. Construction of an overhead solution in this area of the downtown core would not be possible.	
	Safety (5.4.5.2.B.2) These projects are not intended to address safety concerns with the distribution system.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a	

System Service Specific Requirements (5.4.5.2.C.c)

Project Name	Duct Structure – Elgin TS to King St	Table 3

System Service Specific Requirements (5.4.5.2.C.c)

Benefit to Customers (5.4.5.2.C.c.i)

This project will enable additional redundancy and connections between stations will provide Horizon Utilities with additional operational contingencies to address service interruptions.

Regional Planning Requirements (5.4.5.2.C.c.i)

This project is not related or impacted by regional planning requirements.

Integration of Advance Technology (5.4.5.2.C.c.iii)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

System Benefits to Reliability, Efficiency and Safety (5.4.5.2.C.c.iv)

n/a

Factors Affecting Implementing Timing/Priority (5.4.5.2.C.c.v)

n/a

Summary of Options Analysis (5.4.5.2.C.c.vi)

n/a

2017 General Plant Investments

Capital Project Summary

Project Name	2017 Annual Corporate Computer Replacement
Budget Year	2017
Investment Category	General Plant
Project Summary	This project is part of an ongoing business requirement to refresh end user computers. Horizon Utilities utilizes a three-year lifecycle for replacement of end user computers. On an annual basis, approximately one third of all Horizon Utilities' computers (~150 PCs/year) are replaced.

Capital Investment (5.4.5.2.A.i)		
	Capital Investment (gross)	$353,200
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)	n/a

Project Dates (5.4.5.2.A.iii)				
	Start Date	Jan. 2017		
	In Service Date	Dec. 2017		
	Expenditure Timing			
	Q1	Q2	Q3	Q4
	25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Schedule - Implementation is phased throughout the year starting in January and ending in December based on age of PCs being replaced.

Risk – The primary risk to this project is product availability from suppliers.

Risk Mitigation – Work closely with suppliers to schedule orders based on required delivery times.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the annual corporate computer replacement for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 336,000
2011 (CGAAP)- $ 227,000
2012 (MIFRS) - $ 312,000
2013 (MIFRS) - $ 364,947
2014 (MIFRS) - $ 366,200

Total Capital and OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

	Leave to Construct Approval (5.4.5.2.A.vii) n/a
Evaluation Criteria and Information	**Project Name** 2017 Annual Corporate Computer Replacement Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant (100%) **Secondary Driver (5.4.5.2.B.1.a)** n/a **Investment Priority (5.4.5.2.B.1.b)** High Priority – Personal computers are treated as a strategic asset. They are Horizon Utilities' primary staff productivity tool. They are used to: maintain and deliver services to customers; improve staff productivity; cost-effectively manage total cost of PC ownership; and support investments in new applications, infrastructure and business capabilities
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) n/a
	Safety (5.4.5.2.B.2) n/a
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Suppliers of enterprise systems such as: GIS; OMS; SCADA; AMI; and IFS ERP are constantly upgrading their products to deliver new processes and functionality. As new versions are released, up-to-date hardware is required in order to perform necessary upgrades to maintain vendor support for the systems.
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

General Plant Specific Requirements

Project Name	2017 Annual Corporate Computer Replacement	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

n/a

Business Case Justification Documentation (5.4.5.2.C.d.i)

Horizon Utilities' PCs are treated as a strategic asset, because they are the primary staff productivity tool. Horizon Utilities has streamlined its PC lifecycle management processes utilizing a PC refresh cycle of three years, in order to: deliver, maintain and improve services to customers; to improve staff productivity; to cost-effectively manage total cost of PC ownership; and to support investments in new applications, infrastructure and business capabilities.

A three-year PC refresh cycle reduces the total cost of ownership by reducing the number of models of PCs supported, which results in the reduction of the IST service desk effort required to deploy, secure, and manage new systems and applications. The reduction in the number of supported models has allowed Horizon Utilities to introduce mobile computing for remote field workers and to increase the number of supported PCs by over 100 devices since 2011, without an increase in IST service desk support staff.

A refresh lifecycle of three years reduces the likelihood of device failures that lead to a loss of staff productivity and increased IT support effort. Over 50% of Horizon Utilities' staff utilizes a mobile PC (laptop or tablet) in the performance of their daily activities, many in harsh operating environments outside the office, which increases the likelihood of failure due to operating environment and the age of the device.

Horizon Utilities has introduced several new enterprise business and engineering systems to: mitigate business risks related to aging systems (e.g. GIS); improve electricity system operation (i.e. GIS, OMS); and to address end of vendor support for systems (i.e. IFS ERP, Microsoft Windows XP). Maintaining a three-year PC lifecycle refresh program allows Horizon Utilities' to migrate to these applications without a need to make large one-time investments in PCs to meet the minimum operating requirements of new applications.

PCs are the primary productivity tool used by Horizon Utilities' staff. Unreliable and slow PCs impact productivity and customer service.

Minimizing the number of supported models reduces the IST support effort required to manage, order, configure, and deploy PCs and it reduces the total cost of ownership for PCs.

Capital Project Summary

Project Name	2017 John Street Windows Replacement
Budget Year	2017
Investment Category	General Plant

Project Summary;

This project is scheduled to take place between 2015 to 2017 to replace the existing windows of the John Street building as they have reached the end-of-lie with the objective to:

- Improve energy performance as the they are no longer weather resistant;
- Prevent further damage to interior walls and facilities related components;
- Prevent further damage to the building exterior structure;
- Prevent damage to operational systems; and
- Reduce operational related costs.

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$200,000
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a
Customer Attachments / Load (5.4.5.2.A.ii)	n/a	
Project Dates (5.4.5.2.A.iii)	Start Date	March 2017
	In Service Date	December 2017

Expenditure Timing			
Q1	Q2	Q1	Q2
10%	30%	30%	30%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Project timelines and costs exceeding the budget are risks. The project manager will report regularly on project timelines and adherence to budget and escalates issues for resolution.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

n/a.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)

n/a

Evaluation Criteria and Information	**Project Name:** 2017 John Street Windows Replacement Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant – 100% **Secondary Driver (5.4.5.2.B.1.a)** n/a **Investment Priority (5.4.5.2.B.1.b)** High
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Horizon Utilities engaged the MMM Group Limited in 2013 to conduct a condition assessment using visual inspections, air leakage testing and building energy simulations air test. Recommendations are based on the results of the tests and inspections.
	Safety (5.4.5.2.B.2) n/a
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) N/A
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** n/a
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a **Environmental Benefits** (5.4.5.2.B.6) **(where applicable)** n/a

General Plant Specific Requirements

Project Name	2017 John Street Windows Replacement	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

Horizon Utilities engaged the MMM Group Limited in 2013 to conduct a condition assessment using visual inspections, air leakage testing and building energy simulations air test. Recommendations are based on the results of the tests and inspections.

Business Case Justification Documentation (5.4.5.2.C.d.i)
The windows are no longer weather resistant or energy efficient and allow cold drafts to enter the building. The windows collect frost on the inside in the winter which melts and damages interior walls and carpeting. The assessment was conducted using visual inspections, air leakage testing and building energy simulations. The testing concluded that the condition of the operable windows in the John Street office building is poor. The windows, installed in 1994, have reached end-of-life and require replacement in order to reduce energy costs and to maintain the comfort of the employees from a climate and noise perspective. Weather stripping was determined to be insufficient as identified through air leakage tests.

Capital Project Summary

Project Name	2017 Vehicle Replacement
Budget Year	2017
Investment Category	General Plant

Project Summary;

Horizon Utilities has identified a number of current vehicles that will require replacement as they have reached end-of-life as per the criteria within Horizon Utilities' Fleet Replacement Plan.

Other expected objectives and outcomes are to:

- Maintain vehicle reliability and availability;
- Reduce fuel consumption;
- Reduce emissions;
- Reduce down time required to conduct maintenance and repairs; and
- Maintain customer response time.

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$775,000
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)

Project Dates (5.4.5.2.A.iii)

Start Date March 2017

In Service Date December 2017

Expenditure Timing

Q1	Q2	Q3	Q4
0%	0%	50%	50%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Risk – The primary risk to this project is product availability and adherence to delivery schedules from suppliers.
Risk Mitigation – Work closely with suppliers to schedule orders based on required delivery times.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for vehicle replacements for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 1,590,516
2011 (CGAAP)- $ 1,033,975
2012 (MIFRS) - $ 1,057,410
2013 (MIFRS) - $ 36,365
2014 (MIFRS) - $ 785,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)
n/a

Evaluation Criteria and Information

Project Name: 2017 Vehicle Replacement	Table 2
Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver** (5.4.5.2.B.1.a) General Plant – 100% **Secondary Driver (5.4.5.2.B.1.a)** n/a	
Investment Priority (5.4.5.2.B.1.b) High	
Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) n/a	
Safety (5.4.5.2.B.2) n/a	
Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a	
Co-ordination and Interoperability (5.4.5.2.B.4)	

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

n/a

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

n/a

Economic Development (5.4.5.2.B.5) **(where applicable)**

n/a

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

General Plant Specific Requirements

Project Name	2017 Vehicle Replacement	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

Horizon Utilities uses the data collected from electronic fleet and fuel management system, the Global Positional System ("GPS") data which includes engine hours, power take-off ("PTO"), engine idling hours, traffic patterns, utilization, and mileage to determine the optimal maintenance scheduling and vehicle maintenance and repairs activities to determine maintenance schedules and vehicles replacements..

Business Case Justification Documentation (5.4.5.2.C.d.i)

To maintain the quality, reliability and availability of Horizon Utilities' vehicle fleet to Construction and Maintenance, Metering Services and corporate group activities, vehicles are assessed annually based on a replacement criteria matrix defined within the Fleet Replacement Plan.

Replacement strategies also ensure that Horizon Utilities maintains safe vehicles for employees, while targeting reduced emissions, as well as reduced fuel, operating and maintenance costs. Horizon Utilities will not be procuring any net new vehicles over the 2014-2019 period and instead will focus on the replacement of end of life vehicles.

Due to budget mitigation efforts in 2011, 2012, and 2013, a number of vehicles scheduled for replacement were kept in operation and rescheduled for replacement in 2014. It is now critical that these vehicles be replaced as maintenance and repairs costs have increased and the vehicles no longer operate at full capacity, reducing vehicle availability and impacting service delivery.

Regular vehicle replacement is necessary to avoid undue vehicle down time and associated negative impacts to customer response time and employee productivity.

Capital Project Summary

Project Name	2017 Tools, Shop and Garage Equipment
Budget Year	2017
Investment Category	General Plant

Project Summary
This program includes capital expenditures pertaining to the replacement of tools, shop and garage equipment, which are either worn, have come to the end of their useful life, or the continued use of such creates health and safety risk

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$508,600
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	$0
Customer Attachments / Load (5.4.5.2.A.ii)	n/a	
Project Dates (5.4.5.2.A.iii)	Start Date	January 2017
	In Service Date	December 2017

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Risk – n/a

Risk Mitigation – n/a

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

n/a

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)

n/a

Evaluation Criteria and Information	
	Project Name: 2017 Tools, Shop and Garage Equipment Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant (100%) **Secondary Driver (5.4.5.2.B.1.a)** n/a
	Investment Priority (5.4.5.2.B.1.b) High **Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)** Tools and equipment over $5000 are procured through a competitive process and alternatives are considered at the time of requisition.
	Safety (5.4.5.2.B.2) Tools and equipment meet CSA requirements and are reviewed for conformance to requirements by Horizon Utilities' Tool & Equipment Committee.
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) N/A
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** n/a
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

General Plant Specific Requirements

Project Name	2017 Tools, Shop and Garage Equipment	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

Each year a condition assessment is conducted on the inventory of tools and equipment in use, to determine a forecast for expected replacements. Feedback from the crews that use the tools and equipment, together with feedback from the Fleet Mechanics who maintain the tools and equipment on each vehicle, is used to establish the annual budgets. It becomes unsafe, costly and inefficient to use or maintain this type of equipment which has reached the end of its useful life.

New tools become available on the market, on a periodic basis, that offer improved safety, ergonomics and productivity features which Horizon Utilities evaluates for use. Changes in regulations, which require a different standard of equipment, may necessitate a replacement of tools and equipment. Fall arrest equipment for example, needs to be exchanged when new standards come into effect, and any required new equipment is included in the budget.

Business Case Justification Documentation (5.4.5.2.C.d.i)

n/a

Capital Project Summary

Project Name	2017 Building Renovations – John St
Budget Year	2017
Investment Category	General Plant

Project Summary

This project involves the renovation of the sixth floor of the John Street building. This floor is virtually unchanged from its time of construction in the 1960s, with limited updates approximately twelve years ago. Renovations will also include removal of all existing walls, the remediation of hazard materials and expansion of the floor foot print to current space requirements.

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$2,200,000
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)	n/a
Project Dates (5.4.5.2.A.iii)	Start Date: April 2017 In Service Date: December 2017

Expenditure Timing

Q1	Q2	Q3	Q4
0%	30%	30%	40%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Project timelines and costs exceeding the budget are risks. The project manager will report regularly on project timelines and adherence to budget and escalates issues for resolution.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for building renovations for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 1,767,000
2013 (MIFRS) - $ 5,490,000
2014 (MIFRS) - $ 3,700,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)

N/A

Evaluation Criteria and Information	**Project Name:** 2017 Building Renovations – John St Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant – 100% **Secondary Driver (5.4.5.2.B.1.a)** n/a **Investment Priority (5.4.5.2.B.1.b)** High
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Horizon Utilities' building renovation plans were developed through a facilities planning process that utilized the outputs of a space planning study and multiple building assessments
	Safety (5.4.5.2.B.2) n/a
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** n/a
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

General Plant Specific Requirements

Project Name	John St 6th Floor Building Renovation Project	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

n/a

Business Case Justification Documentation (5.4.5.2.C.d.i)

One project is planned for 2017 to address congested office spaces at Head Office by renovating the sixth floor which is largely original to the 1960s building.

The office space study conducted in 2010 concluded that additional space for corporate offices, corporate business units, and meeting spaces was required on the 6th floor of the John St. building. To help provide that space, Horizon Utilities reclaimed part of the 6th floor from the City of Hamilton Water Division. This space has been used, and will continue to used, as "swing space" to support building renovation and renewals projects from 2012 to 2016. On completion of the 2012-2016 projects, the swing space will be renovated to provide the much needed office and meeting space, remediate hazardous materials, improve airflow, and reduce energy and water consumption.

The renovation of the sixth floor, which presently hosts certain members of the Executive Management Team and includes temporary swing space for re-located departments as renovation projects occur, will include:

- the creation of additional office space to address organizational congestion
- the installation of HVAC and fire and life safety systems that are at end-of-life
- the anticipated disposal of hazardous materials including asbestos and mould
- The creation of necessary meeting room space.

2018 System Access Investments

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2018 Meters		
Budget Year	2018		
Investment Category	System Access		
Capital Investment (5.4.5.2.A.i)	Capital Investment	$ 2,063,000	
	Total	$ 2,063,000	
	O&M Expenditure	$0	
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	n/a		
Project Dates (5.4.5.2.A.iii)	Start Date 2018/01/01		
	In Service Date 2018/12/31		

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Metering investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP) - $1,715,716
2011 (CGAAP)- $3,467,413
2012 (MIFRS) - $25,168,043
2013 (MIFRS) - $1,658,707
2014 (MIFRS) - $2,499,104

The increased investment in 2012 was due to the implementation of Smart Meters at a cumulative capital cost of $23,277,588. Horizon Utilities substantially completed its mass deployment of Smart Meters in 2009 and, as at the end of 2011, had installed Smart Meters for 229,322 customers or 98.0% of all metering points.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and as such no associated OM&A costs related to REG will be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

n/a

Evaluation Criteria and Information (5.4.5.2.B)		
	Project Name 2018 Meters	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Access (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Renewal (20%) Replacement of commercial meters with Smart Meters. **Investment Priority (5.4.5.2.B.1.b)** 5 – Mandatory Project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Metering asset management is governed by Measurement Canada regulation and customer requirements for new and upgraded services.	
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Horizon Utilities' Smart Meter and related AMI network have been procured through Elster. Elster's system supports a multi-layered security approach including: access control, authorization, authentication and data integrity protocols. As part of its continuous improvement model, Horizon Utilities performs periodic security assessments to identify opportunities for enhanced system hardening.	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** The Smart Meter infrastructure supports the provinces' conservation culture. Smart metering also provides environmental benefits through reduction in field visits associated with manual meter reading.	

System Access Specific Requirements (5.4.5.2.C.a)

Project Name	2018 Meters	Table 3

System Access Specific Requirements (5.4.5.2.C.a)

Factors Affecting Implementing Project Timing/Priority (5.4.5.2.C.a.i)
Compliance sampling work completed to comply with Measurement Canada regulations. The schedule is created to smooth the annual sampling requirements from the original Smart Meter mass deployments.

New and replacement metering is provided on demand to address new load growth and meter failures.

Factors Related to Customer Preference or 3rd Party Input (5.4.5.2.C.a.ii)

Metering for new and upgraded connection projects are customer initiated and are designed to meet customer identified requirements.

Factors Affecting Final Project Cost (5.4.5.2.C.a.iii)
Please refer to Note I for an explanation on the factors affecting the final project cost.

Controllable Cost Minimization (5.4.5.2.C.a.iv)

Please refer to Note I for an explanation regarding controllable cost mitigation.

Other Planning Objectives (5.4.5.2.C.a.v)

Horizon Utilities combines work from multiple work groups to reduce costs and increase efficiency. The line work and meter work is combined when connecting new customers to allow the work to be completed by a single work group.

Assessment of Technical or Implementation Options (5.4.5.2.C.a.vi)

Metering work is Measurement Canada and customer driven and the technology is primarily based on the metering products available from a sole source supplier.

Summary of Options Analysis (5.4.5.2.C.a.vii)

Metering supplier selected as part of the smart meter implementation program.

Final Economic Evaluation Results (5.4.5.2.C.a.viii)

n/a

Identification of System Impacts (5.4.5.2.C.a.ix)

System expansion, if required, to connect customers within this category are governed by Horizon Utilities' Conditions of Service Section 2.1.2.1.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2018 Road Relocations
Budget Year	2018
Investment Category	System Access

Project Description	Projects in this category include all projects required for the relocation of system plant for roadway reconstruction work. Horizon Utilities follows the *Public Service Works on Highway Act*, 1990 and associated regulations governing the recovery of costs related to road reconstruction work by collecting contributed capital for 50% of labour and labour saving devices.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$2,682,499
	Customer Contribution	$904,360
	Capital Investment (net)	$1,778,139
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	n/a	
Project Dates (5.4.5.2.A.iii)	Start Date	Various – driven by road authority schedules
	In Service Date	Various – driven by road authority schedules

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Road relocations for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP) - $ 2,889,575
2011 (CGAAP)- $ 895,524
2012 (MIFRS) - $ 3,151,887
2013 (MIFRS) - $ 340,491
2014 (MIFRS) - $ 977,024

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	
	Project Name 2018 Road Relocations Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Access (90%) **Secondary Driver (5.4.5.2.B.1.a)** System Renewal (5%) System Service (5%) **Investment Priority (5.4.5.2.B.1.b)** 5 – Mandatory Project
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Horizon Utilities co-ordinates project design and discusses design alternatives for each project with the organization (City, Municipality, Ministry of Transportation) originating the request to relocate distribution assets.
	Safety (5.4.5.2.B.2) These projects are not intended to address safety concerns with the distribution system.
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Timelines for the execution of these projects are dictated by the City of Hamilton, City of St. Catharines, the Ministry of Transportation or the Region of Niagara. Horizon Utilities coordinates work with these stakeholders, wherever possible, on the road relocations with planned distribution projects. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

System Access Specific Requirements (5.4.5.2.C.a)

Project Name	2018 Road Relocations	Table 3

System Access Specific Requirements (5.4.5.2.C.a)

Factors Affecting Implementing Project Timing/Priority (5.4.5.2.C.a.i)

The road authority's schedule and timing of the road project will affect Horizon Utilities' project implementation and timing.

Factors Related to Customer Preference or 3rd Party Input (5.4.5.2.C.a.ii)

Road relocation projects involve a co-ordinated design process and the initiating organization (City, Municipality, or Ministry of Transportation) has input into the design of the project.
The designs for all projects within the public right-of-way are reviewed with the City as Municipal Consents are required prior to construction. Consideration is given by the road authority to coordinate all utilities within the right-of-way in the least disruptive manner.

Factors Affecting Final Project Cost (5.4.5.2.C.a.iii)

Please refer to Note I for an explanation on the factors that can affect the final project cost.

Controllable Cost Minimization (5.4.5.2.C.a.iv)

50% of the labour, labour saving devices and equipment rentals are recovered from the road authority.

Please refer to Note I for an explanation on controllable cost minimization.

Other Planning Objectives (5.4.5.2.C.a.v)

Horizon Utilities combines work to reduce overall costs and increase efficiency. The most common opportunity is during city road relocation projects where a new water main is being installed. Horizon Utilities may be able to take advantage of the fact that installing duct structure is less costly since the road is already excavated. Horizon Utilities may also be able to change the schedule of a renewal project to align with the road authority's work to maximize these benefits. The costs of these additional works are allocated to either system service or system renewal where applicable. Horizon Utilities can maximize the amount of work that can be completed at the lowest cost to benefit ratepayers in these cases.

Assessment of Technical or Implementation Options (5.4.5.2.C.a.vi)

Horizon Utilities co-ordinates project design and discusses design alternatives for each project with the road authority (City, Municipality, Ministry of Transportation) originating the request to relocate distribution assets.

Summary of Options Analysis (5.4.5.2.C.a.vii)

Horizon Utilities reviews proposed design with municipalities and the Ministry of Transportation, as applicable, in an effort to determine the most cost effective solution.

Final Economic Evaluation Results (5.4.5.2.C.a.viii)

This is not applicable to road relocations projects.

Identification of System Impacts (5.4.5.2.C.a.ix)

Horizon Utilities follows the *Public Service Works on Highways Act*, 1990 and associated regulations governing the recovery of costs related to road reconstruction work by collecting contributed capital for 50% of the labour; labour saving devices, and equipment rentals. Capital contributions toward the cost of all customer demand projects are collected by Horizon Utilities in accordance with the DSC and the provisions of its Conditions of Service.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2018 Customer Connections
Budget Year	2018
Investment Category	System Access

Project Summary	Projects in this category include multiple projects required to connect, upgrade, or disconnect customers to the distribution system. Horizon Utilities' obligation to connect new customers is governed by the *Electricity Act, 1998, Schedule 28.*		
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$5,046,586	
	Customer Contribution	$796,297	
	Capital Investment (net)	$4,250,288	
	O&M Expenditure	$0	
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	Horizon Utilities completes approximately 1800 connections annually; 1500 through subdivisions and 300 customer projects, contributing approximately 25MVA in system load growth.		
Project Dates (5.4.5.2.A.iii)	Start Date	Various – as driven by the customer	
	In Service Date	Various – as driven by the customer	

Expenditure Timing			
Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable investments, net of capital contributions, for the 2010 and 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 1,023,336
2011 (CGAAP)- $ 2,030,541
2012 (MIFRS) - $ 1,652,000
2013 (MIFRS) - $ 3,541,455
2014 (MIFRS) - $ 4,063,471

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)
This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

	Leave to Construct Approval (5.4.5.2.A.vii) This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name**	2018 Customer Connections	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Access (100%) **Secondary Driver (5.4.5.2.B.1.a)** N/A **Investment Priority (5.4.5.2.B.1.b)** 5 – Mandatory Project		
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Customer connection projects are driven by customer requests and the customer's specific technical requirements. To build efficiencies into the process, Horizon Utilities utilizes a set of design standards that have been engineered and approved. Customer connections requests are fulfilled consistent with Horizon Utilities' Conditions of Service, designed to meet the customer requirements and maintain system reliability.		
	Safety (5.4.5.2.B.2) These projects are not intended to address safety concerns with the distribution system.		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.		
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** This is not applicable for these projects.		
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.		

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Access Specific Requirements (5.4.5.2.C.a)

Project Name 2018 Customer Connections Table 3

System Access Specific Requirements (5.4.5.2.C.a)

Factors Affecting Implementing Project Timing/Priority (5.4.5.2.C.a.i)

Schedule of work based on customer expectations; customer request may not be standard design.

Factors Related to Customer Preference or 3rd Party Input (5.4.5.2.C.a.ii)

There projects are customer initiated and are designed to meet customer identified requirements.

Factors Affecting Final Project Cost (5.4.5.2.C.a.iii)

Please refer to Note I for an explanation on the factors affecting final project cost.

Controllable Cost Minimization (5.4.5.2.C.a.iv)

Please refer to Note I for an explanation on the factors affecting controllable cost.

Other Planning Objectives (5.4.5.2.C.a.v)

n/a

Assessment of Technical or Implementation Options (5.4.5.2.C.a.vi)

Please refer to Note III for information on the technical and implementation options.

Summary of Options Analysis (5.4.5.2.C.a.vii)

Please refer to Note III for information on the technical and implementation options.

Final Economic Evaluation Results (5.4.5.2.C.a.viii)

Horizon Utilities completes the economic evaluation for any customer system access project which requires the construction of new facilities to the main distribution system or an increase in the existing capacity of distribution facilities. For further details please see Appendix E of Horizon Utilities' Conditions of Service. The economic evaluation is completed in accordance with section 3.2 of the Distribution System Code ("DSC"). For the 2015-2019 forecast period Horizon Utilities has no known projects for which to provide the final economic evaluation. When a road authority requests a relocation of Horizon Utilities' plant located on the public road allowance, the costs shall be shared, as outlined in the Ontario *Public Service Works on Highways Act*. Other projects within this category will have an economic evaluation completed where applicable in accordance with both the DSC and Appendix E of Horizon Utilities' Conditions of Service.

Identification of System Impacts (5.4.5.2.C.a.ix)

System expansion, if required, to connect customers within this category is governed by Horizon Utilities' Conditions of Service Section 2.1.2.1.

2018 System Renewal Investments

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	AB-F2 & AB-F4 Renewal – Aberdeen East
Budget Year	2018
Investment Category	System Renewal

Project Summary	This project involves the renewal of the Aberdeen substation F2 & F4 feeders in central Hamilton along Aberdeen Rd East.		
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$2,643,203	
	Customer Contribution	$0	
	Capital Investment (net)	$2,643,203	
	O&M Expenditure	$0	
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This customer impacts approximately 2,600 customers and 5000kVA of transformation.		

Project Dates (5.4.5.2.A.iii)

Start Date 2018/01/01

In Service Date 2018/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Aberdeen substation as part of the 4kV and 8kV Renewal Program. The 2018 investment for the renewal of Aberdeen substation is $2,643,000. The 2018 investment in the 4kV and 8kV Renewal Program is $15,684,000.

Comparable gross investments for the 4kV and 8kV Renewal Program for the 2010 and 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	AB-F2 & AB-F4 Renewal – Aberdeen East	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. It is necessary to renew both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of these distribution assets at the current 4kV level was not a feasible alternative.

The renewal of the area serviced by Aberdeen substation started in 2017 and is scheduled to be completed in 2021.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name AB-F2 & AB-F4 Renewal – Aberdeen East Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The two substations servicing the downtown Hamilton operating area service a total of 7,400 customers and were constructed in 1950 and 1960. The overall Station Health Index for Aberdeen and Central substations is 53% and 56% respectively. The switchgear at the Aberdeen substation is 40 years old; Kinectrics determined its effective age is 54 years old. Kinectrics analysis determined that this switchgear has a high risk of failure within five years. Aberdeen substation, which services 2,600 customers, has inadequate backup for all feeders. The failure of the switchgear at this substation will leave customers without power or subject them to rotating blackouts.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts approximately 2,600 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.137

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Aberdeen substation is scheduled for 2017 to 2021. This project is required to be completed in 2018 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Renewal of this area will allow for the decommissioning of the substation assets by 2021 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	BD-F1 Renewal - Cross St
Budget Year	2018
Investment Category	System Renewal
Project Summary	This project involves the renewal of the Baldwin substation F1 feeder in Dundas along Cross St.

Capital Investment (5.4.5.2.A.i)		
	Capital Investment (gross)	$1,540,148
	Customer Contribution	$0
	Capital Investment (net)	$1,540,148
	O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project impacts approximately 800 customers and 2000kVA of transformation

Project Dates (5.4.5.2.A.iii)

Start Date	2018/03/01
In Service Date	2018/09/30

Expenditure Timing

Q1	Q2	Q3	Q4
15%	40%	45%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Baldwin substation as part of the 4kV and 8kV Renewal Program. The 2018 investment for the renewal of Baldwin substation is $1,788,000. The 2018 investment in the 4kV and 8kV Renewal Program is $15,684,000. Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	BD-F1 Renewal - Cross St	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)

3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of these distribution assets at the current 4kV level was not a feasible alternative.

This project is the first project of multiple projects required to renew the service territory serviced by Baldwin substation.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name BD-F1 Renewal - Cross St Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The distribution assets in the Dundas operating area are in poor health and have significant operating constraints. The Dundas operating area also contains 25% of the 4kV XLPE cable. The 4kV XLPE cable is in poor health with 38% of the assets having a Health Index of either 'very poor' or 'poor'.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 800 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.029

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Baldwin substation is scheduled for renewal in 2018 and 2019. This project is required to be completed in 2018 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Renewal of this area will allow for the decommissioning of the substation assets by 2019 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	Bluebird Crescent Rear Lot Renewal
Budget Year	2018
Investment Category	System Renewal
Project Summary	This project involves the replacement of rear lot overhead construction. Replacement options include relocating primary only, or relocating all assets to either overhead or underground in the front lot. Options are dependent on many factors (e.g. presence of trees and availability of room in the road allowance) and are assessed on a case by case basis. This project will involve the renewal of end of life rear lot overhead distribution assets serviced at 13.8kV and therefore not included in the 4kV and 8kV Renewal Program.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$695,002
Customer Contribution	n/a
Capital Investment (net)	$695,002
O&M Expenditure	n/a

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project affects approximately 30 customers and 65kVA of transformation.

Project Dates (5.4.5.2.A.iii)

Start Date 2018/05/01

In Service Date 2018/10/01

Expenditure Timing

Q1	Q2	Q3	Q4
0%	40%	60%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There are no equivalent projects for comparison

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

	Leave to Construct Approval (5.4.5.2.A.vii) This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name**	Bluebird Crescent Rear Lot – Phase 1	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project		
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Replacement options considered on a project by project basis include relocating primary only, or relocating all assets to either overhead or underground in the front lot. Options are dependent on many factors (e.g. presence of trees and availability of room in the road allowance).		
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.		
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.		
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.		

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a.

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name Bluebird Crescent Rear Lot – Phase 1 Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

Horizon Utilities has identified several residential areas serviced by a rear lot overhead distribution system. Horizon Utilities has experienced a dramatic increase in reliability issues surrounding rear lot distribution systems due to damage caused from customer owned trees and lack of access for utility crews to repair or replace equipment. The poles are a mix of wood and concrete that, by design, are unsafe to scale to repair, and replacement of poles and equipment is labour intensive and requires specialized equipment access rear yards. Access is poor and therefore failure restoration time is significantly extended. These identified assets are nearing or beyond end of life and should be replaced. In the past several years, storm related failures in these areas have increased, as has the outage duration (in excess of 24 hours).

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

The poles in this project are 51 years old and are not the current construction standards. Transformers are of a similar vintage. Many of the assets are nearing or beyond the end of their useful life.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts approximately 30 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.002

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will improve the service received by the customers impacted. Service interruptions of rear lot distribution systems involve longer restoration times due to the difficulty in accessing the assets. The service interruption restoration times will be reduced once the assets have been relocated.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

n/a

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will not have a material impact on system O&M costs in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

Reliability will be improved through the relocation of these assets which will result in reduced service interruption restoration times. Safety will be improved due to improved and easier access to the assets and the ability to work on the assets from aerial bucket trucks versus having to manually climb poles when they are located in the rear lot.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The cost of this project is required to remove rear lot assets and is specifically designed not to renew using a like-for-like methodology. Horizon Utilities will determine whether to relocate the primary only to the front lot or to relocate all plant to either underground and/or overhead front lot. The decision will be made on a project by project basis.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	CE-F10 Renewal – John St S
Budget Year	2018
Investment Category	System Renewal

Project Summary	This project involves the renewal of the Central Substation F10 feeder in central Hamilton along John St South.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$1,652,254
	Customer Contribution	$0
	Capital Investment (net)	$1,652,254
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project impacts approximately 1,000 customers.	
Project Dates (5.4.5.2.A.iii)	Start Date	2018/04/01
	In Service Date	2018/11/30

Expenditure Timing

Q1	Q2	Q3	Q4
0%	40%	45%	15%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no directly comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Central substation as part of the 4kV and 8kV Renewal Program. The 2018 investment for the renewal of Central substation is $1,652,000. The 2018 investment in the 4kV and 8kV Renewal Program is $15,684,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 and 2013 Historical Year and the 2014 Bridge Year are:
2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

	Leave to Construct Approval (5.4.5.2.A.vii) This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name**	CE-F10 Renewal – John St S	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project		
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This project is part of the multi-year 4kV and 8kV Renewal Program. It is necessary to renew both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of the distribution assets at the current 4kV level was not a feasible alternative. The renewal of the area serviced by Central substation started in 2016 and is scheduled to be completed in 2022.		
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.		
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.		
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.		

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name CE-F10 Renewal – John St S Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The two substations servicing the downtown Hamilton operating area service a total of 7,400 customers and were constructed in 1950 and 1960. The overall Station Health Index for Aberdeen and Central substations is 53% and 56% respectively. Central substation has ten feeders; six of which are obsolete, oil-filled breakers are at end-of-life. Kinectrics forecasted that these circuit breakers have a high risk of failure within three years. Two of the six feeders are radial feeders with no backup. Failure of the breakers for these feeders would result in the loss of service for over 50 commercial customers in downtown Hamilton for a minimum of several hours to several days. Central substation has limited interconnection with other substations. The loss of the entire substation would affect all 3,100 customers who would be out of power until the substation assets were repaired.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts approximately 1,000 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.242

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Central substation is schedule for 2016 to 2022. This project is required to be completed in 2018 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Renewal of this area will allow for the decommissioning of the substation assets by 2022 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2018 Reactive Renewal
Budget Year	2018
Investment Category	System Renewal
Project Summary	This category includes all projects required for the reactive renewal or repairs driven by emergency equipment failures and associated corrective action. Projects arise from trouble calls or inspection programs identifying an urgent need to replace system assets and the scope of the equipment replacement requires engineering. Also included in this category are projects to address customer power quality issues, and Electrical Safety Authority ("ESA") due diligence inspection outcomes.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$1,549,868
Customer Contribution	n/a
Capital Investment (net)	n/a
O&M Expenditure	n/a

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date January 1, 2018

In Service Date December 31, 2018

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable investments for the 2010 and 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 8,745,125
2011 (CGAAP)- $ 8,230,970
2012 (MIFRS) - $ 4,032,000
2013 (MIFRS) - $ 6.069,566
2014 (MIFRS) - $ 4,840,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2018 Reactive Renewal	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

No alternatives are considered for these projects as they involve the emergency replacement of failed equipment required to restore service.

Safety (5.4.5.2.B.2)

These projects are intended to primarily address failed assets however investments required to address immediate safety issues, including issues presenting a potential risk to public safety identified by the ESA, are included in this project.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

System Renewal Specific Requirements (5.4.5.2.C.b)	**Project Name**	2018 Reactive Renewal	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

These projects are reactive in nature and are initiated from equipment that has failed or that have a high risk of failure resulting in a service interruption. These projects have a very high probability of impacting Horizon Utilities' reliability targets.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

These projects address failed assets or assets with a high risk of imminent failure and as such, these assets are at the end of their useful life. The asset condition relative to their typical life cycle varies in each incident or outage.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

The number of customers impacted varies in each incident or outage.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

The quantitative customer impact varies in each incident or outage.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

These projects address customer satisfaction as they are required to address failed assets that have either caused a system interruption, or have a high probability of causing a service interruption.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each incident or outage.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

These projects are reactive in nature and address failed assets, or assets at risk of imminent failure. Investments must be performed when identified.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

Improvements to reliability and security are expected as secondary benefits to this project.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

Investment for this project address failed assets, or assets at risk of imminent failure. Investments are not subject to project prioritization as they are reactive and non-discretionary.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

Assets replaced reactively to replace failed assets, or assets at risk of imminent failure are performed on a like-for-like basis. No extra costs to address other distributor planning objectives are incurred with these projects.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2018 Load Break Disconnect Switch ("LBDS") Replacement
Budget Year	2018
Investment Category	System Renewal
Project Summary	This project involves the replacement of LBDS found to be either inoperable or beyond economic repair (where the cost of maintenance is not warranted) as found through Horizon Utilities' maintenance and inspection programs. Such switches will be replaced with automated switches where an operational benefit can be realized. This is a multi-year program based on 16 replacements per year.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$357,000
Customer Contribution	$0
Capital Investment (net)	$357,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2018/06/01

In Service Date 2018/11/30

Expenditure Timing

Q1	Q2	Q3	Q4
0%	0%	50%	50%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 212,000
2014 (MIFRS) - $ 312,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2018 LBDS Replacement	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project involves the replacement of LBDS identified as requiring replacement through Horizon Utilities' maintenance and inspection programs. When feasible, the switches are refurbished rather than replaced. Where refurbishment is not possible, the switches will be replaced with an automated switch where an operational benefit can be realized.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Horizon Utilities utilizes the Smart Meter communication infrastructure when communicating with automated switches. Horizon Utilities' Smart Meter and related AMI network have been procured through Elster. Elster's system supports a multi-layered security approach including: access control, authorization, authentication and data integrity protocols. As part of its continuous improvement model, Horizon Utilities performs periodic security assessments to identify opportunities for enhanced system hardening.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

This is not applicable to this project.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

	Project Name 2018 LBDS Replacement	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

LBDS are critical devices for the operation of the distribution system and are installed at key operating points (e.g. feeder tie points, feeder sectionalizing). Unplanned failures of these devices would impact Horizon Utilities' ability to restore power, resulting in extended outages.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

The asset condition of load break switches relative to their typical lifecycle varies from switch to switch depending upon the operational stresses experienced by the switch. LBDS that are identified for replacement are replaced because they would not operate properly when required and are beyond economical repair.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

n/a

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

n/a

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

Failure of an LBDS to operate when required can impact Horizon Utilities' operational ability which can adversely affect the service experienced by customers.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each instance.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The timing of this project is dependent upon the timing of Horizon Utilities' LBDS maintenance program.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

Reliability can be adversely affected when a LBDS fails to operate when required as part of switching to restore service.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

LDBS are replaced with an automated switch where an operational benefit can be realized. Otherwise they are replaced on a like-for-like basis.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2018 Proactive Transformer Replacement
Budget Year	2018
Investment Category	System Renewal
Project Summary	This project was established to proactively replace distribution transformers as required. Renewal of distribution transformers in the past has either been reactive upon failure or proactive when included in the 4kV & 8KV Renewal or XLPE Primary Cable Renewal Programs. There are instances where proactive replacement of transformers is required even when the replacement is outside of the scope of the programs mentioned above. This is a multi-year project, based on 25 replacements per year.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$384,000
Customer Contribution	$0
Capital Investment (net)	$384,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2018/06/01

In Service Date 2018/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
		50%	50%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv)

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 104,447
2012 (MIFRS) - $ 185,523
2013 (MIFRS) - $ 276,978
2014 (MIFRS) - $ 339,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2018 Proactive Transformer Replacement	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (100%)

Secondary Driver (5.4.5.2.B.1.a)
N/A

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

Proactive transformer replacements are identified through Horizon Utilities' visual inspection programs and PCB testing programs. Proactive replacement criteria include:

- Transformers that have visibly deteriorated and have a high risk of imminent failure;
- Obsolete Transformers that do not have replacement units in inventory and, in a reactive replacement scenario, the customer(s) may be subject to an extended outage duration;
- Transformers that have visible oil leaks; and
- Transformers that have been identified through testing as containing PCBs.

These criteria were selected due to the level of associated risk. Transformers with visible oil leaks or containing PCBs represent a significant environmental risk. All oil spills must be tracked, reported, and the oil reclaimed where possible. Obsolete transformers, where a replacement is not available in inventory, pose a risk of prolonged service interruption upon failure and are replaced to reduce the risk of outage to the customer.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

This is not applicable to this project.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name 2018 Proactive Transformer Replacement Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The transformers selected for proactive replacement represent a level of risk to Horizon Utilities and this project provides risk mitigation consistent with Horizon Utilities' asset management objectives.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

The asset condition of these transformers relative to their typical lifecycle varies from transformer to transformer. Transformers selected for replacement present a level of risk to Horizon Utilities either through imminent failure of the transformer or through the need to address environmental risk associated with PCBs; or through the risks associated with transformers that have visible oil leaks.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

n/a

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

n/a

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

These criteria were selected due to the level of associated risk. Transformers with visible oil leaks or containing PCBs represent a significant environmental risk. All oil spills must be tracked, reported, and the oil reclaimed where possible. Obsolete transformers, where a replacement is not available in inventory, represent a risk of prolonged service interruption upon failure and are replaced to reduce the risk of outage to the customer.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each instance.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

n/a

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

n/a.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

n/a.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2018 Substation Infrastructure Renewal
Budget Year	2018
Investment Category	System Renewal
Project Summary	This program involves the renewal of substation infrastructure throughout Horizon Utilities' service territory. Substation maintenance and inspection programs identify a number of required investments for the continued safe and reliable operation of Horizon Utilities' substations, annually. Investments under this program include battery replacements, SCADA and communication upgrades, and grounding improvements.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$491,000
Customer Contribution	$0
Capital Investment (net)	$491,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2018/01/01

In Service Date 2018/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 146,477
2011 (CGAAP)- $ 326,000
2012 (MIFRS) - $ 305,000
2013 (MIFRS) - $ 168,507
2014 (MIFRS) - $ 455,503

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)		
	Project Name	2018 Substation Infrastructure Renewal — Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This program is required for the ongoing safe and reliable operation of Horizon Utilities' municipal substations. The 4kV and 8kV Renewal Program is structured to decommission Horizon Utilities' 28 substations over the next 34 years. There is no investment in the renewal of the major electrical assets (power transformers, switchgear and breakers) forecasted for the 2015 to 2019 Test Years. The investments provided above are required to maintain the ancillary substation assets in safe working order. Substation investment requirements are identified though preventative maintenance programs performed on both routine maintenance cycles and monthly inspections. Safety related investments include: installation of eye wash stations; end-of-life replacements of batteries and chargers for the emergency backup breaker operation circuits; and the replacement of end-of-life or obsolete station service transformers. These transformers are required to light and heat the substation and are the main source of power for the substation equipment. Miscellaneous investments include: reactive replacement of relays; communication equipment; and protection instrument transformers. Investments are required to address both electrical assets within the substation (e.g. replacement of switchgear components and instrument transformers) and ancillary equipment (e.g. SCADA, communication equipment, or backup batteries). All of these components are critical to the continued safe and reliable operation of the substation. A failure to undertake these required investments could lead to premature failure of substation components that would result in a service interruption and increased operating or reactive capital expenditure.	
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a.

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name 2018 Substation Infrastructure Renewal Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

This project involves investment to replace substation infrastructure required for the continued safe and reliable operation of Horizon Utilities' substations.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

n/a

Number of Customers Impacted (5.4.5.2.C.b.i.3)

n/a.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

n/a

Value of Customer Impact (5.4.5.2.C.b.i.6)

Medium

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The timing of investments in this project are dependent upon the timing of substation maintenance programs and the infrastructure requiring renewal identified while performing maintenance.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on O&M expenditures.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

n/a

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The assets renewed in this program are replaced on a like-for-like basis.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2018 Hamilton Mountain XLPE Renewal
Budget Year	2018
Investment Category	System Renewal
Project Summary	Renewal of end-of-life XLPE cable assets in the Hamilton Mountain area. Projects will include the renewal of XLPE on the Horning M63 feeder and the Mohawk M63 feeder.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$4,641,343
Customer Contribution	
Capital Investment (net)	$4,641,343
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

The customer and load impacted by this project will vary depending upon the final scope of the project

Project Dates (5.4.5.2.A.iii)

Start Date 2018/03/01

In Service Date 2018/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
10%	40%	40%	10%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

This project is part of a multi-year investment to renewal XLPE primary cable. The 2018 investment in the XLPE Renewal Program is $9,384,000.

Comparable gross investments for the XLPE Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 1,572,090
2014 (MIFRS) - $ 893,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2018 Hamilton Mountain XLPE Renewal	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
5 – Mandatory Project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year XLPE Renewal Program. Horizon Utilities considered the four replacement philosophies for addressing risk inherent in the XLPE asset group: Area; Reactive; Selected; and Refurbishment. The area replacement philosophy will be utilized for selected areas of the service territory where the asset health analysis and the failure history indicates a substantial risk of continued failures. A reactive replacement philosophy will continued to be used for the remaining areas of the service territory.

The area replacement philosophy will be employed for the Hamilton Mountain operating area due to the high volume of XLPE primary cable. The underground XLPE cable in this area comprises approximately 33% of the total installed XLPE and is the primary cause for 65% of the outages caused by failure of underground assets.

Safety (5.4.5.2.B.2)

These projects are not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name 2018 Hamilton Mountain XLPE Renewal Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

XLPE primary cable is the asset group with the largest investment requirement as identified by the Kinectrics ACA. The current backlog volume of XLPE primary cable requiring renewal cannot be addressed in a single year and requires a multiple year investment strategy. The optimal level of renewal for XLPE cable, based on a 40-year useful life replacement cycle, is 50km/year. Horizon Utilities' proposed investment for the 2015 to 2019 Test Years is $36,014,000, which provides for the replacement of 180km of cable over the 2015 to 2019 Test Years. This represents a managed, gradual increase in investment in order to balance rate payer concerns and practical operational limitations.

The Hamilton Mountain operating area has 225km of XLPE primary cable with a Health Index of either "very poor" or "poor". Due to the exponential nature of failures experienced as the 50+ year old cables experience material breakdown, the future cost of required investments will dramatically increase in the short term if not addressed in a systematic manner.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

An analysis of all service interruptions, caused by material or equipment failure from 2010 to 2013, revealed that 50% of service interruptions, measured by customer minutes of outage, were due to failures of underground cable and equipment. Over 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration. These durations far exceed Horizon Utilities' corporate target of one hour and nine minutes of outage on average per customer.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

Approximately 1000 customers will be impacted by this project.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

The qualitative customer varies for customers affected by this project.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets at risk of failure. Failures of XLPE primary cable result in extended service interruptions; 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

Proactive replacements are required because, as assets continue to age and degrade, the cable will fail at an exponential rate. In the worst case scenario, it will exceed Horizon Utilities' ability to keep pace with repairs. Reliability will also deteriorate to unacceptable levels. Reactive replacements will be considerably more costly than proactive renewal.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the XLPE primary cable, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the XLPE primary cable system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

Failure to invest in the proactive renewal of XLPE primary cable and associated underground assets would result in unacceptable levels of system failures and outages beyond Horizon Utilities ability to resolve within a reasonable timeframe as these assets continue to age and degrade. Reactive replacements will also be considerably more costly than the forecast expenditure required to execute the proposed proactive replacement.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

XLPE renewal projects will include: the elimination of radial underground feeds; replacement of below grade transformers with padmount transformers; and the introduction of fusing on the underground distribution systems where applicable.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	JN-F1 Renewal
Budget Year	2018
Investment Category	System Renewal

Project Summary	This project involves the renewal of 4kV distribution assets on the John F1 feeder as part of the 4kV and 8kV Renewal Program. The assets are located along Bond St and Melville St in Dundas.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$2,525,572
	Customer Contribution	$0
	Capital Investment (net)	$2,525,572
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project will impact 1,048 customers and 5000kVA of transformation	
Project Dates (5.4.5.2.A.iii)	Start Date	2018/02/01
	In Service Date	2018/09/30

Expenditure Timing

Q1	Q2	Q3	Q4
20%	60%	20%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by John substation as part of the 4kV and 8kV Renewal Program. The 2018 investment for the renewal of John substation is $2,525,572. The 2018 investment in the 4kV and 8kV Renewal Program is $15,684,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 and 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

	Leave to Construct Approval (5.4.5.2.A.vii) This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name** JN-F1 Renewal	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (60%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (40%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Renewal of assets at 4kV would not allow for the eventual decommissioning of John substation. Horizon Utilities' substation assets are being decommissioned over the life of the 4kV and 8kV Renewal Program to avoid capital investment required for the renewal of substation assets that are nearing the end of their useful lives.	
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a	

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name JN-F1 Renewal Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The distribution assets in the Dundas operating area are in poor health and have significant operating constraints. The Dundas operating area also contains 25% of the 4kV XLPE cable. The 4kV XLPE cable is in poor health with 38% of the assets having a Health Index of either 'very poor' or 'poor'.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are of the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 1,048 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.025

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The timing of this project is required to co-ordinate with the 4kV and 8kV Renewal Program as it involves both the renewal of XLPE primary cable the renewal of the underground section of the John substation F1 feeder. Renewal of this area will allow for the decommissioning of the substation assets by 2019 thereby avoiding the need for capital investment into these substations.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of XLPE primary cable will provide reliability improvements through reduced service interruptions caused by failed equipment. The cable renewed by this project is direct buried and therefore subject to extended outages, requiring multiple hours to repair, upon failure.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project is required to co-ordinate with the 4kV and 8kV Renewal Program as it involves both the renewal of XLPE primary cable the renewal of the underground section of the John substation F1 feeder. Renewal of this area will allow for the decommissioning of the substation assets by 2019 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2018 Pole Residual Replacements
Budget Year	2018
Investment Category	System Renewal
Project Summary	This project involves the replacement of wood poles that have a high risk of failure, as identified by pole residual testing.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$1,333,151
Customer Contribution	$0
Capital Investment (net)	$1,333,151
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2018/01/01

In Service Date 2018/06/30

Expenditure Timing

Q1	Q2	Q3	Q4
50%	50%	0%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 1,326,407
2011 (CGAAP)- $ 895,000
2012 (MIFRS) - $ 930,000
2013 (MIFRS) - $ 718,074
2014 (MIFRS) - $ 1,190,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)			
	Project Name	2018 Pole Residual Replacements	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (100%) **Secondary Driver (5.4.5.2.B.1.a)** N/A **Investment Priority (5.4.5.2.B.1.b)** 5 – Mandatory Project		
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) The replacement of wood poles in this project is identified through Horizon Utilities' pole testing maintenance program. The pole testing categorized the poles requiring replacement into two categories: 1) requiring immediate replacement; and 2) requiring replacement within five years. Horizon Utilities replaces poles requiring immediate replacement as soon as possible to mitigate the risk of service interruptions and the risk to public safety resulting from a failure of the pole. Horizon Utilities replaces poles requiring replacement within five years in the following year. Failure to replace in the following year compounds the volume of work in subsequent years resulting in cascading delays and compounded volumes in subsequent years. Poles replaced in this project are replaced on a like-for-like basis where possible.		
	Safety (5.4.5.2.B.2) This project will address wood poles requiring replacement as identified through testing. Renewal of these assets prior to failure avoids the potential risk to public safety that would result from a failure of a wood pole.		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.		
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** This is not applicable to this project.		
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.		

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	2018 Pole Residual Replacements	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

This project is reactive in nature. The work required is initiated through Horizon Utilities' maintenance and inspection programs. This project has a very high probability of impacting Horizon Utilities' reliability targets if the poles are not replaced.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

This project address wood poles that have been identified as having a high risk of failure and as such, these assets are at the end of their useful life. The asset condition relative to their typical life cycle varies in case.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

The number of customers impacted varies in each incident or outage.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

The quantitative customer impact varies in each incident or outage.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

These projects address customer satisfaction as they are required to address assets at risk of failure which would result in a service interruption.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each incident or outage.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

These projects are reactive in nature and address assets at risk of failure. Horizon Utilities replaces poles requiring immediate replacement as soon as possible to mitigate the risk of service interruptions and the risk to public safety resulting from a failure of the pole.

Horizon Utilities replace poles requiring replacement within five years in the following year. Failure to replace in the following year compounds the volume of work in subsequent years resulting in cascading delays and compounded volumes in subsequent years.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

This project will provide reliability and safety benefits as the project involves the replacement of wood poles that are at risk of failure. Failure of the asset would result in a service interruption and a potential risk to public safety.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

Poles replaced in this project are replaced on a like-for-like basis where possible as this presents the lowest cost option. No additional costs are incurred to address other distributor planning objectives.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	ST-F3 & ST-F4 Renewal
Budget Year	2018
Investment Category	System Renewal

Project Summary	This project involves the renewal of the Strouds Substation F3 & F4 feeders in West Hamilton as part of the 4kV and 8kV Renewal Program.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$3,830,389
	Customer Contribution	$0
	Capital Investment (net)	$3,830,389
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project will impact approximately 2,400 customers and 5000kVA of transformation	
Project Dates (5.4.5.2.A.iii)	Start Date	2018/04/01
	In Service Date	2018/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
0%	30%	40%	30%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Strouds Substation as part of the 4kV and 8kV Renewal Program. The 2018 investment for the renewal of Strouds substation is $3,831,000. The 2018 investment in the 4kV and 8kV Renewal Program is $15,684,000.

Comparable gross investments for the 4kV and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	ST-F3 & ST-F4 Renewal	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of the distribution assets at the current 4kV level was not a feasible alternative.

The renewal of the area serviced by the Strouds substation started in 2014 and is scheduled to be completed in 2018. Strouds substation was constructed in 1938. The switchgear at this substation is 44 years old and has a Health Index of 'very poor' as identified in the Substation Asset Condition Assessment ("SACA") and confirmed by the Kinectrics ACA.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name ST-2 & ST-6 Renewal Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The distribution assets in the Hamilton West operating area are in poor health and the switchgear in both substations servicing this area has switchgear with a 'very poor' Health Index.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 2,400 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.125

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by the Strouds substation is scheduled for 2014 to 2018.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Kinectrics identified that both substations' switchgear had a high probability of failure within one to three years. Switchgear failure will result in the complete loss of the substation. A loss of both substations would result in an outage that would affect all 5,400 customers. These customers would be without power until the substation assets were repaired. Horizon Utilities does not maintain spare parts for all substation assets

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and will require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2018 Stoney Creek XLPE Renewal
Budget Year	2018
Investment Category	System Renewal

Project Summary	Renewal of end-of-life XLPE cable assets in the Stoney Creek area.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$1,908,000
	Customer Contribution	$0
	Capital Investment (net)	$1,908,000
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	The customer and load impacted by this project will vary depending upon the final scope of the project.	
Project Dates (5.4.5.2.A.iii)	Start Date	2018/03/01
	In Service Date	2018/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
10%	40%	40%	10%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is part of a multi-year investment to renewal XLPE primary cable. The 2018 investment in the XLPE Renewal Program is $9,384,000.

Comparable gross investments for the XLPE Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 1,572,090
2014 (MIFRS) - $ 893,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2018 Stoney Creek XLPE Renewal	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
4 – Required Project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year XLPE Renewal Program. Horizon Utilities considered the four replacement philosophies for addressing risk inherent in the XLPE asset group: Area; Reactive; Selected; and Refurbishment. The area replacement philosophy will be utilized for selected areas of the service territory where the asset health analysis and the failure history indicates a substantial risk of continued failures. A reactive replacement philosophy will continue to be used for the remaining areas of the service territory. The Stoney Creek operating area contains many small pockets of direct buried XLPE primary cable. The XLPE renewal projects in the Stoney Creek operating area will involve the full renewal of each pocket of XLPE cable. Project selection will be guided by asset health, operating history, and reliability of each of the underground pockets of XLPE.

Safety (5.4.5.2.B.2)

These projects are not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name 2018 Stoney Creek XLPE Renewal Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

XLPE primary cable is the asset group with the largest investment requirement as identified by the Kinectrics ACA. The current backlog volume of XLPE primary cable requiring renewal cannot be addressed in a single year and requires a multiple year investment strategy. The optimal level of renewal for XLPE cable, based on a 40-year useful life replacement cycle, is 50km/year. Horizon Utilities' proposed investment for the 2015 to 2019 Test Years is $36,014,000, which provides for the replacement of 180km of cable over the 2015 to 2019 Test Years. This represents a managed, gradual increase in investment in order to balance rate payer concerns and practical operational limitations.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

An analysis of all service interruptions, caused by material or equipment failure from 2010 to 2013, revealed that 50% of service interruptions, measured by customer minutes of outage, were due to failures of underground cable and equipment. Over 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration. These durations far exceed Horizon Utilities' corporate target of one hour and nine minutes of outage on average per customer.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

The number of customers impacted will vary depending upon the area.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

The quantitative customer impact varies.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets at risk of failure. Failures of XLPE primary cable result in extended service interruptions; 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

Proactive replacements are required because, as assets continue to age and degrade, the cable will fail at an exponential rate. In the worst case scenario, it will exceed Horizon Utilities' ability to keep pace with repairs. Reliability will also deteriorate to unacceptable levels. Reactive replacements will be considerably more costly than proactive renewal.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the XLPE primary cable, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the XLPE primary cable system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

Failure to invest in the proactive renewal of XLPE primary cable and associated underground assets would result in unacceptable levels of system failures and outages beyond Horizon Utilities' ability to resolve within a reasonable timeframe as these assets continue to age and degrade. Reactive replacements will also be considerably more costly than the forecast expenditure required to execute the proposed proactive replacement.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

XLPE renewal projects will include: the elimination of radial underground feeds; replacement of below grade transformers with padmount transformers; and the introduction of fusing on the underground distribution systems where applicable.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2018 St. Catharines XLPE Renewal
Budget Year	2018
Investment Category	System Renewal
Project Summary	Renewal of end-of-life XLPE cable assets in the St. Catharines operating area.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$2,835,000
Customer Contribution	$0
Capital Investment (net)	$2,835,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

The customer and load impacted by this project will vary depending upon the final scope of the project.

Project Dates (5.4.5.2.A.iii)

Start Date 2018/03/01

In Service Date 2018/12.31

Expenditure Timing

Q1	Q2	Q3	Q4
10%	40%	10%	40%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv)

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is part of a multi-year investment to renewal XLPE primary cable. The 2018 investment in the XLPE Renewal Program is $9,384,000.

Comparable gross investments for the XLPE Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 1,572,090
2014 (MIFRS) - $ 893,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)			
	Project Name	2018 St. Catharines XLPE Renewal	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 4 – Required Project		
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This project is part of the multi-year XLPE Renewal Program. Horizon Utilities considered the four replacement philosophies for addressing risk inherent in the XLPE asset group: Area; Reactive; Selected; and Refurbishment. The area replacement philosophy will be utilized for selected areas of the service territory where the asset health analysis and the failure history indicates a substantial risk of continued failures. A reactive replacement philosophy will continued to be used for the remaining areas of the service territory. The St. Catharines operating area contains many small pockets of direct buried XLPE primary cable. The XLPE renewal projects in the St. Catharines operating area will involve the full renewal of each pocket of XLPE cable. Project selection will be guided by asset health, operating history, and reliability of each of the underground pockets of XLPE.		
	Safety (5.4.5.2.B.2) These projects are not intended to address safety concerns with the distribution system.		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project		
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.		
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.		
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a		

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	2018 St. Catharines XLPE Renewal	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

XLPE primary cable is the asset group with the largest investment requirement as identified by the Kinectrics ACA. The current backlog volume of XLPE primary cable requiring renewal cannot be addressed in a single year and requires a multiple year investment strategy. The optimal level of renewal for XLPE cable, based on a 40-year useful life replacement cycle, is 50km/year. Horizon Utilities' proposed investment for the 2015 to 2019 Test Years is $36,014,000, which provides for the replacement of 180km of cable over the 2015 to 2019 Test Years. This represents a managed, gradual increase in investment in order to balance rate payer concerns and practical operational limitations.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

An analysis of all service interruptions, caused by material or equipment failure from 2010 to 2013, revealed that 50% of service interruptions, measured by customer minutes of outage, were due to failures of underground cable and equipment. Over 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration. These durations far exceed Horizon Utilities' corporate target of one hour and nine minutes of outage on average per customer.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

The number of customers impacted will vary depending upon the area

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

The quantitative customer impact varies.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets at risk of failure. Failures of XLPE primary cable result in extended service interruptions; 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

Proactive replacements are required because, as assets continue to age and degrade, the cable will fail at an exponential rate. In the worst case, it will exceed Horizon Utilities' ability to keep pace with repairs. Reliability will also deteriorate to unacceptable levels. Reactive replacements will be considerably more costly than proactive renewal.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the XLPE primary cable, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the XLPE primary cable system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

Failure to invest in the proactive renewal of XLPE primary cable and associated underground assets would result in unacceptable levels of system failures and outages beyond Horizon Utilities' ability to resolve within a reasonable timeframe as these assets continue to age and degrade. Reactive replacements will also be considerably more costly than the forecast expenditure required to execute the proposed proactive replacement.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

XLPE renewal projects will include: the elimination of radial underground feeds; the replacement of below grade transformers with padmount transformers; and the introduction of fusing on the underground distribution systems where applicable.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	WH – F6 Renewal- Whitney Ave
Budget Year	2018
Investment Category	System Renewal

Project Summary	This project involves the renewal of 4kV distribution assets on the Whitney substation as part of the 4kV and 8kV Renewal Program. The assets are located along Whitney Ave in West Hamilton.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$2,114,857
	Customer Contribution	$0
	Capital Investment (net)	$2,114,857
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project will impact 2,971 customers and 5000 kVA of transformation	
Project Dates (5.4.5.2.A.iii)	Start Date 2018/03/01	
	In Service Date 2018/12/31	

Expenditure Timing

Q1	Q2	Q3	Q4
10%	40%	40%	10%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Whitney substation as part of the 4kV and 8kV Renewal Program. The 2018 investment for the renewal of Whitney substation is $2,115,000. The 2017 investment in the 4kV and 8kV Renewal Program is $15,684,000.

Comparable gross investments for the 4kV and 8kV Renewal Program for the 2010 to 2013 Historical Year and the 2014 Bridge Year are:
2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	WH – F6 Renewal- Whitney Ave	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore, the renewal of these distribution assets at the current 4kV level was not a feasible alternative.

The renewal of the area serviced by the Whitney substation started in 2014 and is scheduled to be completed in 2018. Whitney substation was constructed in 1962. The switchgear at this substation is 46 years old and has a Health Index of 'very poor' as identified in the Substation Asset Condition Assessment ("SACA") and confirmed by the Kinectrics ACA.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	WH – F6 Renewal- Whitney Ave	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The distribution assets in the Hamilton West operating area are in poor health and the switchgear in both substations servicing this area have switchgear with a 'very poor' Health Index

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 2,971 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.008

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

Renewal of assets at 4kV would not allow for the eventual decommissioning of Whitney Substation. Horizon Utilities' Substation assets are being decommissioned over the life of the 4kV and 8kV Renewal Program to avoid capital investment required for the renewal of substation assets that are nearing the end of their useful lives.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by the Whitney substation is scheduled for 2014 to 2018.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	YK-F1 York Rd Renewal
Budget Year	2018
Investment Category	System Renewal

Project Summary	This project involves the renewal of 4kV distribution assets on the York F1 feeder as part of the 4kV and 8kV Renewal Program.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$1,073,512
	Customer Contribution	$0
	Capital Investment (net)	$1,073,512
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project will impact approximately 400 customers and 1000kVA of transformation.	
Project Dates (5.4.5.2.A.iii)	Start Date	2018/03/01
	In Service Date	2018/09/30

Expenditure Timing

Q1	Q2	Q3	Q4
15%	40%	45%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by York substation as part of the 4kV and 8kV Renewal Program. The 2018 investment for the renewal of York substation is $1,073,512. The 2018 investment in the 4kV and 8kV Renewal Program is $15,684,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 and 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

	Leave to Construct Approval (5.4.5.2.A.vii) This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name**	YK-F1 York Rd Renewal	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project		
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of this project at the current 4kV level was not a feasible alternative.		
	Safety (5.4.5.2.B.2) These projects are not intended to address safety concerns with the distribution system.		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a		
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.		
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.		

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name YK-F1 York Rd Renewal Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The distribution assets in the Dundas operating area are in poor health and have significant operating constraints. The Dundas operating area also contains 25% of the 4kV XLPE cable. The 4kV XLPE cable is in poor health with 38% of the assets having a Health Index of either 'very poor' or 'poor'.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 400 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.003

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by York substation is scheduled for renewal in 2018. This project is required to be completed in 2018 to allow for the renewal of the remaining area to complete on schedule.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Renewal of this area will allow for the decommissioning of the substation assets by 2019 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	East 16th and Mohawk Security Project
Budget Year	2018
Investment Category	System Service
Project Summary	This project will create a loop feed for an islanded 13.8kV radial feed surrounded by 4kV distribution.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$323,633
Customer Contribution	$0
Capital Investment (net)	$323,633
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project affects 1000 customers and 250kVA of transformation.

Project Dates (5.4.5.2.A.iii)

Start Date 2018/05/01

In Service Date 2018/09/30

Expenditure Timing

Q1	Q2	Q3	Q4
0%	50%	50%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no equivalent project for comparison.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)		
	Project Name East 16th and Mohawk Security Project	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Service (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Renewal (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) No alternatives exist to provide redundancy to this island of 13.8kV distribution. The alternative would be to continue to serve these customers on a radial feed with no backup.	
	Safety (5.4.5.2.B.2) These projects are not intended to address safety concerns with the distribution system.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a	

System Service Specific Requirements (5.4.5.2.C.c)

Project Name	East 16th and Mohawk Security Project	Table 3

System Service Specific Requirements (5.4.5.2.C.c)

Benefit to Customers (5.4.5.2.C.c.i)

This project will provide redundancy to the customers serviced by this radial fed section of 13.8kV distribution system. The line directly feeding the school experienced a cable fault in 2011 which caused the school to be closed for two days until repairs were made.

Regional Planning Requirements (5.4.5.2.C.c.i)

N/A

Integration of Advance Technology (5.4.5.2.C.c.iii)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

System Benefits to Reliability, Efficiency and Safety (5.4.5.2.C.c.iv)

n/a

Factors Affecting Implementing Timing/Priority (5.4.5.2.C.c.v)

n/a

Summary of Options Analysis (5.4.5.2.C.c.vi)

n/a

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	St. Paul Street Conductor Upgrade
Budget Year	2018
Investment Category	System Service
Project Summary	This project is required to alleviate a bottleneck on the Vansickle M53 feeder along St. Paul Street in St. Catharines by upgrading the conductor from 3/0 ACSR to 556 Aluminum.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$1,362,121
Customer Contribution	$0
Capital Investment (net)	$1,362,121
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date	2018/03/01
In Service Date	2018/09/30

Expenditure Timing

Q1	Q2	Q3	Q4
15%	40%	45%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no equivalent project for comparison.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)		
	Project Name St. Paul St Conductor Upgrade	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Service (60%) **Secondary Driver (5.4.5.2.B.1.a)** System Renewal (40%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Vansickle TS was upgraded in 2010 to provide increased capacity in the west end of St. Catharines and to provide additional backup and load transferring capability to Carlton TS. A number of subsequent upgrades to the distribution system have been performed to improve the interconnection between Carlton TS and Vansickle TS. This project is the final project required to complete the interconnection through the removal of a capacity constraint along St. Paul Street.	
	Safety (5.4.5.2.B.2) These projects are not intended to address safety concerns with the distribution system.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a	

stem Service Specific Requirements (5.4.5.2.C.c)

Project Name	St. Paul Street Conductor Upgrade	Table 3

System Service Specific Requirements (5.4.5.2.C.c)

Benefit to Customers (5.4.5.2.C.c.i)

This project will improve security by bringing a feeder with capacity to the area and redefining the open points to enhance flexibility during restoration.

Regional Planning Requirements (5.4.5.2.C.c.i)

n/a

Integration of Advance Technology (5.4.5.2.C.c.iii)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

System Benefits to Reliability, Efficiency and Safety (5.4.5.2.C.c.iv)

System benefits include: improved operability within the area and improved life expectancy from the assets that are being relieved by the new feeder.

Factors Affecting Implementing Timing/Priority (5.4.5.2.C.c.v)

n/a

Summary of Options Analysis (5.4.5.2.C.c.vi)

n/a

2018 General Plant Investments

Capital Project Summary

Project Name	2018 Annual Corporate Computer Replacement
Budget Year	2018
Investment Category	General Plant
Project Summary	This project is part of an ongoing business requirement to refresh end user computers. Horizon Utilities utilizes a three-year lifecycle for replacement of end user computers. On an annual basis, approximately one third of all Horizon Utilities computers (~150 PCs/year) are replaced.

Capital Investment (5.4.5.2.A.i)		
	Capital Investment (gross)	$361,200
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)	n/a

Project Dates (5.4.5.2.A.iii)				
	Start Date	Jan. 2018		
	In Service Date	Dec. 2018		
	Expenditure Timing			
	Q1	Q2	Q3	Q4
	25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Schedule - Implementation is phased throughout the year starting in January and ending in December based on age of PCs being replaced.

Risk – The primary risk to this project is product availability from suppliers.
Risk Mitigation – Work closely with suppliers to schedule orders based on required delivery times.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the annual corporate computer replacement for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 336,000
2011 (CGAAP)- $ 227,000
2012 (MIFRS) - $ 312,000
2013 (MIFRS) - $ 364,947
2014 (MIFRS) - $ 366,200

Total Capital and OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)
n/a

Leave to Construct Approval (5.4.5.2.A.vii)
n/a

Evaluation Criteria and Information		
	Project Name	2018 Annual Corporate Computer Replacement Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant (100%) **Secondary Driver (5.4.5.2.B.1.a)** n/a **Investment Priority (5.4.5.2.B.1.b)** High Priority – Personal computers are treated as a strategic asset. They are Horizon Utilities' primary staff productivity tool. They are used to: maintain and deliver services to customers; improve staff productivity; cost-effectively manage total cost of PC ownership; and, support investments in new applications, infrastructure and business capabilities	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) n/a	
	Safety (5.4.5.2.B.2) n/a	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Suppliers of enterprise systems such as, GIS, OMS, SCADA, AMI, and IFS ERP, are constantly upgrading their products to deliver new processes and functionality. As new versions are released up-to-date hardware is required to perform required upgrades to maintain vendor support for the systems.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a	

General Plant Specific Requirements

Project Name	2018 Annual Corporate Computer Replacement	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

n/a

Business Case Justification Documentation (5.4.5.2.C.d.i)

Horizon Utilities' PCs are treated as a strategic asset, because they are the primary staff productivity tool. Horizon Utilities has streamlined its PC lifecycle management processes utilizing a PC refresh cycle of three years, in order to: deliver, maintain and improve services to customers; to improve staff productivity; to cost-effectively manage total cost of PC ownership; and to support investments in new applications, infrastructure and business capabilities.

A three-year PC refresh cycle reduces the total cost of ownership by reducing the number of models of PCs supported, which results in the reduction of the IST service desk effort required to deploy, secure, and manage new systems and applications. The reduction in the number of supported models has allowed Horizon Utilities to introduce mobile computing for remote field workers and to increase the number of supported PCs by over 100 devices since 2011, without an increase in IST service desk support staff.

A refresh lifecycle of three years reduces the likelihood of device failures that lead to a loss of staff productivity and increased IT support effort. Over 50% of Horizon Utilities' staff utilizes a mobile PC (laptop or tablet) in the performance of their daily activities, many in harsh operating environments outside the office, which increases the likelihood of failure due to operating environment and the age of the device.

Horizon Utilities has introduced several new enterprise business and engineering systems to: mitigate business risks related to aging systems (e.g. GIS); improve electricity system operation (i.e. GIS, OMS); and to address end of vendor support for systems (i.e. IFS ERP, Microsoft Windows XP). Maintaining a three-year PC lifecycle refresh program allows Horizon Utilities' to migrate to these applications without a need to make large one-time investments in PCs to meet the minimum operating requirements of new applications.

PCs are the primary productivity tool used by Horizon Utilities' staff. Unreliable and slow PCs impact productivity and customer service.

Minimizing the number of supported models reduces the IST support effort required to manage, order, configure, and deploy PCs and it reduces the total cost of ownership for PCs.

Capital Project Summary

Project Name	2018 IFS ERP Upgrade
Budget Year	2018
Investment Category	General Plant
Project Summary	This is an enterprise-wide project for the lifecycle upgrade of Horizon Utilities' ERP system from IFS version 8.1 to the then current vendor supported version. This is a major upgrade to the IFS ERP system which was last upgraded in 2013. This project is required to mitigate operational risks dependent on software not supported by the vendor. This project will be a straight migration of functionality to the most current version.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$1,225,000
Customer Contribution	n/a
Capital Investment (net)	n/a
O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date Jan. 2018

In Service Date Dec 2018

Expenditure Timing

Q1	Q2	Q3	Q4
30%	30%	40%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Schedule - Implementation is being phased throughout the year starting in January and ending in December. The project is being phased based on a combination of the potential benefit of the process improvement and the business unit resource availability to define, configure, and test the process change.

Risk – The primary risk to this project is internal resource availability.

Risk Mitigation – Utilization of Horizon Utilities Project Management Framework to effectively manage project to budget and schedule.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Horizon Utilities has no recently completed project which is comparable in scope and scale which can be as a reasonable comparator

Total Capital and OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)

n/a

Evaluation Criteria and Information		
	Project Name 2018 IFS ERP Upgrade	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant 100% **Secondary Driver (5.4.5.2.B.1.a)** n/a	
	Investment Priority (5.4.5.2.B.1.b) High Priority – The IFS ERP System is an enterprise-wide system used to manage business processes in Finance, Human Resources, Supply Chain, and Engineering Project Management and as such, must be maintained at software vendor supported levels. **Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)** n/a	
	Safety (5.4.5.2.B.2) n/a	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** n/a	
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a	

General Plant Specific Requirements

Project Name	2018 IFS ERP Upgrade	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

n/a

Business Case Justification Documentation (5.4.5.2.C.d.i)

Horizon Utilities uses IFS to manage business critical processes in Finance, Human Resources, Supply Chain Management, Asset Management, and Engineering Project Planning. This project is both a lifecycle upgrade and a risk mitigation project. IFS's software development plans are to release a new major version of the system every 3 years. IFS will only provide support for the two most recent versions. The application must be upgraded in order to maintain IFS support for the system.

Horizon Utilities has scheduled this project in 2018 to manage required IT investment and to manage internal resource commitments to minimize impact on customers and business operations. Any delay of this project would conflict with a required major upgrade of Horizon Utilities' CIS system, the development for which begins in 2019.

Capital Project Summary

Project Name	2018 Vehicle Replacement
Budget Year	2018
Investment Category	General Plant

Project Summary;

Horizon Utilities has identified a number of current vehicles that require replacement as they have reached end-of-life as per the criteria within Horizon Utilities' Fleet Replacement Plan.

Other expected objectives and outcomes are to:

- Maintain vehicle reliability and availability;
- Reduce fuel consumption;
- Reduce emissions;
- Reduce down time required to conduct maintenance and repairs; and
- Maintain customer response time.

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$785,000
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)				
Project Dates (5.4.5.2.A.iii)	Start Date	March 2018		
	In Service Date	December 2018		
		Expenditure Timing		
	Q1	Q2	Q1	Q2
	0%	0%	50%	50%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Risk – The primary risk to this project is product availability and adherence to delivery schedules from suppliers.

Risk Mitigation – Work closely with suppliers to schedule orders based on required delivery times.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for vehicle replacements for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 1,590,516
2011 (CGAAP)- $ 1,033,975
2012 (MIFRS) - $ 1,057,410
2013 (MIFRS) - $ 36,365
2014 (MIFRS) - $ 785,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

N/A

Leave to Construct Approval (5.4.5.2.A.vii)
N/A

Evaluation Criteria and Information

Project Name: 2018 Vehicle Replacement	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)

General Plant – 100%

Secondary Driver (5.4.5.2.B.1.a)
n/a

Investment Priority (5.4.5.2.B.1.b)

High

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

n/a

Safety (5.4.5.2.B.2)

n/a

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)
n/a

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

n/a

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

n/a

Economic Development (5.4.5.2.B.5)

n/a

Environmental Benefits (5.4.5.2.B.6)

n/a

General Plant Specific Requirements

Project Name	2018 Vehicle Replacement	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

Horizon Utilities uses the data collected from electronic fleet and fuel management system, the Global Positional System ("GPS") data which includes engine hours, power take-off ("PTO"), engine idling hours, traffic patterns, utilization, and mileage to determine the optimal maintenance scheduling and vehicle maintenance and repairs activities to determine the maintenance scheduling and vehicles replacements.

Business Case Justification Documentation (5.4.5.2.C.d.i)

To maintain the quality, reliability and availability of Horizon Utilities' vehicle fleet to Construction and Maintenance, Metering Services and corporate group activities, vehicles are assessed annually based on a replacement criteria matrix defined within the Fleet Replacement Plan.

Replacement strategies also ensure that Horizon Utilities maintains safe vehicles for employees, while targeting reduced emissions, as well as reduced fuel, operating and maintenance costs. Horizon Utilities will not be procuring any net new vehicles and instead will focus on the replacement of end of life vehicles over the 2015-2019 Test Years.

Due to budget mitigation efforts in 2011, 2012, and 2013, a number of vehicles scheduled for replacement were kept in operation and rescheduled for replacement in 2014. It is now critical that these vehicles be replaced as maintenance and repairs costs have increased and the vehicles no longer operate at full capacity, reducing vehicle availability and impacting service delivery.

Regular vehicle replacement is necessary to avoid undue vehicle down and associated negative impacts to customer response time and employee productivity.

Capital Project Summary

Project Name	2018 Tools, Shop and Garage Equipment
Budget Year	2018
Investment Category	General Plant

Project Summary
This program includes capital expenditures pertaining to the replacement of tools, shop and garage equipment, which are either worn, have come to the end of their useful life, or the continued use of such creates health and safety risk

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$530,600
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	$0
Customer Attachments / Load (5.4.5.2.A.ii)	n/a	

Project Dates (5.4.5.2.A.iii)

Start Date	January 2018
In Service Date	December 2018

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Risk – n/a

Risk Mitigation – n/a

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

n/a

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)

n/a

Evaluation Criteria and Information	
	Project Name: 2018 Tools, Shop and Garage Equipment Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant (100%) **Secondary Driver (5.4.5.2.B.1.a)** n/a
	Investment Priority (5.4.5.2.B.1.b) High **Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)** Tools and equipment over $5000 are procured through a competitive process and alternatives are considered at the time of requisition.
	Safety (5.4.5.2.B.2) Tools and equipment meet CSA requirements and are reviewed for conformance to requirements by Horizon Utilities' Tool & Equipment Committee.
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** n/a
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

General Plant Specific Requirements

Project Name	2018 Tools, Shop and Garage Equipment	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Su**mmary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)**

Each year a condition assessment is conducted on the inventory of tools and equipment in use, to determine a forecast for expected replacements. Feedback from the crews that use the tools and equipment, together with feedback from the Fleet Mechanics who maintain the tools and equipment on each vehicle, is used to establish the annual budgets. It becomes unsafe, costly and inefficient to use or maintain this type of equipment which has reached the end of its useful life.

New tools become available on the market, on a periodic basis, that offer improved safety, ergonomics and productivity features which Horizon Utilities evaluates for use. Changes in regulations, which require a different standard of equipment may necessitate a replacement of tools and equipment. Fall arrest equipment for example, needs to be exchanged when new standards come into effect, and any required new equipment is included in the budget.

Business Case Justification Documentation (5.4.5.2.C.d.i)

n/a

Capital Project Summary

Project Name	2018 Building Renovation – John St
Budget Year	2018
Investment Category	General Plant

Project Summary:

The objectives of this project planned for 2018 is to replace end-of-life facilities in the John St basement washroom/shower/lockers area to support the current and planned work force and to improve the lobby space to better service Horizon Utilities' customers [redacted] This project will enhance the quality of the workplace for employees; reduce safety risks; remove hazards materials; and improve the use of existing space.

Other expected objectives and outcomes include:

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- Improved energy performance of buildings including systems and infrastructure;
- Replacement of end of life equipment;
- Increased washroom facilities to support current requirements; mad
- Compliance of facilities to support wheel chair access and meet *Accessibility for Ontarians with Disabilities Act* requirements

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$1,200,000
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)

Project Dates (5.4.5.2.A.iii)

Start Date March 2018

In Service Date December 2018

Expenditure Timing

Q1	Q2	Q1	Q2
10%	30%	30%	30%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Project timelines and costs exceeding the budget are risks. The project manager will report regularly on project timelines and adherence to budget and escalates issues for resolution.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for building renovations for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 1,767,000
2013 (MIFRS) - $ 5,490,000
2014 (MIFRS) - $ 3,700,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)

n/a

Evaluation Criteria and Information

Project Name: 2018 Building Renovation – John St	Table 2
Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant – 100% **Secondary Driver (5.4.5.2.B.1.a)** n/a **Investment Priority (5.4.5.2.B.1.b)** High	
Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Horizon Utilities' building renovation plans were developed through a facilities planning process that utilized the outputs of a space planning study and multiple building assessments. **Safety** (5.4.5.2.B.2)	
n/a **Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)**	
n/a **Co-ordination and Interoperability** (5.4.5.2.B.4)	
Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable) n/a	

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

n/a

Economic Development (5.4.5.2.B.5) **(where applicable)**

n/a

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

General Plant Specific Requirements

Project Name	2018 Building Renovation – John St	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

n/a

Business Case Justification Documentation (5.4.5.2.C.d.i)

The project's primary focus is to address employee and public safety concerns in the basement and lobby of the John Street building, which is largely original to the 1950s building.

The project will include the following:

- Renovation of the locker, washroom, and shower space which is original to the 1950's building. The facilities have leaking plumbing and is unable to accommodate the size and needs of the current workforce;
- The removal of anticipated hazardous materials and the replacement of end-of-life HVAC and fire and life safety systems; and
- Renovations to the public entrances to improve the utilization of space and to address concerns regarding [redacted]

2019 System Access Investments

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2019 Meters			
Budget Year	2019			
Investment Category	System Access			
Capital Investment (5.4.5.2.A.i)	Capital Investment	$ 2,063,000		
	Total	$ 2,063,000		
	O&M Expenditure	$0		
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	n/a.			
Project Dates (5.4.5.2.A.iii)	Start Date	2019/01/01		
	In Service Date	2019/12/31		
	Expenditure Timing			
	Q1	Q2	Q3	Q4
	25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Metering investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP) - $1,715,716
2011 (CGAAP)- $3,467,413
2012 (MIFRS) - $25,168,043
2013 (MIFRS) - $1,658,707
2014 (MIFRS) - $2,499,104

The increased investment in 2012 was due to the implementation of Smart Meters at a cumulative capital cost of $23,277,588. Horizon Utilities substantially completed its mass deployment of Smart Meters in 2009 and, as at the end of 2011, had installed Smart Meters for 229,322 customers or 98.0% of all metering points.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and as such no associated OM&A costs related to REG will be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)		
	Project Name 2019 Meters	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Access (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Renewal (20%) Replacement of commercial meters with Smart Meters. **Investment Priority (5.4.5.2.B.1.b)** 5 – Mandatory Project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Metering asset management is governed by Measurement Canada regulation and customer requirements for new and upgraded services.	
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Horizon Utilities' Smart Meter and related AMI network have been procured through Elster. Elster's system supports a multi-layered security approach including: access control, authorization, authentication and data integrity protocols. As part of its continuous improvement model, Horizon Utilities performs periodic security assessments to identify opportunities for enhanced system hardening.	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** The smart meter infrastructure supports the province's conservation culture. Smart Metering also provides environmental benefits through reduction in field visits associated with manual meter reading.	

System Access Specific Requirements (5.4.5.2.C.a)

Project Name	2019 Metering	Table 3

System Access Specific Requirements (5.4.5.2.C.a)

Factors Affecting Implementing Project Timing/Priority (5.4.5.2.C.a.i)
Compliance sampling work completed to comply with Measurement Canada regulations. The schedule is created to smooth the annual sampling requirements from the original Smart Meter mass deployments.

New and replacement metering is provided on demand to address new load growth and meter failures.

Factors Related to Customer Preference or 3rd Party Input (5.4.5.2.C.a.ii)

Metering for new and upgraded connection projects are customer initiated and are designed to meet customer identified requirements.

Factors Affecting Final Project Cost (5.4.5.2.C.a.iii)
Please refer to Note I for an explanation on the factors affecting the final project cost.

Controllable Cost Minimization (5.4.5.2.C.a.iv)

Please refer to Note I for an explanation regarding controllable cost minimization.

Other Planning Objectives (5.4.5.2.C.a.v)

Horizon Utilities combines work from multiple work groups to reduce costs and increase efficiency. The line work and meter work is combined when connecting new customers to allow the work to be completed by a single work group.

Assessment of Technical or Implementation Options (5.4.5.2.C.a.vi)

Metering work is Measurement Canada and customer driven and the technology is primarily based on the metering products available from a sole source supplier.

Summary of Options Analysis (5.4.5.2.C.a.vii)

Metering supplier selected as part of the smart meter implementation program.

Final Economic Evaluation Results (5.4.5.2.C.a.viii)

n/a

Identification of System Impacts (5.4.5.2.C.a.ix)

System expansion, if required, to connect customers within this category are governed by Horizon Utilities' Conditions of Service Section 2.1.2.1.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2019 Road Relocations
Budget Year	2019
Investment Category	System Access
Project Description	Projects in this category include all projects required for the relocation of system plant for roadway reconstruction work. Horizon Utilities follows the *Public Service Works on Highway Act,* 1990 and associated regulations governing the recovery of costs related to road reconstruction work by collecting contributed capital for 50% of labour and labour saving devices.

Capital Investment (5.4.5.2.A.i)		
	Capital Investment (gross)	$2,749,687
	Customer Contribution	$904,360
	Capital Investment (net)	$1,845,327
	O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	n/a.

Project Dates (5.4.5.2.A.iii)				
	Start Date	Various – driven by road authority schedules		
	In Service Date	Various – driven by road authority schedules		
	Expenditure Timing			
	Q1	Q2	Q3	Q4
	25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Road relocations for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP) - $ 2,889,575
2011 (CGAAP)- $ 895,524
2012 (MIFRS) - $ 3,151,887
2013 (MIFRS) - $ 340,491
2014 (MIFRS) - $ 977,024

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2019 Road Relocations	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)

System Access (100%)

Secondary Driver (5.4.5.2.B.1.a) System Service (10%)

N/A

Investment Priority (5.4.5.2.B.1.b)
5 – Mandatory Project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

Horizon Utilities co-ordinates project design and discusses design alternatives for each project with the organization (City, Municipality, Ministry of Transportation) originating the request to relocate distribution assets.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project

Co-ordination and Interoperability (5.4.5.2.B.4)

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Access Specific Requirements (5.4.5.2.C.a)

Project Name 2019 Road Relocations Table 3

System Access Specific Requirements (5.4.5.2.C.a)

Factors Affecting Implementing Project Timing/Priority (5.4.5.2.C.a.i)

The road authority's schedule and timing of the road project will affect Horizon Utilities' project implementation and timing.

Factors Related to Customer Preference or 3rd Party Input (5.4.5.2.C.a.ii)

Road relocation projects involve a co-ordinated design process and the initiating organization (City, Municipality, or Ministry of Transportation) has input into the design of the project.
The designs for all projects within the public right-of-way are reviewed with the City as Municipal Consents are required prior to construction. Consideration is given by the road authority to coordinate all utilities within the right-of-way in the least disruptive manner.

Factors Affecting Final Project Cost (5.4.5.2.C.a.iii)

Please refer to Note I for an explanation on the factors that can affect the final project cost.

Controllable Cost Minimization (5.4.5.2.C.a.iv)

50% of Labour, Labour saving devices and Equipment rentals are recovered from the road authority. Please refer to Note I for an explanation on controllable cost minimization.

Other Planning Objectives (5.4.5.2.C.a.v)

Horizon Utilities combines work to reduce overall costs and increase efficiency. The most common opportunity is during city road relocation projects where a new water main is being installed. Horizon Utilities may be able to take advantage of the fact that installing duct structure is less costly since the road is already excavated. Horizon Utilities may also be able to change the schedule of a renewal project to align with the road authority's work to maximize these benefits. The cost of the additional work is allocated either to system service or system renewal where applicable. Horizon Utilities can maximize the amount of work that can be completed at the lowest cost to benefit ratepayers in these cases.

Assessment of Technical or Implementation Options (5.4.5.2.C.a.vi)

Horizon Utilities co-ordinates project design and discusses design alternatives for each project with the road authority (City, Municipality, Ministry of Transportation) originating the request to relocate distribution assets.

Summary of Options Analysis (5.4.5.2.C.a.vii)

Horizon Utilities reviews proposed design with municipalities and the Ministry of Transportation, as applicable, in an effort to determine the most cost effective solution.

Final Economic Evaluation Results (5.4.5.2.C.a.viii)

This is not applicable to road relocations.

Identification of System Impacts (5.4.5.2.C.a.ix)

Horizon Utilities follows the *Public Service Works on Highways Act*, 1990 and associated regulations governing the recovery of costs related to road reconstruction work by collecting contributed capital for 50% of the labour; labour saving devices, and equipment rentals. Capital contributions toward the cost of all customer demand projects are collected by Horizon Utilities in accordance with the DSC and the provisions of its Conditions of Service.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2019 Customer Connections
Budget Year	2019
Investment Category	System Access
Project Summary	Projects in this category include multiple projects required to connect, upgrade, or disconnect customers to the distribution system. Horizon Utilities' obligation to connect new customers is governed by the *Electricity Act, 1998, Schedule 28.*

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$5,185,023
Customer Contribution	$820,186
Capital Investment (net)	$4,364,835
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date	Various – as driven by the customer
In Service Date	Various – as driven by the customer

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable investments, net of capital contributions, for the 2010 and 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 1,023,336
2011 (CGAAP)- $ 2,030,541
2012 (MIFRS) - $ 1,652,000
2013 (MIFRS) - $ 3,541,455
2014 (MIFRS) - $ 4,063,471

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name** 2019 Customer Connections Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Access (100%) **Secondary Driver (5.4.5.2.B.1.a)** N/A **Investment Priority (5.4.5.2.B.1.b)** 5 – Mandatory Project **Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)** Please refer to Note III for information on analysis of the project and project alternatives.
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project
	Co-ordination and Interoperability (5.4.5.2.B.4) **Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** This is not applicable for these projects.
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

System Access Specific Requirements (5.4.5.2.C.a)

Project Name	2019 Customer Connections	Table 3

System Access Specific Requirements (5.4.5.2.C.a)

Factors Affecting Implementing Project Timing/Priority (5.4.5.2.C.a.i)

Schedule of work based on customer expectations; customer request may not be standard design.

Factors Related to Customer Preference or 3rd Party Input (5.4.5.2.C.a.ii)

There projects are customer initiated and are designed to meet customer identified requirements.

Factors Affecting Final Project Cost (5.4.5.2.C.a.iii)

Please refer to Note I for an explanation on the factors affecting final project cost.

Controllable Cost Minimization (5.4.5.2.C.a.iv)

Please refer to Note I for an explanation on the factors affecting controllable cost.

Other Planning Objectives (5.4.5.2.C.a.v)

n/a

Assessment of Technical or Implementation Options (5.4.5.2.C.a.vi)

Please refer to Note III for information on the technical and implementation options.

Summary of Options Analysis (5.4.5.2.C.a.vii)

Please refer to Note III for information on results of options analysis.

Final Economic Evaluation Results (5.4.5.2.C.a.viii)

Horizon Utilities completes the economic evaluation for any customer system access project which requires the construction of new facilities to the main distribution system or an increase in the existing capacity of distribution facilities. For further details please see Appendix E of Horizon Utilities' Conditions of Service. The economic evaluation is completed in accordance with section 3.2 of the Distribution System Code ("DSC"). For the 2015-2019 Test Years, Horizon Utilities has no known projects for which to provide the final economic evaluation. When a road authority requests a relocation of Horizon Utilities' plant located on the public road allowance, the costs shall be shared, as outlined in the Ontario *Public Service Works on Highways Act*. Other projects within this category will have an economic evaluation completed where applicable in accordance with both the DSC and Appendix E of Horizon Utilities' Conditions of Service.

Identification of System Impacts (5.4.5.2.C.a.ix)

System expansion, if required, to connect customers within this category are governed by Horizon Utilities' Conditions of Service Section 2.1.2.1.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	AB-F2 Renewal - Bold St
Budget Year	2019
Investment Category	System Renewal
Project Summary	This project involves the renewal of 4kV distribution assets on the Aberdeen F2 feeder as part of the 4kV and 8kV Renewal Plan. The assets are located along Bold St in central Hamilton.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$2,900,412
Customer Contribution	$0
Capital Investment (net)	$2,900,412
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project will impact 1,295 customers and 2000kVA of transformation

Project Dates (5.4.5.2.A.iii)

Start Date 2019/03/01

In Service Date 2019/09/30

Expenditure Timing

Q1	Q2	Q3	Q4
20%	60%	20%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Aberdeen substation as part of the 4kV and 8kV Renewal Plan. The 2019 investment for the renewal of Aberdeen substation is $2,900,000. The 2019 investment in the 4kV and 8kV Renewal Program is $16,846,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 and 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	AB-F2 Renewal - Bold St	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. It is necessary to renew both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of these distribution assets at the current 4kV level was not a feasible alternative

The renewal of the area serviced by Aberdeen substation started in 2017 and is scheduled to be completed in 2021.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name AB-F2 Renewal - Bold St Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The two substations servicing the downtown Hamilton operating area service a total of 7,400 customers and were constructed in 1950 and 1960. The overall Station Health Index for Aberdeen and Central substations is 53% and 56% respectively. The switchgear at the Aberdeen substation is 40 years old; Kinectrics determined its effective age is 54 years old. Kinectrics analysis determined that this switchgear has a high risk of failure within five years. Aberdeen substation, which services 2,600 customers, has inadequate backup for all feeders. The failure of the switchgear at this substation will leave customers without power or subject them to rotating blackouts.

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Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts approximately 1,295 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.137

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Aberdeen substation is scheduled for 2017 to 2021. This project is required to be completed in 2019 to allow for the renewal of the remaining area to be completed on schedule.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Renewal of this area will allow for the decommissioning of the substation assets by 2021 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	BD-F1 Renewal - Alma St
Budget Year	2019
Investment Category	System Renewal
Project Summary	This project involves the renewal of 4kV distribution assets on the Baldwin F1 feeder as part of the 4kV and 8kV Renewal Program. The assets are located along Alma St in Dundas.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$1,943,487
Customer Contribution	$0
Capital Investment (net)	$1,943,487
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project will impact 862 customers and 4000KVA of transformation

Project Dates (5.4.5.2.A.iii)

Start Date 2019/03/01

In Service Date 2019/10/01

Expenditure Timing

Q1	Q2	Q3	Q4
15%	40%	45%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Baldwin substation as part of the 4kV and 8kV Renewal Program. The 2019 investment for the renewal of Baldwin substation is $4,403,000. The 2019 investment in the 4kV and 8kV Renewal Program is $16,846,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	BD-F1 Renewal - Alma St	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)

3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of these distribution assets at the current 4kV level was not a feasible alternative.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name BD-F1 Renewal - Alma St Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The distribution assets in the Dundas operating area are in poor health and have significant operating constraints. The Dundas operating area also contains 25% of the 4kV XLPE cable. The 4kV XLPE cable is in poor health with 38% of the assets having a Health Index of either 'very poor' or 'poor'.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 862 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.029

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Baldwin substation is scheduled for renewal in 2018 and 2019.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	BD-F2 Renewal
Budget Year	2019
Investment Category	System Renewal

Project Summary	This project involves the renewal of 4kV distribution assets on the Baldwin F2 feeder as part of the 4kV and 8kV Renewal Program.		
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$2,336,349	
	Customer Contribution	$0	
	Capital Investment (net)	$2,336,349	
	O&M Expenditure	$0	
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project will impact 862 customers and 4000kVA of transformation		
Project Dates (5.4.5.2.A.iii)	Start Date	2019/03/01	
	In Service Date	2019/09/30	

Expenditure Timing

Q1	Q2	Q3	Q4
15%	40%	45%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Baldwin substation as part of the 4kV and 8kV Renewal Program. The 2019 investment for the renewal of Baldwin substation is $4,403,000. The 2019 investment in the 4kV and 8kV Renewal Program is $16,846,000.

Comparable gross investments for the 4kV and 8kV Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name** BD-F2 Renewal Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This project is part of the multi-year 4kV and 8kV Renewal Program. Both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations are at the end of their useful life. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of these distribution assets at the current 4kV level was not a feasible alternative.
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name BD-F2 Renewal Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The distribution assets in the Dundas operating area are in poor health and have significant operating constraints. The Dundas operating area also contains 25% of the 4kV XLPE cable. The 4kV XLPE cable is in poor health with 38% of the assets having a Health Index of either 'very poor' or 'poor'.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts 862 customers

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.029

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Baldwin substation is scheduled for renewal in 2018 and 2019.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	CE-F4 Renewal – Freeman Place
Budget Year	2019
Investment Category	System Renewal
Project Summary	This project involves the renewal of 4kV distribution assets on the Central F4 feeder as part of the 4kV and 8kV Renewal Program. The assets are located along Freeman Place in central Hamilton.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$647,524
Customer Contribution	$0
Capital Investment (net)	$647,524
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

This project will impact 750 customers and 2500kVA of transformation

Project Dates (5.4.5.2.A.iii)

Start Date 2019/09/01

In Service Date 2019/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
0%	0%	25%	75%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by Central substation as part of the 4kV and 8kV Renewal Program. The 2019 investment for the renewal of Central substation is $648,000. The 2019 investment in the 4kV and 8kV Renewal Program is $16,846,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 and 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	CE-F4 Renewal – Freeman Place	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project is part of the multi-year 4kV and 8kV Renewal Program. It is necessary to renew both the 4kV and 8kV distribution system and the Horizon Utilities-owned substations. Horizon Utilities has chosen to renew the 4kV and 8kV distribution systems to a higher voltage to avoid the cost of the investment in the renewal of the substations. The total avoided substation renewal investment over the remaining 35 years of the plan is $70,000,000 for all 28 substations. Therefore the renewal of these distribution assets at the current 4kV level was not a feasible alternative.

The renewal of the area serviced by Central substation started in 2016 and is scheduled to be completed in 2022.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name CE-F4 Renewal – Freeman Place Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The two substations servicing the downtown Hamilton operating area service a total of 7,400 customers and were constructed in 1950 and 1960. The overall Station Health Index for Aberdeen and Central substations is 53% and 56% respectively. Central substation has ten feeders; six of which are obsolete, oil-filled breakers are at end-of-life. The Health Index for these breakers is "very poor" and Kinectrics identified that this switchgear has a high risk of failure within three years. Central substation has limited interconnection with other substations. The loss of the entire substation would affect all 3100 customers who would be out of power until the substation assets were repaired.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are of the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)
This project impacts approximately 750 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.242

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The renewal of the area serviced by Central substation is schedule for 2016 to 2022. This project is required to be completed in 2016 to allow for the renewal of the remaining area to completed on schedule

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area. Renewal of this area will allow for the decommissioning of the substation assets by 2022 thereby avoiding the need for capital investment into these substations.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2019 Load Break Disconnect Switch ("LBDS") Replacement
Budget Year	2019
Investment Category	System Renewal
Project Summary	This project involves the replacement of LBDS found to be either inoperable or beyond economic repair (where the cost of maintenance is not warranted) as found through Horizon Utilities' maintenance and inspection programs. Such switches will be replaced with automated switches where an operational benefit can be realized. This is a multi-year program based on 16 replacements per year.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$368,000
Customer Contribution	$0
Capital Investment (net)	$368,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2019/06/01

In Service Date 2019/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
0%	0%	50%	50%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv)

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 212,000
2014 (MIFRS) - $ 312,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)
This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name 2019 LBDS Replacement Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This project involves the replacement of LBDS identified as requiring replacement through Horizon Utilities' maintenance and inspection programs. When feasible, the switches are refurbished rather than replaced. Where refurbishment is not possible, the switches will be replaced with an automated switch where an operational benefit can be realized.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Horizon Utilities utilizes the Smart Meter communication infrastructure when communicating with automated switches. Horizon Utilities' Smart Meter and related AMI network have been procured through Elster. Elster's system supports a multi-layered security approach including: access control, authorization, authentication and data integrity protocols. As part of its continuous improvement model, Horizon Utilities performs periodic security assessments to identify opportunities for enhanced system hardening.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

This is not applicable to this project.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name 2019 LBDS Replacement Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

LBDS are critical devices for the operation of the distribution system and are installed at key operating points (e.g. feeder tie points, feeder sectionalizing). Unplanned failures of these devices would impact Horizon Utilities' ability to restore power, resulting in extended outages.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

The asset condition of load break switches relative to their typical lifecycle varies from switch to switch depending upon the operational stresses experienced by the switch. LBDS that are identified for replacement are replaced because they would not operate properly when required and are beyond economical repair.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

None if the project is planned.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

n/a

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

Failure of a LBDS to operate when required can impact Horizon Utilities' operational ability which can adversely affect the service experienced by customers.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each instance.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The timing of this project is dependent upon the timing of Horizon Utilities' LBDS maintenance program.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

Reliability can be adversely affected when a LBDS fails to operate when required as part of switching to restore service.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

LDBS are replaced with an automated switch where an operational benefit can be realized. Otherwise they are replaced on a like-for-like basis.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2019 Proactive Transformer Replacement
Budget Year	2019
Investment Category	System Renewal
Project Summary	This project was established to proactively replace distribution transformers as required. Renewal of distribution transformers in the past has either been reactive upon failure or proactive when included in the 4kV & 8KV Renewal or XLPE Primary Cable Renewal Programs. There are instances where proactive replacement of transformers is required even when the replacement is outside of the scope of the programs mentioned above. This is a multi-year project, based on 25 replacements per year.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$395,000
Customer Contribution	$0
Capital Investment (net)	$395,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2019/06/01

In Service Date 2019/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
0%	0%	50%	50%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 104,447
2012 (MIFRS) - $ 185,523
2013 (MIFRS) - $ 276,978
2014 (MIFRS) - $ 339,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)
This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2019 Proactive Transformer Replacement	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (100%)

Secondary Driver (5.4.5.2.B.1.a)
n/a

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

Proactive transformer replacements are identified through Horizon Utilities' visual inspection programs and PCB testing programs. Proactive replacement criteria include:

- Transformers that have visibly deteriorated and have a high risk of imminent failure;
- Obsolete Transformers that do not have replacement units in inventory and, in a reactive replacement scenario, the customer(s) may be subject to an extended outage duration;
- Transformers that have visible oil leaks; and
- Transformers that have been identified through testing as containing PCBs.

These criteria were selected due to the level of associated risk. Transformers with visible oil leaks or containing PCBs represent a significant environmental risk. All oil spills must be tracked, reported, and the oil reclaimed where possible. Obsolete transformers, where a replacement is not available in inventory, represent a risk of prolonged service interruption upon failure and are replaced to reduce the risk of outage to the customer.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

This is not applicable to this project.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name 2019 Proactive Transformer Replacement Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The transformers selected for proactive replacement represent a level of risk to Horizon Utilities and this project provides risk mitigation consistent with Horizon Utilities asset management objectives.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

The asset condition of these transformers relative to their typical lifecycle varies from transformer to transformer. Transformers selected for replacement present a level of risk to Horizon Utilities either through imminent failure of the transformer or through the need to address environmental risk associated with PCBs; or through the risks associated with transformers that have visible oil leaks.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

n/a

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

n/a

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

These criteria were selected due to the level of associated risk. Transformers with visible oil leaks or containing PCBs represent a significant environmental risk. All oil spills must be tracked, reported, and the oil reclaimed where possible. Obsolete transformers, where a replacement is not available in inventory, represent a risk of prolonged service interruption upon failure and are replaced to reduce the risk of outage to the customer.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each instance.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

n/a

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

n/a.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

n/a.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2019 Substation Infrastructure Renewal
Budget Year	2019
Investment Category	System Renewal
Project Summary	This program involves the renewal of substation infrastructure throughout Horizon Utilities' service territory. Substation maintenance and inspection programs annually identify a number of required investments for the continued safe and reliable operation of Horizon Utilities' substations. Investments under this program include: battery replacements; SCADA and communication upgrades; and grounding improvements

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$500,000
Customer Contribution	$0
Capital Investment (net)	$500,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date 2019/01/01

In Service Date 2019/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv)

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 146,477
2011 (CGAAP)- $ 326,000
2012 (MIFRS) - $ 305,000
2013 (MIFRS) - $ 168,507
2014 (MIFRS) - $ 455,503

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2019 Substation Infrastructure Renewal	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (80%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (20%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

This program is required for the ongoing safe and reliable operation of Horizon Utilities' municipal substations. The 4kV and 8kV Renewal Program is structured to decommission Horizon Utilities' 28 substations over the next 34 years. There is no investment in the renewal of the major electrical assets (power transformers, switchgear and breakers) forecasted for the 2015 to 2019 Test Years. The investments provided above are required to maintain the ancillary substation assets in safe working order. Substation investment requirements are identified though preventative maintenance programs performed on both routine maintenance cycles and monthly inspections. Safety related investments include: installation of eye wash stations; end-of-life replacements of batteries and chargers for the emergency backup breaker operation circuits; and the replacement of end-of-life or obsolete station service transformers. These transformers are required to light and heat the substation and are the main source of power for the substation equipment. Miscellaneous investments include reactive replacement of relays, communication equipment and protection instrument transformers. Investments are required to address both electrical assets within the substation (e.g. replacement of switchgear components and instrument transformers), and ancillary equipment (e.g. SCADA, communication equipment, or backup batteries). All of these components are critical to the continued safe and reliable operation of the substation. A failure to undertake these required investments could lead to premature failure of substation components that would result in a service interruption and increased operating or reactive capital expenditure.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

Environmental Benefits (5.4.5.2.B.6) **(where applicable)**

n/a.

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name 2019 Substation Infrastructure Renewal Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

This project involves investment to replace substation infrastructure required for the continued safe and reliable operation of Horizon Utilities' substations.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

n/a

Number of Customers Impacted (5.4.5.2.C.b.i.3)

n/a.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

n/a

Value of Customer Impact (5.4.5.2.C.b.i.6)

Medium

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The timing of investments in this project is dependent upon the timing of substation maintenance programs and the infrastructure requiring renewal identified while performing maintenance.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on O&M expenditures.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

n/a

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The assets renewed in this program are replaced on a like-for-like basis.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2019 Reactive Renewal
Budget Year	2019
Investment Category	System Renewal
Project Summary	This category includes all projects required for the reactive renewal or repairs driven by emergency equipment failures and associated corrective action. Projects arise from trouble calls or inspection programs identifying an urgent need to replace system assets and the scope of the equipment replacement requires engineering. Also included in this category are projects to address customer power quality issues and Electrical Safety Authority ("ESA") due diligence inspection outcomes.

Capital Investment (5.4.5.2.A.i)		
Capital Investment (gross)	$4,608,000	
Customer Contribution	n/a	
Capital Investment (net)	n/a	
O&M Expenditure	n/a	

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	n/a

Project Dates (5.4.5.2.A.iii)				
Start Date	January 1, 2019			
In Service Date	December 31, 2019			
	Expenditure Timing			
Q1	Q2	Q3	Q4	
25%	25%	25%	25%	

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable investments for the 2010 and 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 8,745,125
2011 (CGAAP)- $ 8,230,970
2012 (MIFRS) - $ 4,032,000
2013 (MIFRS) - $ 6.069,566
2014 (MIFRS) - $ 4,840,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)		
	Project Name 2019 Reactive Renewal	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) No alternatives are considered for these projects as they involve the emergency replacement of failed equipment required to restore service.	
	Safety (5.4.5.2.B.2) These projects are intended to primarily address failed assets however investments required to address immediate safety issues, including issues presenting a potential risk to public safety identified by the ESA, are included in this project.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a	

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	2019 Reactive Renewal	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

These projects are reactive in nature and are initiated from equipment that has failed or with a high risk of failure resulting in a service interruption. These projects have a very high probability of impacting Horizon Utilities' reliability targets.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

These projects address failed assets or assets with a high risk of imminent failure and as such, these assets are at the end of their useful life. The asset condition relative to their typical life cycle varies in each incident or outage.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

The number of customers impacted varies in each incident or outage.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

The quantitative customer impact varies in each incident or outage.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

These projects address customer satisfaction as they are required to address failed assets that have either caused a system interruption, or have a high probability of causing a service interruption.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each incident or outage.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

These projects are reactive in nature and address failed assets, or assets at risk of imminent failure. Investments must be performed when identified.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

Improvements to reliability and security are expected as secondary benefits to this project.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

Investment for this project addresses failed assets, or assets at risk of imminent failure. Investments are not subject to project prioritization as they are reactive and non-discretionary.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

Assets replaced reactively to replace failed assets, or assets at risk of imminent failure are performed on a like-for-like basis. No extra costs to address other distributor planning objectives are incurred with these projects.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2019 Hamilton Mountain XLPE Renewal		
Budget Year	2019		
Investment Category	System Renewal		
Project Summary	Renewal of end-of-life XLPE cable assets in the Hamilton Mountain area.		
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$3,473,233	
	Customer Contribution	$0	
	Capital Investment (net)	$3,473,233	
	O&M Expenditure	$0	
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	The customer and load impacted by this project will vary depending upon the final scope of the project		
Project Dates (5.4.5.2.A.iii)	Start Date	2019/01/01	
	In Service Date	2019/12/31	

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is part of a multi-year investment to renewal XLPE primary cable. The 2019 investment in the XLPE Renewal Program is $10,271,000.

Comparable gross investments for the XLPE Renewal Program for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 1,572,090
2014 (MIFRS) - $ 893,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name** 2019 Hamilton Mountain XLPE Renewal Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 5 – Mandatory Project
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This project is part of the multi-year XLPE Renewal Program. Horizon Utilities considered the four replacement philosophies for addressing risk inherent in the XLPE asset group: Area; Reactive; Selected; and Refurbishment. The area replacement philosophy will be utilized for selected areas of the service territory where the asset health analysis and the failure history indicate a substantial risk of continued failures. A reactive replacement philosophy will continued to be used for the remaining areas of the service territory. The area replacement philosophy will be employed for the Hamilton Mountain operating area due to the high volume of XLPE primary cable. The underground XLPE cable in this area comprises approximately 33% of the total installed XLPE and is the primary cause for 65% of the outages caused by failure of underground assets.
	Safety (5.4.5.2.B.2) These projects are not intended to address safety concerns with the distribution system.
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.
	Economic Development (5.4.5.2.B.5) Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.
	Environmental Benefits (5.4.5.2.B.6) n/a

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	2019 Hamilton Mountain XLPE Renewal	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

XLPE primary cable is the asset group with the largest investment requirement as identified by the Kinectrics ACA. The current backlog volume of XLPE primary cable requiring renewal cannot be addressed in a single year and requires a multiple year investment strategy. The optimal level of renewal for XLPE cable, based on a 40-year useful life replacement cycle, is 50km/year. Horizon Utilities' proposed investment for the 2015 to 2019 Test Years is $36,014,000, which provides for the replacement of 180km of cable over the 2015 to 2019 Test Years. This represents a managed, gradual increase in investment in order to balance rate payer concerns and practical operational limitations.

The Hamilton Mountain operating area has 225km of XLPE primary cable with a Health Index of either "very poor" or "poor". Due to the exponential nature of failures experienced as the 50+ year old cables experience material breakdown, the future cost of required investments will dramatically increase in the short term if not addressed in a systematic manner

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

An analysis of all service interruptions, caused by material or equipment failure from 2010 to 2013, revealed that 50% of service interruptions, measured by customer minutes of outage, were due to failures of underground cable and equipment. Over 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration. These durations far exceed Horizon Utilities' corporate target of one hour and nine minutes of outage on average per customer.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

The customer and load impacted by this project will vary depending upon the final scope of the project.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

The qualitative customer varies for customers affected by this project.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets at risk of failure. Failures of XLPE primary cable result in extended service interruptions; 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

Proactive replacements are required because, as assets continue to age and degrade, the cable will fail at an exponential rate and in the worst case scenario overrunning Horizon Utilities' ability to keep pace with repairs. Reliability will also deteriorate to unacceptable levels. Reactive replacements will be considerably more costly than proactive renewal.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the XLPE primary cable, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the XLPE primary cable system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

Failure to invest in the proactive renewal of XLPE primary cable and associated underground assets would result in unacceptable levels of system failures and outages beyond Horizon Utilities' ability to resolve within a reasonable timeframe as these assets continue to age and degrade. Reactive replacements will also be considerably more costly than the forecast expenditure required to execute the proposed proactive replacement.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

XLPE renewal projects will include: the elimination of radial underground feeds; replacement of below grade transformers with padmount transformers; and the introduction of fusing on the underground distribution systems where applicable.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	JN-F1 Renewal
Budget Year	2019
Investment Category	System Renewal

Project Summary	This project involves the renewal of 4kV distribution assets on the John F1 feeder as part of the 4kV and 8kV Renewal Program. The assets are located along Hatt St in Dundas.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$5,927,519
	Customer Contribution	$0
	Capital Investment (net)	$5,927,519
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project will impact 1048 customers and 5000kVA	
Project Dates (5.4.5.2.A.iii)	Start Date 2019/02/01 In Service Date 2019/09/30	

Expenditure Timing

Q1	Q2	Q3	Q4
15%	40%	45%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by John substation as part of the 4kV and 8kV Renewal Program. The 2019 investment for the renewal of John substation is $8,259,000. The 2019 investment in the 4kV and 8kV Renewal Program is $18,846,000.

Comparable gross investments for the 4kV and 8kV Renewal Program for the 2010 and 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name JN-F1 Renewal	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (60%)

Secondary Driver (5.4.5.2.B.1.a)
System Service (40%)

Investment Priority (5.4.5.2.B.1.b)
3 – Required project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

Renewal of assets at 4kV would not allow for the eventual decommissioning of John substation. Horizon Utilities' substation assets are being decommissioned over the life of the 4kV and 8kV Renewal Program to avoid capital investment required for the renewal of substation assets that are nearing the end of their useful lives.

Safety (5.4.5.2.B.2)

This project is not intended to address safety concerns with the distribution system.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project.

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)
Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)
Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

System Renewal Specific Requirements (5.4.5.2.C.b)	**Project Name** JN-F1 Renewal Table 3 **System Renewal Specific Requirements** (5.4.5.2.C.b) **Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)** The distribution assets in the Dundas operating area are in poor health and have significant operating constraints. The Dundas operating area also contains 25% of the 4kV XLPE cable. The 4kV XLPE cable is in poor health with 38% of the assets having a Health Index of either 'very poor' or 'poor'. **Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)** Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively. **Number of Customers Impacted (5.4.5.2.C.b.i.3)** This project impacts 745 customers. **Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)** SAIDI of 0.025 **Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)** This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area. **Value of Customer Impact (5.4.5.2.C.b.i.6)** High **Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)** The timing of this project is required to co-ordinate with the 4kV and 8kV Renewal Program as involves both the renewal of XLPE primary cable the renewal of the underground section of the John substation F1 feeder. Renewal of this area will allow for the decommissioning of the substation assets by 2019 thereby avoiding the need for capital investment into these substations.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	JN-F2 Renewal
Budget Year	2019
Investment Category	System Renewal

Project Summary	This project involves the renewal of 4kV distribution assets on the John F2 feeder in Dundas as part of the 4kV and 8kV Renewal Plan.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$2,331,019
	Customer Contribution	$0
	Capital Investment (net)	$2,331,019
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project will impact approximately 1,048 customers and 5000kVA of transformation	
Project Dates (5.4.5.2.A.iii)	Start Date	2019/03/01
	In Service Date	2019/09/30

Expenditure Timing

Q1	Q2	Q3	Q4
15%	40%	45%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is one phase of a multi-year investment to renew the area served by John substation as part of the 4kV and 8kV Renewal Program. The 2019 investment for the renewal of John substation is $8,259,000. The 2019 investment in the 4kV and 8kV Renewal Program is $18,846,000.

Comparable gross investments for the 4kv and 8kV Renewal Program for the 2010 and 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 2,556,076
2011 (CGAAP)- $ 8,820,000
2012 (MIFRS) - $ 5,268,441
2013 (MIFRS) - $ 5,072,233
2014 (MIFRS) - $ 6,434,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

	Leave to Construct Approval (5.4.5.2.A.vii) This project does not require "Leave to Construct" under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	**Project Name** JN-F2 Renewal	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (60%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (40%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Renewal of assets at 4kV would not allow for the eventual decommissioning of John substation. Horizon Utilities' substation assets are being decommissioned over the life of the 4kV and 8kV Renewal Plan to avoid capital investment required for the renewal of substation assets that are nearing the end of their useful lives.	
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a	

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	JN-F2 Renewal	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

The distribution assets in the Dundas operating area are in poor health and have significant operating constraints. The Dundas operating area also contains 25% of the 4kV XLPE cable. The 4kV XLPE cable is in poor health with 38% of the assets having a Health Index of either 'very poor' or 'poor'.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

Generally the 4kV assets are the oldest vintage in the system. The 4kV distribution system experienced 225% and 254% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively for outages caused by all cause codes over the four year period from 2010 to 2013. When considering only outages caused by equipment failures over this same period, the 4kV distribution system experienced 240% and 256% more outages per circuit km than the 13.8kV and 27.6kV distribution systems respectively.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts approximately 1,048 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.036

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The timing of this project is required to co-ordinate with the 4kV and 8kV Renewal Program as involves both the renewal of XLPE primary cable the renewal of the underground section of the John substation F2 feeder. Renewal of this area will allow for the decommissioning of the substation assets by 2019 thereby avoiding the need for capital investment into these substations.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the 4kV and 8kV distribution system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project, as part of the 4kV and 8kV Renewal Program, is determined through the assessment of the distribution system health and the health of the substation assets servicing the area.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2019 Pole Residual Replacements
Budget Year	2019
Investment Category	System Renewal
Project Summary	This project involves the replacement of wood poles identified by pole residual testing as having a high risk of failure.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$1,368,894
Customer Contribution	$0
Capital Investment (net)	$1,368,894
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date	2019/01/01
In Service Date	2019/06/30

Expenditure Timing

Q1	Q2	Q3	Q4
50%	50%	0%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 1,326,407
2011 (CGAAP)- $ 895,000
2012 (MIFRS) - $ 930,000
2013 (MIFRS) - $ 718,074
2014 (MIFRS) - $ 1,190,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)

Project Name	2019 Pole Residual Replacements	Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)
System Renewal (100%)

Secondary Driver (5.4.5.2.B.1.a)
N/A

Investment Priority (5.4.5.2.B.1.b)

5 – Mandatory Project

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

The replacement of wood poles in this project is identified through Horizon Utilities' pole testing maintenance program. The pole testing categorized the poles requiring replacement into two categories: 1) requiring immediate replacement; and 2) requiring replacement within five years.

Horizon Utilities replaces poles requiring immediate replacement as soon as possible to mitigate the risk of service interruptions and the risk to public safety resulting from a failure of the pole.

Horizon Utilities replaces poles requiring replacement within five years in the following year. Failure to replace in the following year compounds the volume of work in subsequent years resulting in cascading delays and compounded volumes in subsequent years.

Poles replaced in this project are replaced on a like-for-like basis where possible.

Safety (5.4.5.2.B.2)

This project will address wood poles requiring replacement as identified through testing. Renewal of these assets prior to failure avoids the potential risk to public safety that would result from a failure of a wood pole.

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)

Cyber-Security and Privacy are not applicable to this project

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties.

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

This is not applicable to this project.

Economic Development (5.4.5.2.B.5) **(where applicable)**

Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.

	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

System Renewal Specific Requirements (5.4.5.2.C.b)	**Project Name**	2019 Pole Residual Replacements	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

This project is reactive in nature the work required is initiated through Horizon Utilities maintenance and inspection programs. This project has a very high probability of impacting Horizon Utilities' reliability targets if the poles are not replaced.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

This project addresses wood poles that have been identified as having a high risk of failure and as such, these assets are at the end of their useful life. The asset condition relative to their typical life cycle varies in case.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

The number of customers impacted varies in each incident or outage.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

The quantitative customer impact varies in each incident or outage.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

These projects address customer satisfaction as they are required to address assets at risk of failure which would result in a service interruption.

Value of Customer Impact (5.4.5.2.C.b.i.6)

The value of the customer impact varies in each incident or outage.

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

These projects are reactive in nature and address assets at risk of failure. Horizon Utilities replaces poles requiring immediate replacement as soon as possible to mitigate the risk of service interruptions and the risk to public safety resulting from a failure of the pole.

Horizon Utilities replaces poles requiring replacement within five years in the following year. Failure to replace in the following year compounds the volume of work in subsequent years resulting in cascading delays and compounded volumes in subsequent years.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

These projects do not materially impact system O&M costs.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

This project will provide reliability and safety benefits as the project involves the replacement of wood poles that are at risk of failure. Failure of the asset would result in a service interruption and a potential risk to public safety.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

n/a

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

Poles replaced in this project are replaced on a like-for-like basis where possible as this presents the lowest cost option. No additional costs are incurred to address other distributor planning objectives.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	YK-F2 Watsons Lane XLPE Renewal
Budget Year	2019
Investment Category	System Renewal

Project Summary	This project involves the renewal of 4kV XLPE distribution assets on the York F2 feeder as part of the 4kV and 8kV Renewal Program.	
Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$2,216,862
	Customer Contribution	$0
	Capital Investment (net)	$2,216,862
	O&M Expenditure	$0
Customer Attachments / Load (kVA) (5.4.5.2.A.ii)	This project will impact approximately 400 customers and 1000kVA of transformation	
Project Dates (5.4.5.2.A.iii)	Start Date	2019/07/01
	In Service Date	2019/12/31

Expenditure Timing			
Q1	Q2	Q3	Q4
0%	0%	50%	50%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project supports both the 4kV and 8kV Renewal Program and the XLPE Renewal Program.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)			
	Project Name	YK-F2 Watsons Lane XLPE Renewal	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project		
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Renewal of assets at 4kV would not allow for the eventual decommissioning of York Substation. Horizon Utilities' substation assets are being decommissioned over the life of the 4kV and 8kV Renewal Program to avoid capital investment required for the renewal of substation assets that are nearing the end of their useful lives.		
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.		
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.		
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.		
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a		

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	YK-F2 Watsons Lane XLPE Renewal	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

XLPE primary cable is the asset group with the largest investment requirement as identified by the Kinectrics ACA. The current backlog volume of XLPE primary cable requiring renewal cannot be addressed in a single year and requires a multiple year investment strategy. The optimal level of renewal for XLPE cable, based on a 40-year useful life replacement cycle, is 50km/year. Horizon Utilities' proposed investment for the 2015 to 2019 Test Years is $36,014,000, which provides for the replacement of 180km of cable over the 2015 to 2019 Test Years. This represents a managed, gradual increase in investment in order to balance rate payer concerns and practical operational limitations.

The Dundas operating area has 13.5km of XLPE cable with a Health Index of either "very poor" or "poor".

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

An analysis of all service interruptions, caused by material or equipment failure from 2010 to 2013, revealed that 50% of service interruptions, measured by customer minutes of outage, were due to failures of underground cable and equipment. Over 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration. These durations far exceed Horizon Utilities' corporate target of one hour and nine minutes of outage on average per customer. Generally the 4kV assets are of the oldest vintage in the system.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

This project impacts approximately 400 customers.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

SAIDI of 0.014

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets with inadequate backup. Aging assets represent an increased risk of service interruption to customers and inadequate backup would result in long duration service interruptions upon occurrence. These factors would lead to customer dissatisfaction in this area.

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

The timing of this project is required to co-ordinate with the 4kV and 8kV Renewal Program as involves both the renewal of XLPE primary cable the renewal of the underground section of the York substation F2 feeder. Renewal of this area will allow for the decommissioning of the substation assets by 2019 thereby avoiding the need for capital investment into these substations.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the 4kV and 8kV distribution systems, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years.

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of XLPE primary cable will provide reliability improvements through reduced service interruptions caused by failed equipment. The cable renewed by this project is direct buried and therefore subject to extended outages, requiring multiple hours to repair, upon failure.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

The timing of this project is required to co-ordinate with the 4kV and 8kV Renewal Program as involves both the renewal of XLPE primary cable the renewal of the underground section of the York substation F2 feeder.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

The like-for-like renewal of these assets (i.e. same system configuration and same distribution voltage) will perpetuate the existing operating constraints and require capital investment to renew substation assets. Renewal of the distribution assets at a higher voltage does not involve any material incremental costs over renewal at the existing voltage. Operating constraints (e.g. undersized conductor, radial feeds) are addressed on a case by case basis where appropriate.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	2019 St. Catharines XLPE Renewal
Budget Year	2019
Investment Category	System Renewal
Project Summary	This project involves the renewal of direct buried XLPE primary cable in the St. Catharines service territory.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$4,096,184
Customer Contribution	$0
Capital Investment (net)	$4,096,184
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

The customer and load impacted by this project will vary depending upon the final scope of the project.

Project Dates (5.4.5.2.A.iii)

Start Date 2019/01/01

In Service Date 2019/12/31

Expenditure Timing

Q1	Q2	Q3	Q4
20%	30%	30%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv)

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There is no direct comparator in scope, size and design characteristics for this project. This project is part of a multi-year investment to renewal XLPE primary cable. The 2019 investment in the XLPE Renewal Program is $10,271,000.

Comparable gross investments for the XLPE Renewal Program for the 2010 to 2013 Historical Year and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 0
2013 (MIFRS) - $ 1,572,090
2014 (MIFRS) - $ 893,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)		
	Project Name	2019 St. Catharines XLPE Renewal Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Renewal (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Service (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This project is part of the multi-year XLPE Renewal Program. Horizon Utilities considered the four replacement philosophies for addressing risk inherent in the XLPE asset group: Area; Reactive; Selected; and Refurbishment. The area replacement philosophy will be utilized for selected areas of the service territory where the asset health analysis and the failure history indicate a substantial risk of continued failures. A reactive replacement philosophy will continued to be used for the remaining areas of the service territory. The St. Catharines operating area contains many small pockets of direct buried XLPE primary cable. The XLPE renewal projects in the St. Catharines operating area will involve the full renewal of each pocket of XLPE cable. Project selection will be guided by asset health, operating history, and reliability of each of the underground pockets of XLPE.	
	Safety (5.4.5.2.B.2) These projects are not intended to address safety concerns with the distribution system.	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensure all policies and practices don't unnecessarily create barriers to economic development which are primarily focused within our communities.	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a.	

System Renewal Specific Requirements (5.4.5.2.C.b)

Project Name	2019 St. Catharines XLPE Renewal	Table 3

System Renewal Specific Requirements (5.4.5.2.C.b)

Asset Performance Target and Asset Lifecycle Optimization (5.4.5.2.C.b.i.1)

XLPE primary cable is the asset group with the largest investment requirement as identified by the Kinectrics ACA. The current backlog volume of XLPE primary cable requiring renewal cannot be addressed in a single year and requires a multiple year investment strategy. The optimal level of renewal for XLPE cable, based on a 40-year useful life replacement cycle, is 50km/year. Horizon Utilities' proposed investment for the 2015 to 2019 Test Years is $36,014,000, which provides for the replacement of 180km of cable over the 2015 to 2019 Test Years. This represents a managed, gradual increase in investment in order to balance rate payer concerns and practical operational limitations.

Asset Condition Relative to Typical Life Cycle (5.4.5.2.C.b.i.2)

An analysis of all service interruptions, caused by material or equipment failure from 2010 to 2013, revealed that 50% of service interruptions, measured by customer minutes of outage, were due to failures of underground cable and equipment. Over 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration. These durations far exceed Horizon Utilities' corporate target of one hour and nine minutes of outage on average per customer.

Number of Customers Impacted (5.4.5.2.C.b.i.3)

The number of customers impacted will vary depending upon the area.

Quantitative Customer Impact and Risk (5.4.5.2.C.b.i.4)

The quantitative customer impact varies.

Qualitative Customer Impact and Risk (5.4.5.2.C.b.i.5)

This project will address aging assets at risk of failure. Failures of XLPE primary cable result in extended service interruptions with 30% of these outages exceeded four hours in duration, while 5% of these outages exceeded twelve hours in duration

Value of Customer Impact (5.4.5.2.C.b.i.6)

High

Other Factors Affecting Project Timing (5.4.5.2.C.b.ii)

Proactive replacements are required because, as assets continue to age and degrade, the cable will fail at an exponential rate. In the worst case scenario, it will exceed Horizon Utilities' ability to keep pace with repairs. Reliability will also deteriorate to unacceptable levels. Reactive replacements will be considerably more costly than proactive renewal.

Impact on System O&M Costs (5.4.5.2.C.b.iii)

This project will have no material impact on planned O&M costs. The renewal of the XLPE primary cable, as a whole, will provide a reduction in reactive O&M costs to address service interruptions caused by failed equipment. These reductions will not be material in the 2015 to 2019 Test Years

Reliability and Safety Factors (5.4.5.2.C.b.iv)

The renewal of the XLPE primary cable system will provide reliability improvements through reduced service interruptions caused by failed equipment.

Analysis of Project Benefits and Timing (5.4.5.2.C.b.v)

Failure to invest in the proactive renewal of XLPE primary cable and associated underground assets would result in unacceptable levels of system failures and outages beyond Horizon Utilities' ability to resolve within a reasonable timeframe as these assets continue to age and degrade. Reactive replacements will also be considerably more costly than the forecast expenditure required to execute the proposed proactive replacement.

Like-for-Like Renewal Analysis (5.4.5.2.C.b.vi)

XLPE renewal projects will include: the elimination of radial underground feeds; replacement of below grade transformers with padmount transformers; and the introduction of fusing on the underground distribution systems where applicable.

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	Security – Lake 141X Grays Road
Budget Year	2019
Investment Category	System Service
Project Summary	This project involves upgrading the conductor size of the main trunk line to accommodate a full capacity tie with an adjacent feeder.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$412,551
Customer Contribution	$0
Capital Investment (net)	$412,551
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date	2019/01/01
In Service Date	2019/05/01

Expenditure Timing

Q1	Q2	Q3	Q4
75%	25%	0%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There are no equivalent projects for comparison.

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)			
	Project Name	Security – Lake 141X Grays Road	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** System Service (80%) **Secondary Driver (5.4.5.2.B.1.a)** System Renewal (20%) **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project		
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) No alternatives exist to provide redundancy to this area of Grays Road.		
	Safety (5.4.5.2.B.2) These projects are not intended to address safety concerns with the distribution system.		
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.		
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.		
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.		
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a		

System Service Specific Requirements (5.4.5.2.C.c)

Project Name	Security – Lake 141X Grays Road	Table 3

System Service Specific Requirements (5.4.5.2.C.c)

Benefit to Customers (5.4.5.2.C.c.i)

This project will provide redundancy to the customers serviced by this radial fed section of 13.8kV distribution system.

Regional Planning Requirements (5.4.5.2.C.c.i)

n/a

Integration of Advance Technology (5.4.5.2.C.c.iii)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

System Benefits to Reliability, Efficiency and Safety (5.4.5.2.C.c.iv)

n/a

Factors Affecting Implementing Timing/Priority (5.4.5.2.C.c.v)

n/a

Summary of Options Analysis (5.4.5.2.C.c.vi)

n/a

Capital Project Summary

General Information on Project (5.4.5.2.A)

Project Name	Mohawk/Nebo TS Upgrade
Budget Year	2019
Investment Category	System Service
Project Summary	Payment planned for Hydro One to upgrade the capacity at either Mohawk TS or Nebo TS (13.8kV bus) as load forecasts project the loading to encroach on the 10-day LTR rating at these stations in the medium term.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$1,000,000
Customer Contribution	$0
Capital Investment (net)	$1,000,000
O&M Expenditure	$0

Customer Attachments / Load (kVA) (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date	2019/07/01
In Service Date	2019/08/01

Expenditure Timing

Q1	Q2	Q3	Q4
0%	0%	100%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Please refer to Note I for risk and risk mitigation.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

The Nebo TS upgrade was the only comparable project in the 2010 to 2013 Historical Years and the 2014 Bridge Year. The Nebo TS expenditures were:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 970,000
2013 (MIFRS) - $ 1,450,000
2014 (MIFRS) - $ 1,708,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

This project is not associated with an REG investment and therefore OM&A costs related to REG will not be incurred.

Leave to Construct Approval (5.4.5.2.A.vii)

This project does not require “Leave to Construct” under Section 92 of the *Ontario Energy Board Act* 1998.

Evaluation Criteria and Information (5.4.5.2.B)	
	Project Name Mohawk/Nebo TS Upgrade Table 2
	Investment Driver (5.4.5.2.B.1.a) System Service (100%) **Secondary Driver (5.4.5.2.B.1.a)** N/A **Investment Priority (5.4.5.2.B.1.b)** 3 – Required project
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) This project is required to address capacity issues in the Hamilton Mountain operating area. There are three Hydro One transformer stations that supply this area and Horizon Utilities will co-ordinate with Hydro One to determine the most appropriate station to upgrade. The loading of each of the existing transformer stations; the area where the load growth is occurring; and the investment required to upgrade each station will be leveraged to determine the best option.
	Safety (5.4.5.2.B.2) This project is not intended to address safety concerns with the distribution system.
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) Cyber-Security and Privacy are not applicable to this project.
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** Please refer to Note II for an explanation on co-ordination with utilities, regional planning and/or links with 3rd parties. **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Please refer to Note IV for an explanation enabling of future technology and future operational requirements.
	Economic Development (5.4.5.2.B.5) **(where applicable)** Horizon Utilities ensures that policies and practices do not unnecessarily create barriers to economic development which are primarily focused within its communities.
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

System Service Specific Requirements (5.4.5.2.C.c)

Project Name	Mohawk/Nebo TS Upgrade	Table 3

System Service Specific Requirements (5.4.5.2.C.c)

Benefit to Customers (5.4.5.2.C.c.i)

This project will allow for continued load growth.

Regional Planning Requirements (5.4.5.2.C.c.i)

This project involves the upgrade of a Hydro One owned TS. Horizon Utilities will co-ordinate the investment requirements with Hydro One.

Integration of Advance Technology (5.4.5.2.C.c.iii)

Please refer to Note IV for an explanation enabling of future technology and future operational requirements.

System Benefits to Reliability, Efficiency and Safety (5.4.5.2.C.c.iv)

n/a

Factors Affecting Implementing Timing/Priority (5.4.5.2.C.c.v)

The timing for this investment will depend upon the timing of Hydro One's upgrade of the station.

Summary of Options Analysis (5.4.5.2.C.c.vi)

n/a

2019 General Plant Investments

Capital Project Summary

Project Name	Annual Corporate Computer Replacement
Budget Year	2019
Investment Category	General Plant
Project Summary	This project is part of an ongoing business requirement to refresh end user computers. Horizon Utilities utilizes a three-year lifecycle for replacement of end user computers. On an annual basis, approximately one third of all Horizon Utilities computers (~150 PCs/year) are replaced.

Capital Investment (5.4.5.2.A.i)		
	Capital Investment (gross)	$361,200
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)	n/a

Project Dates (5.4.5.2.A.iii)				
	Start Date	Jan. 2019		
	In Service Date	Dec. 2019		
	Expenditure Timing			
	Q1	Q2	Q3	Q4
	25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Schedule - Implementation is phased throughout the year starting in January and ending in December based on age of PCs being replaced.

Risk – The primary risk to this project is product availability from suppliers.
Risk Mitigation – Work closely with suppliers to schedule orders based on required delivery times.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for the annual corporate computer replacement for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 336,000
2011 (CGAAP)- $ 227,000
2012 (MIFRS) - $ 312,000
2013 (MIFRS) - $ 364,947
2014 (MIFRS) - $ 366,200

Total Capital and OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)
n/a

Leave to Construct Approval (5.4.5.2.A.vii)
n/a

Evaluation Criteria and Information		
	Project Name	2019 Annual Corporate Computer Replacement Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant (100%) **Secondary Driver (5.4.5.2.B.1.a)** n/a **Investment Priority (5.4.5.2.B.1.b)** High Priority – Personal computers are treated as a strategic asset. They are Horizon Utilities' primary staff productivity tool. They are used to: maintain and deliver services to customers; improve staff productivity; cost-effectively manage total cost of PC ownership; and, support investments in new applications, infrastructure and business capabilities	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) n/a	
	Safety (5.4.5.2.B.2) n/a	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** Suppliers of enterprise systems such as, GIS, OMS, SCADA, AMI, and IFS ERP, are constantly upgrading their products to deliver new processes and functionality. As new versions are released up-to-date hardware is required to perform required upgrades to maintain vendor support for the systems.	
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a	
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a	

General Plant Specific Requirements

Project Name	2019 Annual Corporate Computer Replacement	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

n/a

Business Case Justification Documentation (5.4.5.2.C.d.i)

Horizon Utilities' PCs are treated as a strategic asset, because they are the primary staff productivity tool. Horizon Utilities has streamlined its PC lifecycle management processes utilizing a PC refresh cycle of three years, in order to: deliver, maintain and improve services to customers; to improve staff productivity; to cost-effectively manage total cost of PC ownership; and to support investments in new applications, infrastructure and business capabilities.

A three-year PC refresh cycle reduces the total cost of ownership by reducing the number of models of PCs supported, which results in the reduction of the IST service desk effort required to deploy, secure, and manage new systems and applications. The reduction in the number of supported models has allowed Horizon Utilities to introduce mobile computing for remote field workers and to increase the number of supported PCs by over 100 devices since 2011, without an increase in IST service desk support staff.

A refresh lifecycle of three years reduces the likelihood of device failures that lead to a loss of staff productivity and increased IT support effort. Over 50% of Horizon Utilities' staff utilizes a mobile PC (laptop or tablet) in the performance of their daily activities, many in harsh operating environments outside the office, which increases the likelihood of failure due to operating environment and the age of the device.

Horizon Utilities has introduced several new enterprise business and engineering systems to: mitigate business risks related to aging systems (e.g. GIS); improve electricity system operation (i.e. GIS, OMS); and to address end of vendor support for systems (i.e. IFS ERP, Microsoft Windows XP). Maintaining a three-year PC lifecycle refresh program allows Horizon Utilities' to migrate to these applications without a need to make large one-time investments in PCs to meet the minimum operating requirements of new applications.

PCs are the primary productivity tool used by Horizon Utilities' staff. Unreliable and slow PCs impact productivity and customer service.

Minimizing the number of supported models reduces the IST support effort required to manage, order, configure, and deploy PCs and it reduces the total cost of ownership for PCs.

Capital Project Summary

Project Name	Storage Area Network ("SAN") Expansion
Budget Year	2019
Investment Category	General Plant
Project Summary	This is a risk management and sustainment project to ensure adequate data storage capacity for Horizon Utilities at the production data centre in Hamilton and the disaster recovery data centre in St. Catharines. The project involves the expansion of the existing SAN in both the production and disaster recovery data centres.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$300,000
Customer Contribution	n/a
Capital Investment (net)	n/a
O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)

N/A

Project Dates (5.4.5.2.A.iii)

Start Date May 2019

In Service Date June 2019

Expenditure Timing

Q1	Q2	Q3	Q4
0%	100%	0%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Schedule - Implementation June 2019

Risk – The primary risk to this project is product availability from suppliers.

Risk Mitigation – Work closely with suppliers to schedule orders based on required delivery times.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There are no comparable projects in scope and nature for comparison.

Total Capital and OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)
n/a

Leave to Construct Approval (5.4.5.2.A.vii)
n/a

Evaluation Criteria and Information	
	Project Name Storage Area Network (“SAN”) Expansion Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant (100%) **Secondary Driver (5.4.5.2.B.1.a)** n/a **Investment Priority (5.4.5.2.B.1.b)** High Priority – This is a risk mitigation project to ensure adequate disk storage capacity.
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) n/a
	Safety (5.4.5.2.B.2) n/a
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)**
	Suppliers of enterprise systems such as, GIS, OMS, SCADA, AMI, and IFS ERP, are constantly upgrading their products to deliver new processes and functionality. As new versions are released up-to-date hardware is required to perform required upgrades to maintain vendor support for the systems. **Economic Development** (5.4.5.2.B.5) **(where applicable)**
	n/a **Environmental Benefits** (5.4.5.2.B.6) **(where applicable)**

General Plant Specific Requirements

Project Name	Storage Area Network ("SAN") Expansion	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

N/A

Business Case Justification Documentation (5.4.5.2.C.d.i)

This project is required to support Horizon Utilities' annual data growth rate which, based on historical experience, exceeds 30% per annum. The data growth rate is expected to increase during the 2015-2019 Test Years as new applications such as, GIS and OMS are implemented and operationalized.

This investment in SAN expansion will eliminate risk related to insufficient storage capacity to support day-to-day business operations.

The risk of not proceeding with this project is that Horizon Utilities will not have enough disk storage capacity to sustain its systems environment to meet business requirements.

Capital Project Summary

Project Name	2019 Capital Lease – IBM
Budget Year	2019
Investment Category	General Plant
Project Summary	This project is the end of lease replacement of the IBM iSeries server hardware environment used to run the Daffron Customer Information System ("CIS") which supports Horizon Utilities' customer management and meter-to-cash processes. The hardware is a three-year lease with planned renewals in 2016 and 2019. The environment includes a production IBM iSeries server in Hamilton and an identical IBM iSeries server at the Disaster Recovery Data Centre in St. Catharines.

Capital Investment (5.4.5.2.A.i)

Capital Investment (gross)	$900,000
Customer Contribution	n/a
Capital Investment (net)	n/a
O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)

n/a

Project Dates (5.4.5.2.A.iii)

Start Date January 2019

In Service Date January 2019

Expenditure Timing

Q1	Q2	Q3	Q4
100%	0%	0%	0%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Schedule - Implementation January 2019

Risk – The primary risk to this project is product availability from suppliers.

Risk Mitigation – Work closely with suppliers to schedule orders based on required delivery times.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

There are no comparable projects in scope and nature for comparison.

Total Capital and OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)
n/a

Leave to Construct Approval (5.4.5.2.A.vii)
n/a

Evaluation Criteria and Information		
	Project Name 2019 Capital Lease – IBM	Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant (100%) **Secondary Driver (5.4.5.2.B.1.a)** n/a **Investment Priority (5.4.5.2.B.1.b)** High Priority – This project is required for the continued operation of Horizon Utilities' CIS system.	
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) n/a	
	Safety (5.4.5.2.B.2) n/a	
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a	
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)**	
	n/a **Economic Development** (5.4.5.2.B.5) **(where applicable)**	
	n/a **Environmental Benefits** (5.4.5.2.B.6) **(where applicable)** n/a	

General Plant Specific Requirements

Project Name	2019 Capital Lease – IBM	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

N/A

Business Case Justification Documentation (5.4.5.2.C.d.i)

The IBM iSeries hardware lease will expire December 31, 2015 and December 31, 2018. This environment is required to maintain the continued operation of Horizon Utilities' Daffron CIS system to ensure appropriate technology for the customer management and meter-to-cash processes. Replacement of the IBM iSeries hardware at end-of-life reduces the likelihood of hardware failures that could disrupt normal business operations, impacting Horizon Utilities' ability to: read Smart Meters; bill customers; apply customer payments; manage customer interactions; and, manage customer work orders.

Capital Project Summary

Project Name	2019 Vehicle Replacement
Budget Year	2019
Investment Category	General Plant

Project Summary;

Horizon Utilities has identified a number of current vehicles that required replacement as they have reached end-of-life as per the criteria within Horizon Utilities' Fleet Replacement Plan.

Other expected objectives and outcomes are to:

- Maintain vehicle reliability and availability;
- Reduce fuel consumption;
- Reduce emissions;
- Reduce down time required to conduct maintenance and repairs; and
- Maintain customer response time.

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$785,000
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)

Project Dates (5.4.5.2.A.iii)

Start Date	March 2019
In Service Date	December 2019

Expenditure Timing

Q1	Q2	Q1	Q2
0%	0%	50%	50%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Risk – The primary risk to this project is product availability and adherence to delivery schedules from suppliers.

Risk Mitigation – Work closely with suppliers to schedule orders based on required delivery times.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for vehicle replacements for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 1,590,516
2011 (CGAAP)- $ 1,033,975
2012 (MIFRS) - $ 1,057,410
2013 (MIFRS) - $ 36,365
2014 (MIFRS) - $ 785,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)
n/a

Evaluation Criteria and Information

Project Name: 2019 Vehicle Replacement Table 2

Efficiency, Customer Value, Reliability (5.4.5.2.B.1)

Investment Driver (5.4.5.2.B.1.a)

General Plant – 100%

Secondary Driver (5.4.5.2.B.1.a)
n/a

Investment Priority (5.4.5.2.B.1.b)

High

Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)

n/a

Safety (5.4.5.2.B.2)

n/a

Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)
n/a

Co-ordination and Interoperability (5.4.5.2.B.4)

Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)

n/a

Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)

n/a

Economic Development (5.4.5.2.B.5) (where applicable)

n/a

Environmental Benefits (5.4.5.2.B.6) (where applicable)

n/a

General Plant Specific Requirements

Project Name	2019 Vehicle Replacement	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

Horizon Utilities uses the data collected from electronic fleet and fuel management system, the Global Positional System ("GPS") data which includes engine hours, power take-off ("PTO"), engine idling hours, traffic patterns, utilization, and mileage to determine the optimal maintenance scheduling and vehicle maintenance and repairs activities to determine the maintenance scheduling and vehicles replacements.

Business Case Justification Documentation (5.4.5.2.C.d.i)

To maintain the quality, reliability and availability of Horizon Utilities' vehicle fleet to Construction and Maintenance, Metering Services and corporate group activities, vehicles are assessed annually based on a replacement criteria matrix defined within the Fleet Replacement Plan.

Replacement strategies also ensure that Horizon Utilities maintains safe vehicles for employees, while targeting reduced emissions, as well as reduced fuel, operating and maintenance costs. During the next six years, Horizon Utilities will not be procuring any net new vehicles and instead will focus on the replacement of end of life vehicles.

Due to budget mitigation efforts in 2011, 2012, and 2013 a number of vehicles scheduled for replacement were kept in operation and rescheduled for replacement in 2014. It is now critical that these vehicles be replaced as maintenance and repairs costs have increased and the vehicles no longer operate at full capacity, reducing vehicle availability and impacting service delivery.

Regular vehicle replacement is necessary to avoid undue vehicle downtime and associated negative impacts to customer response time and employee productivity.

Capital Project Summary

Project Name	2019 Tools, Shop and Garage Equipment
Budget Year	2019
Investment Category	General Plant

Project Summary
This program includes capital expenditures pertaining to the replacement of tools, shop and garage equipment, which are either worn, have come to the end of their useful life, or where the continued use of such creates health and safety risk.

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$580,600
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii)	n/a

Project Dates (5.4.5.2.A.iii)

Start Date	January 2019
In Service Date	December 2019

Expenditure Timing

Q1	Q2	Q3	Q4
25%	25%	25%	25%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Risk – n/a

Risk Mitigation – n/a

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

n/a

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)

n/a

Evaluation Criteria and Information	
	Project Name: 2019 Tools, Shop and Garage Equipment Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant (100%) **Secondary Driver (5.4.5.2.B.1.a)** n/a
	Investment Priority (5.4.5.2.B.1.b) High **Analysis of Project and Project Alternatives (5.4.5.2.B.1.c)** Tools and equipment over $5000 are procured through a competitive process and alternatives are considered at the time of requisition.
	Safety (5.4.5.2.B.2) Tools and equipment meet CSA requirements and are reviewed for conformance to requirements by Horizon Utilities' Tool & Equipment Committee.
	Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable) n/a
	Co-ordination and Interoperability (5.4.5.2.B.4) **Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable)** n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** n/a
	Economic Development (5.4.5.2.B.5) **(where applicable)** n/a
	Environmental Benefits (5.4.5.2.B.6) **(where applicable)** n/a

General Plant Specific Requirements

Project Name	2019 Tools, Shop and Garage Equipment	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Su**mmary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)**

Each year a condition assessment is conducted on the inventory of tools and equipment in use, to determine a forecast for expected replacements. Feedback from the crews that use the tools and equipment, together with feedback from the Fleet Mechanics who maintain the tools and equipment on each vehicle is used to establish the annual budgets. It becomes unsafe, costly and inefficient to use or maintain this type of equipment which has reached the end of its useful life.

New tools become available on the market, on a periodic basis, that offer improved safety, ergonomics and productivity features which Horizon Utilities evaluates for use. Changes in regulations, which require a different standard of equipment, may necessitate a replacement of tools and equipment. Fall arrest equipment for example, needs to be exchanged when new standards come into effect, and any required new equipment is included in the budget

Business Case Justification Documentation (5.4.5.2.C.d.i)

n/a

Capital Project Summary

Project Name	2019 Facility Renovations – Stoney Creek
Budget Year	2019
Investment Category	General Plant

Project Summary;

The objectives of this project planned for 2019 is to replace end-of-life facilities in the Stoney Creek Service Centre and to support current and planned work force. This project will: enhance the quality of workplaces for employees; reduce safety risks; remove hazardous materials; and improve the use of existing space.

Capital Investment (5.4.5.2.A.i)	Capital Investment (gross)	$1,200,000
	Customer Contribution	n/a
	Capital Investment (net)	n/a
	O&M Expenditure	n/a

Customer Attachments / Load (5.4.5.2.A.ii): n/a

Project Dates (5.4.5.2.A.iii)

Start Date: March 2019

In Service Date: December 2019

Expenditure Timing

Q1	Q2	Q1	Q2
10%	30%	30%	30%

Schedule Risk and Risk Mitigation (5.4.5.2.A.iv**)**

Project timelines and costs exceeding the budget are risks. The project manager will report regularly on project timelines and adherence to budget and escalates issues for resolution.

Comparative Information from Equivalent Projects (5.4.5.2.A.v)

Comparable gross investments for building renovations for the 2010 to 2013 Historical Years and the 2014 Bridge Year are:

2010 (CGAAP)- $ 0
2011 (CGAAP)- $ 0
2012 (MIFRS) - $ 1,767,000
2013 (MIFRS) - $ 5,490,000
2014 (MIFRS) - $ 3,700,000

Total Capital OM&A Costs Associated with REG Investments (5.4.5.2.A.vi)

n/a

Leave to Construct Approval (5.4.5.2.A.vii)

n/a

Evaluation Criteria and Information	**Project Name:** 2019 Facility Renovations – Stoney Creek Table 2
	Efficiency, Customer Value, Reliability (5.4.5.2.B.1) **Investment Driver (5.4.5.2.B.1.a)** General Plant – 100% **Secondary Driver (5.4.5.2.B.1.a)** n/a **Investment Priority (5.4.5.2.B.1.b)** High
	Analysis of Project and Project Alternatives (5.4.5.2.B.1.c) Horizon Utilities' building renovation plans were developed through a facilities planning process that utilized the outputs of a space planning study and multiple building assessments. **Safety** (5.4.5.2.B.2)
	n/a **Cyber-Security and Privacy (5.4.5.2.B.3) (where applicable)**
	n/a **Co-ordination and Interoperability** (5.4.5.2.B.4)
	Co-ordination with utilities, regional planning and/or links with 3rd parties (5.4.5.2.B.4.a) (where applicable) n/a **Enabling of Future Technology and/or Future Operational Requirements (5.4.5.2.B.4.b)** n/a **Economic Development** (5.4.5.2.B.5)
	n/a **Environmental Benefits** (5.4.5.2.B.6)
	n/a

General Plant Specific Requirements

Project Name	2019 Facility Renovations – Stoney Creek	Table 3

General Plant Specific Requirements (5.4.5.2.C.d)

Summary of Qualitative and Quantitative Analysis (5.4.5.2.C.d.i)

Space Study and the Building Conditioning Assessment

Business Case Justification Documentation (5.4.5.2.C.d.i)

The Stoney Creek Service Centre is a centralized trades training location for Horizon Utilities and a satellite office for Utility Operations. The project will include the renovation of the locker, washroom, and shower space, and it will replace end-of-life plumbing, lighting, HVAC, and fire and life support systems. These renovations will support the needs of the current and future workforces, and improve employee safety.

Material Investments- Notes Referenced in Project Summary Sheets

Horizon Utilities references each requirement listed in the Material Investments section (5.4.5.2) of the Chapter Five Requirements in the Capital Project Summary sheets. Each Project Summary Sheet is organized to follow the structure set out in that section.

In order to organize information into the Capital Project Summary Sheets, without unnecessary duplication, the following summaries have been included and are referenced in the Project Summary Sheets. These summaries should be read in conjunction with each Project Summary Sheet.

I. Schedule Risk and Risk Mitigation (5.4.5.2.A.iv, 5.4.5.2.C.a.iii, 5.4.5.2.C.a.iv)

Horizon Utilities considers the following as general risks to project schedule and cost:

a. Customer delays or restricted access to work sites
b. Inclement weather, either in the form of extreme temperatures or due to restoration activities following major storms.
c. Delays to material shipment from vendors
d. General unforeseen delays such as striking rock when digging, tree conservation, municipal/regional consent forms.

Horizon Utilities has utilized coordination with 3rd parties to mitigate some of the issues where possible, with municipalities/region/suppliers/customers. Horizon Utilities has implemented a Planning and Scheduling solution (refer to DSP section 1.3, Planning and Implementation) to track projects and resources. The Planning and Scheduling process allows Horizon Utilities to manage schedule and cost risks and improve the overall efficiency of implementation. Horizon Utilities is able to reduce controllable cost impacts on the project due to these risk mitigation strategies.

II. Coordination, Interoperability (5.4.5.2.B.4.a)

Horizon Utilities constructs all new projects using approved construction standards complying with ESA Regulation 22/04. Horizon Utilities participates in regional planning, both at an infrastructure level with local municipalities and regions, as well as at an electrical infrastructure level with Hydro One and other participants in the Regional Planning Process. Horizon Utilities has also been active with neighbouring utilities in trying to resolve Long-Term Load Transfers (“LTLT”). Horizon Utilities also attends Public Utility Coordinating Committee (“PUCC”) meetings which allows for the coordination and planning of investments with other utilities who provide: cable TV; internet; telephone; and natural gas services.

III. Efficiency, Customer Value, and Reliability (5.4.5.2.B.1.c), and Analysis of Project and Project Alternatives for Customer Connections Projects (5.4.5.2.C.c.vi and vii)

Customer connection projects are driven by customer requests and the customer's specific technical requirements. Horizon Utilities utilizes a set of design standards that have been engineered and approved in order to build efficiencies into the process. Customer connections requests are fulfilled consistent with Horizon Utilities' Conditions of Service. The projects are designed to meet the customer requirements and maintain system reliability.

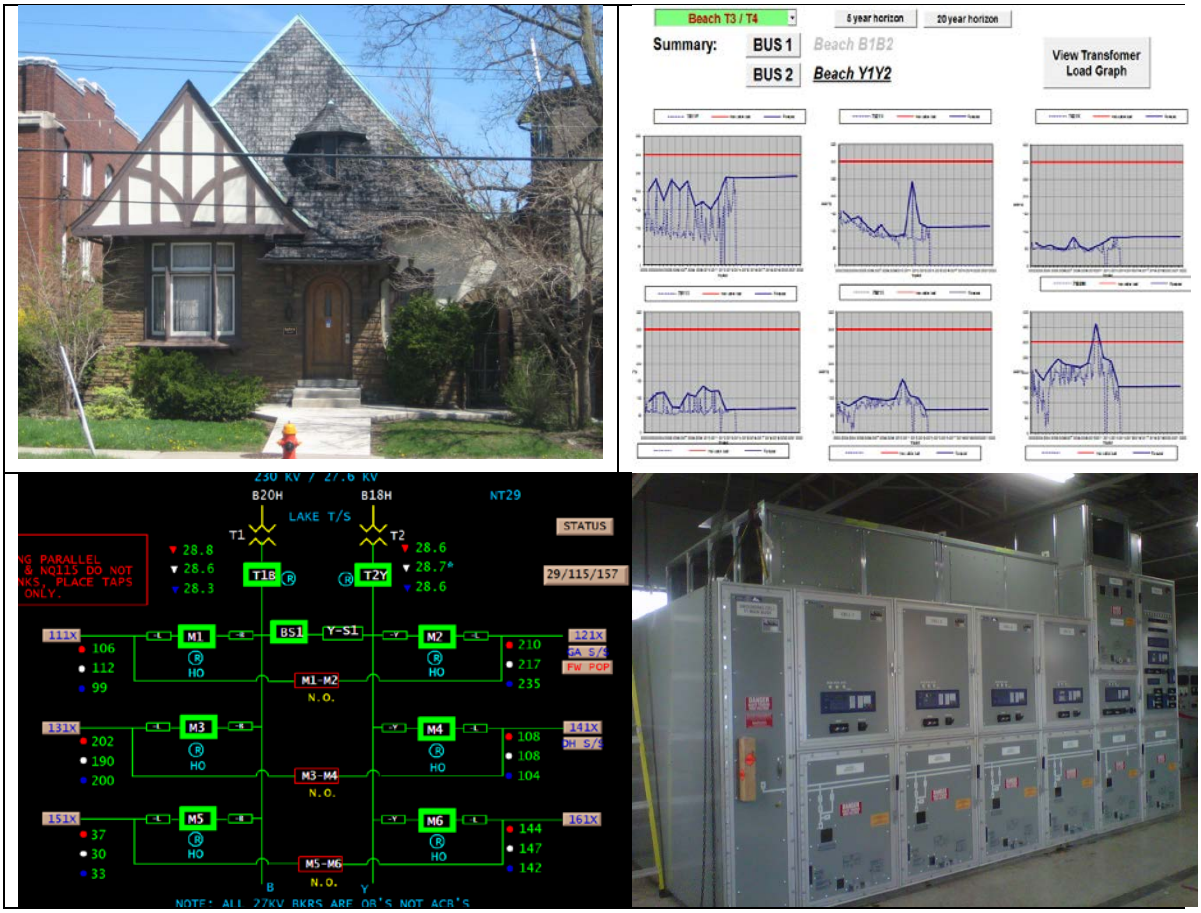
IV. Enabling of future technology and future operational requirements (5.4.5.2.B.4.b, 5.4.5.2.C.c.iii)

Horizon Utilities designs projects according to the life expectancy of the assets being installed. The use of new technology for immediate system benefit, or enabling the future use of new technology is factored into the project design. Marginal additional costs are considered against the benefit, and the additional investment will be made where appropriate.

Appendix H – 2013 Long Term Load Forecast Report

horizon UTILITIES Looking beyond

2013 Long Term Load Forecast Report



Prepared By: Networks **Date:** Nov 12, 2013

DISCLAIMER

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Executive Summary

This report is a summary of distribution forecast planning performed by Horizon Utilities staff to date. The report includes an enhanced long term load forecast generated at the feeder level. Future capacity requirements are based on customer information and a new growth rate determination of 0.25%, unless otherwise specified.

The data is used to perform the capacity analysis at all voltage levels of the Horizon distribution system. It breaks down the analysis at a station and feeder level. At a station level it highlights such issues as Carlton, Horning, Mohawk and Nebo TS running near Limited Time Rating (LTR), which have action plans to resolve the issues.

As listed in the feeder analysis section, feeders that have exceeded 85% loading are identified so that new loads planned for these feeders can be flagged for more intensive investigation.

A summary of constraints on the system, either Bus or Feeder related, is compiled in section 4.0 for quick reference. As well, a listing of underutilized feeders has been added this year, in section 4.1.

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Introduction:

This report is provided to outline Horizon Utilities Corporation's Long Term Load Forecast, and station and feeder capacity analysis. The load forecast is based on over ten years of reliable data gathered by the Networks department. The load forecast is used to determine station and feeder capacity and security needs in both the short and long term.

Issues arising from the station and feeder analysis are highlighted for information purposes. The severity of the issues varies, and thus, subsequent examination is necessary to determine appropriate solutions.

The report is broken down into four sections, the first being the load forecast, the second station analysis, followed by the feeder analysis and lastly a summary of the load forecast spreadsheets.

1.0 Load Forecast (13-27kV):

The long term load forecast is based on six years of reliable data and projected capacity requirements from customers and community growth. In the following two subsections all assumptions used in forecasting demand are listed along with explanation. Included in the report is a:

- 15 year load forecast summary at the bus level for all stations with voltage levels above 4kV (see *Appendix 1*)
- A 5 year and 25 year load forecast at the feeder level and a 34 year bus level forecast can be found on the Horizon corporate server under: V:\Planning\Planning_Forecasts\

Municipal substations are not detailed in this forecast as they are all supplied from either the 13.8kV or 27.6kV Transformer Station feeders, and therefore contribute to the load forecast at that level.

1.1 Assumptions:

- *A general load growth of 0.25% was assumed across all feeders*

  A conservative 0.25% growth factor was applied to all feeders, as the general trend across the system was a gradual decline in loading over the last couple of years. Likely some of the Conservation and Demand Management (CDM) effects are beginning to be realized across the service territory. There has also been some recovery on feeders serving mainly industrial loads back to pre-2009 recession levels.

  It is unclear what the ultimate saturation point for CDM effects will be. As such, the growth rate should be reviewed again in 2 years to determine if this downward trend in loading continues.

- *The load forecast is not weather corrected/normalized*

  It is unclear if Horizon has all the information necessary to generate a weather corrected trend as it has never been performed by the Networks group in previous years. If a normalizing process can be developed then further enhancement would be required to allow the load forecast to utilize this tool.

- *All previously existing feeder demand projects have been accounted for*

  Any project listed since the completion of the previous Load Forecast Report in 2011 was assumed completed unless specifically informed otherwise.

- *The load forecast is based on feeder level growth*

  The load forecast is prepared at a feeder level (based on monthly peak loads) and totalized at the bus level in the 15 year summary in this report. As listed in the introduction, feeder level forecasts are located in the planning folder on Horizon's network

- *Customer-driven projects and projected community growth were added to specific feeders based on information provided to Horizon for forecasted spot load growth*

  A list of known customer projects were accounted for, the list includes;

  [redacted]
  - Caroline/George St developments

  [redacted]
  - Various Customer Connections' department projects that exceed 1MVA

  In addition, information provided to Horizon from the City of Hamilton regarding residential and commercial growth in certain areas was included in the forecast. Those areas include:

  - Ancillary commercial development around the Niagara Regional Hospital
  - Summit Park Subdivision
  - Upper Centennial area development
  - Rymal area bounded by Upper Paradise and Garth
  - Isaac Brock and Highbury area
  - Waterdown east area, south of Highway #5
  - Waterdown west Parkside Drive area
  - Rymal and Stonechurch area bounded by West 5th and Garth streets
  - Glen Morris Rd area

  Residential subdivision developments are accounted in the load forecast by including the planned load and applying a diversity factor of 50%. This diversity factor is derived based on typical loading on transformers in existing comparable subdivisions.

  Large generation projects that have a confirmed in-service date are included in the forecast. No new generation projects have been confirmed as of the writing of this report, although several sites are being considered in Horizon's service territory.

- *Existing Generating stations have been removed from the load forecast*

  Customer Information System data was used to determine the generation capacity and remove the effects of generation from the load forecast to give an accurate value of the actual load on the feeders. The generating stations include:

  [redacted]

2.0 Station Level Capacity Analysis

The charts included in *Appendix 1* provide the station bus level loading forecasts and compare it the 10-day station Limited Time Rating (LTR) stipulated by Hydro One. This value represents the maximum capacity of the station in an (N-1) contingency situation (loss of a single station transformer) and is the indicator of station-level security. A brief explanation for each station is discussed in section 2.1.

Examination has not been performed with regard to the ability of all loads from each transformer station to be transferred to another station at peak load conditions in the event of loss of the complete station (N-2 contingency).

Section 2.2 lists 4 and 8kV Municipal substations with analysis on the capacity at each, corresponding to the charts provided in *Appendix 2*. Stations which have security concerns in the event of loss of the station transformer are explained in further detail in this section.

2.1 Station Capacity Analysis – 27.6kV & 13.8kV

The following section highlights the stations loading, with further explanation on those that are running above the Hydro One provided LTR.

Beach TS:
Beach TS serves mainly industrial customers, typically with direct feeds from the breakers. Generally the capacity is sufficient on the B1B2, Q1Q2, and J1J2 busses. Beach Y1Y2 bus exceeded the LTR in 2010 but has dropped back below the threshold in 2011 and dropped even further in 2012.

Birmingham TS:
Birmingham TS serves mainly industrial customers [redacted], typically with direct feeds from the breakers. Generally the capacity is sufficient on all busses at Birmingham, and actually the load has been decreasing over the last couple of years, largely in part due to the economic downturn.

Dundas TS:
Dundas TS serves primarily residential customers in the Dundas, Ancaster, Flamborough, and Waterdown areas. There aren't any bus level capacity issues at Dundas TS, nor are any expected as this TS saw capacity upgrades in 2002.

Elgin TS:
Elgin TS serves mainly commercial/residential customers in the Hamilton Downtown area as well as some critical large customers, [redacted]. Hydro One has approached Horizon to plan asset renewal at Elgin TS in the near future.

Gage TS:
Gage TS serves mainly industrial customers [redacted] There is capacity available on Gage TS as the economic downturn has reduced the load consumption at these industrial customers. Gage TS is in the midst of a renewal project by Hydro One to replace aging assets and consolidate busses to reflect the diminished loading and to achieve better utilization of assets.

Horning TS:
Horning TS serves mainly residential customers in the West Mountain area in Hamilton. There are also some large loads planned for this station in the near term, including the new Center for Mountain Health. The B1B2 bus was loaded to the 10-day LTR rating in 2011, with further capacity issues anticipated in the short term. The Q1Q2 bus has excess capacity available, so the loading issues on the B1B2 bus can be resolved by transferring load from B1B2 to the Q1Q2 bus.

It is important to note that a portion of the excess capacity at Horning TS on the Q1Q2 bus is to be utilized to address capacity issues at both Mohawk TS and Nebo TS (approximately 6MVA from each TS). As such, it will be important to monitor all large projects to be connected at Horning TS in the future to ensure that reserve capacity does not get used up elsewhere. A long term plan is to re-align the boundaries of the 3 territories served by the TS's on the Hamilton mountain to balance the loading issues.

Kenilworth TS:
Kenilworth TS serves mainly industrial customers [redacted] on the DK and B1Y1 busses, and is split residential/industrial on the EJ bus [redacted] Horizon Utilities municipal substations). There are no capacity issues at Kenilworth TS.

Lake TS:
Lake TS serves mainly residential/commercial customers [redacted] in the Stoney Creek area. There are no capacity issues at Lake TS expected in the near term.

Mohawk TS:
Mohawk TS serves mainly residential/commercial customers [redacted] Horizon Utilities municipal substations) in the Central Mountain area in Hamilton. Mohawk TS has been identified in past reports as having capacity issues and they still persist, but load has gradually decreased over the last few years. The option to upgrade at Mohawk TS is a difficult proposition due to the configuration of the station, so the only way to increase capacity in the short term is to transfer load to adjacent stations.

As mentioned in the Horning TS section, the Planning department is investigating options to transfer approximately 6 MVA of load from Mohawk TS to Horning TS. There is some urgency to address this transfer in the short term as the Mohawk Y1Y2 bus has been operating above the LTR rating in three of the last five years. Accomplishing this transfer would defer the need to address capacity issues at Mohawk TS for the foreseeable future.

Nebo TS:
Nebo TS serves mainly residential/commercial customers (Horizon Utiltiies municipal substations,) in the East Mountain area of Hamilton and the Stoney Creek Mountain. Nebo TS has been identified in past reports as having capacity issues and they still persist on the QJ bus. The Nebo BY bus serves the Stoney Creek Mountain at 27kV, and shares the station with Hydro One Distribution. This area is the primary region experiencing growth in Horizon's service territory. As of the writing of this report, the upgrades to the Nebo BY bus are virtually complete with Horizon gaining ~17 MVA of capacity and 2 new breaker positions.

The Nebo QJ bus (13kV) is also forecast to encroach on the 10-day LTR limit in the short term and as mentioned in the Horning TS section, the Planning department is investigating options to transfer approximately 6 MVA of load from the Nebo QJ bus to Horning TS. Accomplishing this transfer would defer the need to address capacity issues at Nebo TS on the QJ bus for the foreseeable future.

Newton TS:
Newton TS serves mainly residential/commercial customers (Horizon Utilities municipal) in the West Hamilton area. No capacity issues are forecasted at Newton TS in the near term.

Stirton TS:
Stirton TS serves mainly residential/industrial customers (Horizon Utilities municipal substations) in the Central Hamilton area. There are no capacity issues at Stirton TS.

Winona TS:
Winona TS serves mainly residential/commercial customers at 27kV in the Stoney Creek area below the escarpment. Winona TS came into service in 2002 and has not seen the amount of growth anticipated when the TS was planned. The capacity issue at Winona TS is to transfer load *to* the station. One plan being investigated is to transfer the rural load on the Stoney Creek mountain from the constrained Nebo BY bus to Winona TS, which could benefit both stations.

Bunting TS:
Bunting TS serves mainly residential/commercial customers (Horizon Utilities municipal substation) in the Northeast quadrant some generation connected (Rankin Weir 1, Rankin Weir 2). According to the load forecast, the busses are nearing capacity and should be monitored, however the effects of generation will offset some of that load in reality.

Carlton TS:
Carlton TS serves a mix of all customer types (St.Catharines Downtown network, Horizon Utilities municipal substations,) in the Northwest quadrant of St.Catharines and also has some generation connected (Heywood generating station).

Carlton QE bus is virtually unused. Carlton HK bus is encroaching on its 10-day LTR rating, and actually exceeded this rating in 2011 and 2012. As outlined in the last Load Forecast, the Carlton BY bus has been operating well above its 10-day LTR rating since 2006, were it not for Heywood G.S. offsetting about 5-6 MVA of load. With Vansickle JQ bus coming online in 2011, plans to transfer load from Carlton TS to Vansickle TS to alleviate some of this capacity

constraint have been under construction. Furthermore, significant capital expenditure has been planned to increase the number of ties to feeders on the Carlton BY bus with other stations to further improve the ability to shed load from this bus.

Glendale TS:

Glendale TS serves a mix of all customer types ([redacted]) in the Southeast quadrant of St.Catharines, and also has some generation connected [redacted]). Glendale TS was scheduled for upgrades by Hydro One in late-2013, (revised to 2015 per most recent discussions with Hydro One), to undergo replacement of the existing transformers with larger sized transformers as part of Hydro One's asset renewal program.

Vansickle TS:

Vansickle TS serves mainly residential/commercial customers ([redacted]) in the Southwest quadrant of St.Catharines. The Vansickle JQ bus was placed into service in 2011 to address the capacity constraints at Vansickle TS. Projects are underway to utilize this new capacity to shift loads from the heavily loaded Vansickle BY bus, as well as from Carlton TS. At the time of this report, Hydro One had not yet provided a revised value for the 10-day LTR at Vansickle TS post-upgrade.

2.2 Station Capacity Analysis – 4.16 & 8.32 kV

The following section highlights stations capacity availability when operating at full transformer rating, as well as detailing which stations that would be in jeopardy during a transformer (N-1) contingency situation. Refer to *Appendix 2* for a detailed table indicating the loading of each station. *Note*: the amount of load required to be shed in an (N-1) situation does not take into account feeder security ties with other stations.

Aberdeen MS – 13.3 MVA capacity
Aberdeen MS is a 4kV dual-transformer station. Should one of the transformers fail under peak conditions, no load would need to be shed from the station.

Baldwin MS – 7.5 MVA capacity
Baldwin MS is a 4kV single transformer station. If the station were to lose the transformer under peak conditions, 2.2 MVA would need to be shed from the station.

Bartonville MS – 13.3 MVA capacity
Bartonville MS is a 4kV single transformer station, with the space available to maintain a deployable spare. If the station were to lose the transformer under peak conditions, 4.9 MVA would need to be shed from the station. It is recommended that the existing scrap transformer occupying the spare pad be removed and replaced with a deployable spare kept on-potential at Bartonville MS.

Caroline MS – 10 MVA capacity
Caroline MS is a 4kV dual-transformer station. If the station were to lose the transformer under peak conditions, no load would need to be shed from the station. Caroline MS is planned to be decommissioned in 2014, therefore no further investment need be considered.

Central MS – 26.7 MVA capacity
Central MS is a 4kV dual-transformer station. If the station were to lose a transformer under peak conditions, no load would need to be shed from the station.

Cope MS – 20.0 MVA capacity
Cope MS is a 4kV three-transformer station. If the station were to lose a transformer under peak conditions, no load would need to be shed from the station.

Deerhurst MS – 7.5 MVA capacity
Deerhurst MS is an 8kV single transformer station. If the station were to lose the transformer under peak conditions, 0.8 MVA would need to be shed from the station.

Dewitt MS – 5.0 MVA capacity
Dewitt MS is an 8kV single transformer station. If the station were to lose the transformer under peak conditions, 0.8 MVA would need to be shed from the station.

Eastmount MS – 26.7 MVA capacity
Eastmount MS is a 4kV four-transformer station. If the station were to lose another transformer under peak conditions, no load would need to be shed from the station.

Elmwood MS – 20.0 MVA capacity
Elmwood MS is a 4kV three-transformer station. If the station were to lose a transformer under peak conditions, no load would need to be shed from the station.

Galbraith MS – 5.6 MVA capacity
Galbraith MS is an 8kV single transformer station. If the station were to lose the transformer under peak conditions, 0.8 MVA would need to be shed from the station.

Highland MS – 6.7 MVA capacity
Highland MS is a 4kV single transformer station. If the station were to lose the transformer under peak conditions, 2.3 MVA would need to be shed from the station.

Hughson MS – 20.0 MVA capacity
Hughson MS is a 4kV four-transformer station, operating in an (N-1) situation at present. If the station were to lose another transformer under peak conditions, no load would need to be shed from the station. Hughson MS is planned to be decommissioned in early 2014.

John MS – 6.7 MVA capacity
John MS is a 4kV single transformer station. If the station were to lose the transformer under peak conditions, 2.4 MVA would need to be shed from the station.

Kenilworth MS – 13.3 MVA capacity
Kenilworth MS is a 4kV dual-transformer station. If the station were to lose a transformer under peak conditions, no load would need to be shed from the station.

Mohawk MS – 26.7 MVA capacity
Mohawk MS is a 4kV three-transformer station, with one transformer serving as an on-potential deployable spare. If the station were to lose a transformer under peak conditions, no load would need to be shed from the station.

Mountain MS – 26.7 MVA capacity
Mountain MS is a 4kV three-transformer station, with one transformer serving as an on-potential deployable spare. If the station were to lose a transformer under peak conditions, no load would need to be shed from the station.

Ottawa MS – 20.0 MVA capacity
Ottawa MS is a 4kV three-transformer station. If the station were to lose a transformer under peak conditions, no load would need to be shed from the station.

Parkdale MS – 26.7 MVA capacity
Parkdale MS is a 4kV dual-transformer station, with an off-potential spare stored on one of the pads. If the station were to lose a transformer under peak conditions, no load would need to be shed from the station.

Spadina MS – 13.3 MVA capacity
Spadina MS is now a 4kV dual-transformer station. If the station were to lose a transformer under peak conditions, 0.9 MVA would need to be shed from the station. There is a possibility that a deployable spare could be placed at Spadina MS on-potential in the future, but this would require further investigation into the logistics required to facilitate the spare transformer.

Stroud's Lane MS – 13.3 MVA capacity
Stroud's Lane MS is a 4kV dual-transformer station. If the station were to lose a transformer under peak conditions, no load would need to be shed from the station. However, Stroud's Lane MS is slated to begin conversion in 2014 which will reduce the loading on the station.

Webster MS – Decommissioned
Webster MS conversion was completed in 2010.

Wellington MS – 26.7 MVA capacity
Wellington MS is a 4kV four-transformer station. If the station were to lose a transformer under peak conditions, no load would need to be shed from the station.

Wentworth MS – 20.0 MVA capacity
Wentworth MS is a 4kV four-transformer station, operating in an (N-1) situation at present. If the station were to lose a transformer under peak conditions, no load would need to be shed from the station. Furthermore, two of the three remaining transformers are operating at above 75% loading, with the third transformer loaded to only 33%. Restoring the station back to 4 fully operational transformers is planned for the near term.

Whitney MS – 13.3 MVA capacity
Whitney MS is a 4kV dual-transformer station. If the station were to lose a transformer under peak conditions, no load would need to be shed from the station. However, Whitney MS is slated to begin conversion in 2014 which will reduce the loading on the station.

York MS – 4.0 MVA capacity
York MS is a 4kV single transformer station. There is an on-site spare that is ready for service, but would require approximately 8 hours to connect and energize if the station were to lose the main transformer. York MS has no other ties to other stations.

Grantham MS – 11.0 MVA capacity
Grantham MS is a 4kV dual-transformer station in St.Catharines, which is operating in an (N-1) situation at present as there is no way to operate the tie-breaker without dumping all of the customers on the station first. There is also an issue with the cable feeding the T2 transformer, as the cable is undersized for the load. Under peak conditions, 3.3 MVA would need to be shed from the station. Grantham MS is planned to begin conversion in 2015.

Taylor MS – Decommissioned
Taylor MS conversion was completed in 2013.

Vine MS – 14.2 MVA capacity
Vine MS is a 4kV dual-transformer station in St.Catharines. If the station were to lose a transformer under peak conditions, no load would need to be shed from the station. Vine MS is planned to begin conversion in 2014.

Welland MS – 9.6 MVA capacity
Welland MS is a 4kV three-transformer station in St.Catharines. If the station were to lose the transformer under peak conditions, no load would need to be shed from the station. Welland MS is currently in the process of being converted, with a planned completion date of 2015.

3.0 Feeder Level Capacity Analysis

In 2009 after a preliminary review by Network staff a set of new operating ampacities was assigned to more accurately reflect the de-rating required due to cable heating in duct banks.

These assigned ampacities are based on three factors: the cable specifications and termination, the general infrastructure conditions, and the load on the feeders. An average collection of feeder egress scenarios were used to assume an average system condition. This average system condition was then reviewed in various engineering contexts to determine a new standard operating ampacity. This level would apply for all feeders in the Horizon distribution system based on the type of cable being used.

As indicated previously, the load forecast is prepared on a feeder-by-feeder basis which is then totalized to create the station-by-station forecast discussed earlier. Analysis of capacity and security has also been undertaken at the individual feeder level.

Included below is a summary of ampacity ratings for primary cable (underground) and also conductor (overhead) for reference.

Cable	Ampacity	MVA (4.16kV)	MVA (13.8kV)	MVA (27.6kV)
350 MCM PILC	250A	1.8 MVA	6.0 MVA	N/A
4/0 CU PILC	280*A	2.0 MVA	6.7 MVA	N/A
500 MCM PILC / EPR	300A	2.2 MVA	7.2 MVA	N/A
750 MCM CU XLPE	525A	3.8 MVA	12.5 MVA	N/A
1000 MCM AL XLPE	566**A	N/A	13.5 MVA	27.0 MVA
1500 MCM CU XLPE	800***A	5.8 MVA	19.1 MVA	N/A
Conductor	**Ampacity**	**MVA (4.16kV)**	**MVA (13.8kV)**	**MVA (27.6kV)**
#2 AL ACSR	185A	1.3 MVA	4.4 MVA	8.8 MVA
4/0 CU Aerial	480A	3.5 MVA	11.4 MVA	N/A
336 AL ACSR	530A	3.8 MVA	12.6 MVA	25.3 MVA
556 AL ACSR	730A	5.3 MVA	17.4 MVA	34.9 MVA

** - Note that 4/0 CU does not get used as an egress feeder and therefore is not subject to the same de-rating factors applied to 350 MCM cable.*
*** - Note that the ampacity derived for 1000 MCM 15kV XLPE is only applicable when 'floating the neutral' (i.e. grounding the neutral at one end, but not the other). If the neutral is grounded at both ends the ampacity is reduced to 500A.*
**** - Based on the Okonite catalog value for parallel circuits (6 single cables) installed in individual ducts.*

3.1 Constrained Feeder Capacity Analysis

The following section highlights all feeders that have repeatedly experienced a *peak* loading above 85% of their engineering-assigned cable ampacities. These feeders should be highlighted to Planning so as to ensure that further investigation is performed for any new loads proposed on these feeders, and that any required capital work to free up capacity on the feeders is accounted for in the Planning phase.

13.8kV AND 27.6kV TRANSFORMER STATIONS

Beach TS

Q1Q2 Bus:
7311B – 2013 Peak 262A (87% of cable rating)
This feeder serves the Bartonville substation. This circuit likely encroached on the cable ampacity limit due to the various long-term transfers that occurred due to the substation upgrades at neighbouring stations. Loading is likely to reduce in 2014, but this circuit should be reviewed at that time to ensure this expectation holds.

7411X – 2013 Peak 272A (91% of cable rating)
This feeder serves residential customers that have been captured as part of the voltage conversion in the Bartonville/Kenilworth service territory. This circuit is consistently operating with peak loading encroaching on the cable ampacity limits. This circuit may need to be reconfigured in order to be utilized when Bartonville MS undergoes further voltage conversion in the near future in this area.

7441X – 2013 Peak 318A (106% of cable rating)
This feeder serves residential/commercial customers along Parkdale Ave. This circuit should be monitored in 2014 to determine if the peak load continues to encroach on the cable ampacity limits.

J1J2 Bus:
7722X – 2013 Peak 266A (89% of cable rating)
This feeder serves as the primary supply to several industrial customers. This circuit should be monitored in 2014 to determine if the peak load continues to encroach on the cable ampacity limits. It is possible to alleviate the loading problem by switching some of the customers to the alternate supply, which is the Beach 7821X, as this feeder has more capacity available at present. It should also be noted that [redacted] is served on this feeder and are proposing a significant Co-generation facility to displace their load in the near future.

7731X – 2013 Peak 262A (87% of cable rating)
This feeder serves residential and industrial customers along the Eastport Blvd and Beach Blvd areas. This circuit should be monitored in 2014 to determine if the peak load continues to encroach on the cable ampacity limits. The Eastport Blvd industrial park is expected to see some growth over the next few years.

Dundas TS:

JQ Bus:
2D13X – 2013 Peak 481A (85% of cable rating)
This feeder serves residential customers in the Waterdown service territory. This circuit should be monitored in 2014 to determine if the peak load continues to encroach on the cable ampacity limits. It is possible to alleviate the loading problem by transferring some customers to the Dundas 2D12X, which also serves customers in this territory. However, long term plans are to bring another feeder to the area to improve security for the region.

Elgin TS:

QJ Bus:
5231X – 2013 Peak 326A (131% of cable rating)
This feeder serves commercial customers in the Hamilton downtown core. It also functions as the alternate supply to many other customers. This circuit leaves the station as 500 MCM PILC, but transitions to 350 MCM PILC before picking up its load. As a result, the feeder has continually seen overloading. It is recommended that this section of cable be converted to 500 MCM EPR as it presents a major bottleneck in the system for security.

5301X – 2013 Peak 280A (94% of cable rating)
This feeder serves commercial customers in the Hamilton downtown core. It also serves as the alternate supply to many other customers. This circuit should be monitored in 2014 to determine if the peak load continues to encroach on the cable ampacity limits.

Horning TS:

B1B2 Bus:
441X – 2013 Peak 265A (88% of cable rating)
This feeder serves some residential/commercial customers in the West Hamilton Mountain area. This circuit has seen steady growth in loading and has been identified as the supply for a new subdivision, which will push the loading on the feeder even further above the rated ampacity. The Planning group will need to investigate any Capital upgrades required to transfer loads from this feeder to Horning Q1Q2 bus.

491X – 2013 Peak 296A (99% of cable rating)
This feeder serves some residential/commercial customers in the West Hamilton Mountain area. This circuit is being targeted for several large Customer Connection projects at [redacted], which will push the loading on the feeder well above the rated ampacity. The Planning group will need to investigate any Capital upgrades required to transfer loads from this feeder to Horning Q1Q2 bus, if necessary.

4111X – 2013 Peak 272A (91% of cable rating)
This feeder serves some residential/commercial customers in the West Hamilton Mountain area. This circuit should be monitored in 2014 to determine if the peak load continues to approach the cable ampacity limits. The Planning group will need to investigate any Capital upgrades required to transfer loads from this feeder to Horning Q1Q2 bus, if necessary.

Q1Q2 Bus:
4451X – 2013 Peak 289A (96% of cable rating)
This feeder serves some residential/commercial customers in the West Hamilton Mountain area. This circuit has seen steady growth in loading and has been identified as the supply for a new subdivision, which will push the loading on the feeder even further above the rated ampacity. The Planning group will need to investigate any Capital upgrades required to transfer loads from this feeder to other feeders on the Horning Q1Q2 bus.

Lake TS

J1J2 Bus:
1411X – 2013 Peak 295A (98% of cable rating)
This feeder serves commercial customers along Kenora Ave in the East Hamilton area. This circuit should be monitored in 2014 to determine if the peak load continues to encroach on the cable ampacity limits.

1431X – 2013 Peak 285A (95% of cable rating)
This feeder serves residential/commercial customers around Greenhill Ave in the East Hamilton area. This circuit should be monitored in 2014 to determine if the peak load continues to encroach on the cable ampacity limits.

Q1Q2 Bus:
1811X – 2013 Peak 294A (98% of cable rating)
This feeder serves residential/commercial customers around Barton St in Stoney Creek. This circuit should be monitored in 2014 to determine if the peak load continues to encroach on the cable ampacity limits.

1831X – 2013 Peak 284A (95% of cable rating)
This feeder serves residential/commercial customers in along Queenston St in the East Hamilton area. This circuit should be monitored in 2014 to determine if the peak load continues to encroach on the cable ampacity limits.

Mohawk TS

B1B2 Bus:
0611X - 2013 Peak 263A (88% of cable rating)
This feeder serves Mountain Substation. This peak may be a result of the substation upgrades that occurred in 2013, therefore this circuit should be monitored in 2014 to determine if the peak load continues to encroach on the cable ampacity limits.

Y1Y2 Bus:
0731X - 2013 Peak 261A (87% of cable rating)
This feeder serves residential/commercial customers in the Hamilton Central Mountain area and is also the back-up feeder for [redacted]. Plans are underway to alleviate the loading on this feeder by transferring some load to adjacent feeders. This circuit should be monitored in 2014 to determine if the peak load continues to encroach on the cable ampacity limits.

Nebo TS

QJ Bus:
3521X - 2013 Peak 265A (88% of cable rating)
This feeder serves residential/commercial customers in the Hamilton East/Stoney Creek Mountain areas. This circuit should be monitored in 2014 to determine if the peak load continues to encroach on the cable ampacity limits. The Planning group should investigate transferring some loading from the Nebo QJ bus feeders to Horning TS to alleviate the capacity constraints on these feeders.

3621X - 2013 Peak 267A (89% of cable rating)
This feeder serves residential/commercial customers in the Hamilton East/Stoney Creek Mountain areas. This circuit should be monitored in 2014 to determine if the peak load continues to exceed the cable ampacity limits. The Planning group should investigate transferring some loading from the Nebo QJ bus feeders to Horning TS to alleviate the capacity constraints on these feeders.

Newton TS

B Bus:
282X - 2013 Peak 328A (109% of cable rating)
This feeder serves residential/commercial customers in the West Hamilton area. This circuit should be monitored in 2014 to determine if the peak load continues to exceed the cable ampacity limits. The Planning group should investigate the feasibility to transfer some load to the Newton Y bus feeders.

Stirton TS

BY Bus:
8721X - 2013 Peak 285A (114% of cable rating)
This feeder serves residential/commercial customers in the Central Hamilton area. This station has several feeders that egress with 350 MCM PILC cable, including this feeder, which results in a bottleneck in the system. This feeder should be monitored in 2014 to determine if the peak load continues to exceed the cable ampacity limits. The Planning group should investigate the feasibility to remove these bottlenecks in the system to improve security. However, with 8721X the Planning group should also investigate the possibility to transfer part of the load to other feeders.

8831W - 2013 Peak 265A (88% of cable rating)
This feeder serves Wentworth Substation. With the WT-T2 offline, this feeder is carrying more load than originally planned. The Planning group is investigating restoring the WT-T2 to service to alleviate some loading issues in this area at the 4kV level, which would mitigate the loading issue on this feeder as well.

8852X - 2013 Peak 243A (97% of cable rating)
This feeder serves residential/commercial customers in the Central Hamilton area. This station has several feeders that egress with 350 MCM PILC cable, including this feeder, which results in a bottleneck in the system. This feeder should be monitored in 2014 to determine if the peak load continues to exceed the cable ampacity limits. The Planning group should investigate the feasibility to remove these bottlenecks in the system to improve security.

QZ Bus:
8611S - 2013 Peak 262A (87% of cable rating)
This feeder serves residential/commercial customers in the Central Hamilton area. This station has several feeders that egress with 350 MCM PILC cable, this feeder was converted in 2011 to 500 MCM Concentric Neutral cable. This feeder should be monitored in 2012 to determine if the peak load continues to exceed the cable ampacity limits. The Planning group should also investigate the possibility to transfer part of the load from this feeder to other feeders.

8621X - 2013 Peak 220A (88% of cable rating)
This feeder serves [redacted] in the Central Hamilton mountain area. This station has several feeders that egress with 350 MCM PILC cable, including this feeder, which results in a bottleneck in the system. This feeder should be monitored in 2014 to determine if the peak load continues to exceed the cable ampacity limits. The Planning group should investigate the feasibility to remove these bottlenecks in the system to improve security. The Planning group should also investigate the possibility to transfer part of the load from this feeder to other feeders.

Bunting TS

Q1Q2 Bus:
BUM77 - 2013 Peak 495A (87% of cable rating)
This feeder serves residential/commercial customers in the Northeast quadrant of St.Catharines along Vine St. This circuit should be monitored in 2014 to determine if the peak load continues to encroach on the cable ampacity limits.

Carlton TS

BY Bus:
CTM10 - 2013 Peak 679A (129% of cable rating)
This feeder serves residential/commercial customers in the Northwest quadrant of St.Catharines along Ontario St and Lakeshore, and also serves as the primary connection to [redacted]. typically displaces about 250A of load from this feeder, but even taking this amount into account, the feeder is running close to 100% loading under peak conditions. There have been several Capital projects implemented to transfer load from Carlton TS to Vansickle TS in order to alleviate this overload condition. This circuit has seen some reduction in loading since 2011, but should be monitored closely in 2014 to determine if the peak load continues to encroach on the cable ampacity limits. Further planning may be required to shed more load from this feeder as the failure of Heywood G.S. to displace load would severely stress this feeder under peak conditions.

CTM11 - 2013 Peak 553A (105% of cable rating)
This feeder serves residential/commercial customers in the Northwest quadrant of St.Catharines along Geneva St. This circuit should be monitored in 2014 to determine if the peak load continues to exceed the cable ampacity limits.

CTM12 - 2013 Peak 0A (0% of cable rating)
This feeder position is available at Carlton TS on the BY bus, however in addition to the constraints on all of the feeders off the BY bus, there is also bus constraints as the station has exceeded the 10-day LTR rating for the last 8 years. Therefore, before this feeder can be utilized, a significant load will have to be transferred from Carlton TS to an adjoining station, as confirmed in discussions with Hydro One.

CTM21 - 2013 Peak 565A (108% of cable rating)
This feeder serves residential/commercial customers in the Northwest quadrant of St.Catharines along Linwell Rd. This circuit should be monitored in 2014 to determine if the peak load continues to encroach on the cable ampacity limits.

HK Bus:
CTM18 - 2013 Peak 598A (114% of cable rating)
This feeder serves residential/commercial customers in the Northwest quadrant of St.Catharines along Carlton St and Vine Substation. This circuit should be monitored in 2014 to determine if the peak load continues to exceed the cable ampacity limits.

Vansickle TS

BY Bus:
VSM51- 2013 Peak 564A (107% of cable rating)
This feeder serves residential/commercial customers in the Southwest quadrant of St.Catharines along Rykert St. This circuit is undergoing reconfiguration to accept the transfer of significant load from Carlton TS. Once the loading levels are established, the Planning group will have to monitor this situation to make any further changes to re-balance the feeders in the area.

As there are several Capital projects ongoing at Vansickle TS, the Planning group will continue to monitor the Vansickle feeders in 2014 to ensure that the new bus is utilized effectively to distribute the load.

4.16kV AND 8.32kV MUNICIPAL SUBSTATIONS

Aberdeen MS:
AB-2- 2011 Peak 346A (117% of cable rating)
This feeder has peaks above its cable ampacity in July only. However, a monthly peak investigation reveals that this is not an issue that requires a solution as transfer options are available if this feeder requires temporary relief.

Caroline MS:
CA-4- 2011 Peak 293A (98% of cable rating)
This feeder has peaks nearing its cable ampacity in July only. However, a monthly peak investigation reveals that this is not an issue that requires a solution as transfer options are available if this feeder requires temporary relief. Furthermore, Caroline SS is nearing completion of its Voltage Conversion, with an anticipated completion date in early 2014.

Hughson MS:
HU-6- 2011 Peak 313A (104% of cable rating)
This feeder has peaks above its cable ampacity in July only. However, a monthly peak investigation reveals that this is not an issue that requires a solution as transfer options are available if this feeder requires temporary relief. Furthermore, Hughson SS is nearing completion of its Voltage Conversion, with an anticipated completion date in early 2014.

Stroud's Lane MS:
ST-3- 2011 Peak 27A (92% of cable rating)
This feeder has peaks near its cable ampacity in July only. Monthly peak investigation reveals that this is not an issue that requires a solution as transfer options are available if this feeder requires temporary relief, but it should be noted that the transfer options are also constrained feeders. Stroud's Lane MS is scheduled to begin Voltage Conversion in 2013, with loading on this feeder being a priority for the initial stages of conversion.

Wentworth MS:
WT-2- 2011 Peak 264A (88% of cable rating)
This feeder has peaks above its cable ampacity in July only. However, a monthly peak investigation reveals that this is not an issue that requires a solution as transfer options are available if this feeder requires temporary relief.

WT-5- 2011 Peak 272A (91% of cable rating)
This feeder has peaks above its cable ampacity in July only. However, a monthly peak investigation reveals that this is not an issue that requires a solution as transfer options are available if this feeder requires temporary relief.

*4.0 Summa*ry of Constraints on Horizon Distribution System

The following is a list of areas that should be reviewed with Planning due to system capacity constraints (Busses exceeding 85% of LTR, feeders exceeding 85% of feeder ampacity rating).

TS Bus Constraints

Horning B1B2	Mohawk Y1Y2	Carlton BY
Kenilworth EJ	Nebo QJ	Carlton HK

TS Feeder Constraints

Beach 7311B	Horning 4451X	Stirton 8831W
Beach 7411X	Lake 1411X	Stirton 8852X
Beach 7441X	Lake 1431X	Stirton 8611S
Beach 7722X	Lake 1811X	Stirton 8621X
Beach 7731X	Lake 1831X	
Dundas 2D13X	Mohawk 0611X	Bunting BUM77
Elgin 5231X	Mohawk 0731X*(Reserved*)*	Carlton CTM18
Elgin 5301X	Nebo 3521X	Carlton CTM10
Horning 441X	Nebo 3621X	Carlton CTM11
Horning 491X	Newton 282X	Carlton CTM21
Horning 4111X	Stirton 8721X	Vansickle VSM51

**Under current configuration, Mohawk 0731X would not adequately provide reserve capacity without shedding load.*

MS Feeder Constraints

Aberdeen AB-2	Hughson HU-6	Wentworth WT-2
Caroline CA-4	Stroud's Lane ST-3	Wentworth WT-5

4.1 Summary of Capacity available on Horizon Distribution System

The following is a list of areas with excess capacity available (Busses being under 50% of LTR, feeders being under-utilized at 25% rated ampacity of cable or less)

TS Bus Capacity*

Beach B1B2	Gage KE	Winona JQ
Birmingham EZ	Horning Q1Q2	
Dundas BY	Kenilworth DK	Carlton QE
Elgin EZ	Stirton BY	Vansickle JQ
Gage DJ	Stirton QZ	

**does not apply to Distributed Generation*

TS Feeder Capacity Available

Beach 7111SC	Elgin 5251X	Stirton 8712W
Beach 7121SC	Elgin 5281X	Stirton 8751WC
Beach 7141F	Elgin 5512HG *(Reserved)*	Stirton 8762G
Beach 7142F	Elgin 5612X	Stirton 8811X
Beach 7211F	Elgin 5632X	Stirton 8821DG
Beach 7212F	Gage M13,M15,M20	Stirton 8832X
Beach 7231SC	Gage M24,M27	Stirton 8842X
Beach 7241SC	Gage M31,M33,M35,M37	Stirton 8862X
Beach 7611X	Gage M34,M36,M38,M40	Stirton 8541X
Beach 7621X	Horning 492X *	Stirton 8542X
Beach 7631X	Horning 4102X *	Stirton 8641S
Beach 7341X	Kenilworth 9361X	Stirton 8642WC
Beach 7711DF	Kenilworth 9281X *	Stirton 8632X
Beach 7712DF	Kenilworth M51	Winona W15X
Beach 7742X	Kenilworth M54	Winona W16X
Beach 7811DF	Kenilworth M61	
Beach 7812X	Kenilworth M64	Bunting BUM57
Beach 7832X	Lake 111X	Bunting BUM81
Birmingham 50L21	Lake 151X	Bunting BUM82
Birmingham 50L22	Lake 1721X	Carlton CTM13
Birmingham 50PG11	Lake 1832X	Carlton CTM14
Birmingham 50PG21	Mohawk 0531X	Carlton CTM15
Birmingham 50X41	Mohawk 0532X	Carlton CTM16
Birmingham 50X42	Mohawk 0641X	Carlton CTMA3 *
Birmingham 50X52	Mohawk 0642X	Carlton CTM12 *
Birmingham 50DC101	Nebo 3531X *	Glendale GLM24
Dundas 2D11X	Newton 231X	Vansickle VSM71 *(Reserved)*
Elgin 5421X	Newton 262X	Vansickle VSM73
Elgin 5422X	Newton 281X	Vansickle VSM82
Elgin 5441X	Newton 242X	Vansickle VSM83
Elgin 5471X *(Reserved)*	Stirton 8711X	

**Capacity available on feeder however bus is constrained*

MS Feeder Capacity Available

Bartonville BA-3	Parkdale PA-8	York YK-2
Central CE-5	Stroud's Lane ST-4	Deerhurst DH-1
Central CE-6	Wellington WL-6	Deerhurst DH-2
Central CE-9	Wentworth WT-8	Deerhurst DH-3
Kenilworth KE-5	Wentworth WT-11	Galbraith GA-1
Mohawk MK-5	Wentworth WT-12	Galbraith GA-3
Mountain MT-11	Whitney WH-4	Dewitt DW-1
Ottawa OT-6	John JN-2	Dewitt DW-2
Parkdale PA-7	York YK-1	Dewitt DW-3

5.0 Attached Appendices

See attached

HORIZON UTILITIES 25 YEAR LOAD FORECAST SUMMARY

Hydro One Supply Bus		Actual										Forecast																		
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Beach B1B2	MVA	48.9	28.0	28.4	18.6	17.4	19.2	18.6	16.7	18.7	10.6	10.7	10.7	10.7	10.7	10.8	10.8	10.8	10.9	10.9	10.9	10.9	11.0	11.0	11.0	11.0	11.1	11.1	11.1	11.2
	10 day LTR	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5
	Ratio of 10 day LTR	1.27	0.73	0.74	0.48	0.45	0.50	0.48	0.43	0.49	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.29	0.29	0.29	0.29	0.29	0.29
	MVA LAR	10.4																												
Beach Y1Y2	MVA	24.8	27.5	33.5	35.2	30.3	28.0	43.4	35.1	27.8	27.5	27.5	27.6	27.7	27.7	27.8	27.9	28.0	28.0	28.1	28.2	28.2	28.3	28.4	28.5	28.5	28.6	28.7	28.7	28.8
	10 day LTR	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5
	Ratio of 10 day LTR	0.64	0.71	0.87	0.91	0.79	0.73	1.13	0.91	0.72	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.73	0.73	0.73	0.73	0.73	0.74	0.74	0.74	0.74	0.74	0.74	0.75	0.75
	MVA LAR							4.9																						
Beach Q1Q2	MVA	32.7	34.5	32.8	32.9	34.7	27.3	36.8	33.0	37.9	38.3	38.4	38.5	38.6	38.7	38.8	38.9	39.0	39.1	39.2	39.3	39.4	39.5	39.6	39.7	39.8	39.9	40.0	40.1	40.2
	10 day LTR	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
	Ratio of 10 day LTR	0.64	0.68	0.64	0.65	0.68	0.54	0.72	0.65	0.74	0.75	0.75	0.76	0.76	0.76	0.76	0.76	0.77	0.77	0.77	0.77	0.77	0.77	0.78	0.78	0.78	0.78	0.78	0.79	0.79
	MVA LAR																													
Beach J1J2	MVA	23.5	24.8	27.6	29.1	29.5	28.5	43.8	30.6	29.4	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.7	34.8	34.9	35.0	35.1	35.2	35.3	35.4	35.4	35.5	35.6	35.7	35.8
	10 day LTR	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
	Ratio of 10 day LTR	0.46	0.49	0.54	0.57	0.58	0.56	0.86	0.60	0.58	0.67	0.67	0.67	0.67	0.68	0.68	0.68	0.68	0.68	0.68	0.69	0.69	0.69	0.69	0.69	0.70	0.70	0.70	0.70	0.70
	MVA LAR																													
Birmingham BY	MVA	38.1	38.1	33.7	35.6	35.9	13.7	14.0	13.2	14.0	32.4	32.5	32.6	32.7	32.8	32.8	32.9	33.0	33.1	33.2	33.2	33.3	33.4	33.5	33.6	33.7	33.7	33.8	33.9	34.0
	10 day LTR	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0
	Ratio of 10 day LTR	0.91	0.91	0.80	0.85	0.85	0.33	0.33	0.31	0.33	0.77	0.77	0.78	0.78	0.78	0.78	0.78	0.79	0.79	0.79	0.79	0.79	0.80	0.80	0.80	0.80	0.80	0.81	0.81	0.81
	MVA LAR																													
Birmingham QJ	MVA	25.5	24.1	23.0	22.5	21.8	20.8	26.0	23.4	21.3	21.8	21.9	22.0	22.0	22.1	22.1	22.2	22.2	22.3	22.3	22.4	22.5	22.5	22.6	22.6	22.7	22.7	22.8	22.8	22.9
	10 day LTR	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9
	Ratio of 10 day LTR	0.62	0.59	0.56	0.55	0.53	0.51	0.63	0.57	0.52	0.53	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.56	0.56	0.56	0.56
	MVA LAR																													
Birmingham EZ	MVA	28.6	28.6	27.5	28.6	26.7	26.5	33.5	24.9	26.9	20.7	20.7	20.8	20.8	20.9	20.9	21.0	21.0	21.1	21.1	21.2	21.2	21.3	21.3	21.4	21.5	21.5	21.6	21.6	21.7
	10 day LTR	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0
	Ratio of 10 day LTR	0.68	0.68	0.65	0.68	0.64	0.63	0.80	0.59	0.64	0.49	0.49	0.49	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.52
	MVA LAR																													
Birmingham DK	MVA	31.9	31.7	32.3	33.8	33.7	34.3	32.9	28.0	32.1	31.9	31.9	32.0	32.1	32.2	32.3	32.4	32.4	32.5	32.6	32.7	32.8	32.8	32.9	33.0	33.1	33.2	33.3	33.3	33.4
	10 day LTR	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
	Ratio of 10 day LTR	0.71	0.70	0.72	0.75	0.75	0.76	0.73	0.62	0.71	0.71	0.71	0.71	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.73	0.73	0.73	0.73	0.73	0.74	0.74	0.74	0.74	0.74
	MVA LAR																													
Dundas BY	MVA	32.9	33.9	36.1	33.2	31.8	35.1	39.2	44.0	34.4	34.3	34.4	34.5	34.6	34.7	34.8	34.9	34.9	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.6	35.7	35.8	35.9	36.0
	10 day LTR	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0
	Ratio of 10 day LTR	0.34	0.35	0.38	0.35	0.33	0.37	0.41	0.46	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.38
	MVA LAR																													
Dundas JQ	MVA	34.1	38.5	46.0	43.3	42.4	39.4	46.2	49.3	51.5	53.3	54.3	55.3	56.3	57.4	58.4	58.9	59.0	59.2	59.3	59.5	59.6	59.8	59.9	60.1	60.2	60.4	60.5	60.7	60.8
	10 day LTR	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0	96.0
	Ratio of 10 day LTR	0.36	0.40	0.48	0.45	0.44	0.41	0.48	0.51	0.54	0.56	0.57	0.58	0.59	0.60	0.61	0.61	0.61	0.62	0.62	0.62	0.62	0.62	0.62	0.63	0.63	0.63	0.63	0.63	0.63
	MVA LAR																													
Elgin DK	MVA	30.0	30.4	30.8	29.1	28.4	32.6	43.0	43.1	40.3	34.5	34.6	34.7	34.8	34.9	34.9	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.6	35.7	35.8	35.9	36.0	36.1	36.2
	10 day LTR	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8
	Ratio of 10 day LTR	0.66	0.66	0.67	0.63	0.62	0.71	0.94	0.94	0.88	0.75	0.76	0.76	0.76	0.76	0.76	0.76	0.77	0.77	0.77	0.77	0.77	0.78	0.78	0.78	0.78	0.78	0.79	0.79	0.79
	MVA LAR																													
Elgin QJ	MVA	30.7	31.7	33.3	32.7	32.0	34.3	40.0	39.8	36.5	33.5	35.3	37.1	37.2	37.3	37.4	37.5	37.6	37.7	37.8	37.9	38.0	38.1	38.2	38.3	38.4	38.5	38.6	38.7	38.8
	10 day LTR	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8	45.8
	Ratio of 10 day LTR	0.67	0.69	0.73	0.71	0.70	0.75	0.87	0.87	0.80	0.73	0.77	0.81	0.81	0.82	0.82	0.82	0.82	0.82	0.83	0.83	0.83	0.83	0.83	0.84	0.84	0.84	0.84	0.84	0.85
	MVA LAR																													
Elgin EZ	MVA	23.5	25.0	23.3	26.0	25.1	28.2	27.8	23.1	20.5	20.6	20.6	20.7	20.7	20.8	20.8	20.9	20.9	21.0	21.0	21.1	21.1	21.2	21.2	21.3	21.3	21.4	21.4	21.5	21.5
	10 day LTR	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0
	Ratio of 10 day LTR	0.56	0.60	0.56	0.62	0.60	0.67	0.66	0.55	0.49	0.49	0.49	0.49	0.49	0.49	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.51	0.51	0.51	0.51	0.51	0.51	0.51
	MVA LAR																													
Gage ZY	MVA	40.8	47.8	41.4	54.4	41.1	26.0	32.6	6.8	34.6	34.7	34.8	34.8	34.9	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.6	35.7	35.8	35.9	36.0	36.1	36.2	36.3	36.4
	10 day LTR	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0
	Ratio of 10 day LTR	0.64	0.75	0.65	0.85	0.64	0.41	0.51	0.11	0.54	0.54	0.54	0.54	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.57	0.57	0.57
	MVA LAR																													
Gage DJ	MVA	19.4	19.1	16.6	16.4	14.4	18.0	18.3	17.9	13.6	17.2	17.2	17.2	17.3	17.3	17.4	17.4	17.5	17.5	17.5	17.6	17.6	17.7	17.7	17.8	17.8	17.9	17.9	17.9	18.0
	10 day LTR	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0
	Ratio of 10 day LTR	0.27	0.26	0.23	0.23	0.20	0.25	0.25	0.24	0.19	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.25	0.25	0.25
	MVA LAR																													
Gage KE	MVA	82.8	89.0	78.4	78.2	79.0	48.4	60.9	23.8	20.7	18.0	18.0	18.1	18.1	18.2	18.2	18.3	18.3	18.4	18.4	18.4	18.5	18.5	18.6	18.6	18.7	18.7	18.8	18.8	18.9
	10 day LTR	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0
	Ratio of 10 day LTR	0.67	0.72	0.63	0.63	0.64	0.39	0.49	0.19	0.17	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	MVA LAR																													
Gage QB	MVA	25.9	23.2	22.5	22.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	10 day LTR	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0
	Ratio of 10 day LTR	0.36	0.32	0.31	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MVA LAR																													

HORIZON UTILITIES 25 YEAR LOAD FORECAST SUMMARY

Hydro One Supply Bus		Actual										Forecast																	
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Horning B1B2	MVA	46.7	55.2	52.7	49.6	45.4	46.2	53.4	53.6	56.3	49.8	50.4	50.5	50.6	50.7	50.9	51.0	51.1	51.3	51.4	51.5	51.6	51.8	51.9	52.0	52.2	52.3	52.4	52.6	52.7
	10 day LTR	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8
	Ratio of 10 day LTR	0.82	0.97	0.93	0.87	0.80	0.81	0.94	0.94	0.99	0.88	0.89	0.89	0.89	0.89	0.90	0.90	0.90	0.90	0.90	0.91	0.91	0.91	0.91	0.92	0.92	0.92	0.92	0.93	0.93
	MVA LAR																													
Horning Q1Q2	MVA	8.5	8.7	13.6	13.0	10.4	9.4	19.1	21.6	22.2	23.9	27.8	29.5	32.4	33.1	33.9	33.9	34.0	34.1	34.2	34.3	34.4	34.5	34.5	34.6	34.7	34.8	34.9	35.0	35.1
	10 day LTR	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8
	Ratio of 10 day LTR	0.15	0.15	0.24	0.23	0.18	0.17	0.34	0.38	0.39	0.42	0.49	0.52	0.57	0.58	0.60	0.60	0.60	0.60	0.60	0.60	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.62	0.62
	MVA LAR																													
Kenilworth DK	MVA	1.4	2.8	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	10 day LTR	44.1	44.1	44.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ratio of 10 day LTR	0.03	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	MVA LAR																													
Kenilworth EJ	MVA	26.2	30.0	28.1	24.8	26.2	21.1	34.4	32.2	33.8	31.7	31.8	31.9	32.0	32.1	32.1	32.2	32.3	32.4	32.5	32.5	32.6	32.7	32.8	32.9	33.0	33.0	33.1	33.2	33.3
	10 day LTR	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8	37.8
	Ratio of 10 day LTR	0.69	0.79	0.74	0.65	0.69	0.56	0.91	0.85	0.89	0.84	0.84	0.84	0.85	0.85	0.85	0.85	0.85	0.86	0.86	0.86	0.86	0.87	0.87	0.87	0.87	0.87	0.88	0.88	0.88
	MVA LAR																													
Kenilworth B1Y1	MVA	54.7	57.9	59.4	45.4	34.0	32.1	32.3	36.2	32.3	32.8	32.9	33.0	33.1	33.2	33.3	33.3	33.4	33.5	33.6	33.7	33.8	33.8	33.9	34.0	34.1	34.2	34.3	34.4	34.4
	10 day LTR	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0
	Ratio of 10 day LTR	0.86	0.90	0.93	0.71	0.53	0.50	0.50	0.57	0.50	0.51	0.51	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.54	0.54	0.54
	MVA LAR																													
Lake BY (27kV)	MVA	68.3	63.4	65.3	64.0	73.2	82.9	70.8	60.1	66.5	65.5	65.7	65.9	66.0	66.2	66.4	66.5	66.7	66.9	67.0	67.2	67.4	67.5	67.7	67.9	68.0	68.2	68.4	68.5	68.7
	10 day LTR	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0
	Ratio of 10 day LTR	0.64	0.60	0.62	0.60	0.69	0.78	0.67	0.57	0.63	0.62	0.62	0.62	0.62	0.62	0.63	0.63	0.63	0.63	0.63	0.63	0.64	0.64	0.64	0.64	0.64	0.64	0.65	0.65	0.65
	MVA LAR																													
Lake J1J2	MVA	26.1	29.3	30.1	27.5	26.4	26.4	28.2	37.2	29.1	36.6	36.7	36.8	36.9	37.0	37.1	37.1	37.2	37.3	37.4	37.5	37.6	37.7	37.8	37.9	38.0	38.1	38.2	38.3	38.4
	10 day LTR	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
	Ratio of 10 day LTR	0.51	0.57	0.59	0.54	0.52	0.52	0.55	0.73	0.57	0.72	0.72	0.72	0.72	0.72	0.73	0.73	0.73	0.73	0.73	0.74	0.74	0.74	0.74	0.74	0.74	0.75	0.75	0.75	0.75
	MVA LAR																													
Lake Q1Q2	MVA	36.6	40.6	41.0	37.6	34.5	32.9	42.6	41.6	36.0	33.6	35.2	36.8	36.9	37.0	37.1	37.2	37.3	37.4	37.5	37.6	37.7	37.8	37.9	38.0	38.1	38.2	38.2	38.3	38.4
	10 day LTR	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
	Ratio of 10 day LTR	0.72	0.80	0.80	0.74	0.68	0.65	0.84	0.82	0.71	0.66	0.69	0.72	0.72	0.73	0.73	0.73	0.73	0.73	0.74	0.74	0.74	0.74	0.74	0.74	0.75	0.75	0.75	0.75	0.75
	MVA LAR																													
Mohawk B1B2	MVA	36.9	49.3	45.6	42.0	38.6	36.6	37.2	37.0	35.3	32.4	32.9	33.4	33.9	34.4	34.9	35.4	35.5	35.6	35.6	35.7	35.8	35.9	36.0	36.1	36.2	36.3	36.4	36.5	36.6
	10 day LTR	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0
	Ratio of 10 day LTR	0.88	1.17	1.09	1.00	0.92	0.87	0.89	0.88	0.84	0.77	0.78	0.80	0.81	0.82	0.83	0.84	0.84	0.85	0.85	0.85	0.85	0.86	0.86	0.86	0.86	0.86	0.87	0.87	0.87
	MVA LAR		7.3	3.6	0.0																									
Mohawk Y1Y2	MVA	37.9	43.4	45.2	42.8	38.7	39.1	46.5	43.6	43.0	38.4	38.5	38.6	38.7	38.8	38.9	39.0	39.1	39.2	39.3	39.4	39.5	39.6	39.7	39.8	39.9	40.0	40.1	40.2	40.3
	10 day LTR	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0
	Ratio of 10 day LTR	0.90	1.03	1.08	1.02	0.92	0.93	1.11	1.04	1.02	0.92	0.92	0.92	0.92	0.92	0.93	0.93	0.93	0.93	0.94	0.94	0.94	0.94	0.95	0.95	0.95	0.95	0.95	0.96	0.96
	MVA LAR		1.4	3.2	0.8			4.5	1.6	1.0																				
Nebo BY	MVA	23.5	28.6	31.1	32.5	28.4	27.0	31.0	35.1	33.8	34.5	37.4	39.4	41.5	43.6	44.7	45.5	45.6	45.7	45.9	46.0	46.1	46.2	46.3	46.4	46.6	46.7	46.8	46.9	47.0
	10 day LTR	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8
	Ratio of 10 day LTR	0.70	0.85	0.93	0.97	0.85	0.81	0.93	1.05	1.01	1.03	0.74	0.78	0.82	0.86	0.88	0.90	0.90	0.90	0.90	0.91	0.91	0.91	0.91	0.91	0.92	0.92	0.92	0.92	0.93
	MVA LAR								1.6	0.3	1.0																			
Nebo QJ	MVA	42.1	49.8	61.4	59.9	54.6	52.8	61.0	57.5	56.0	56.6	56.8	56.9	57.1	57.2	57.4	57.5	57.6	57.8	57.9	58.1	58.2	58.4	58.5	58.7	58.8	59.0	59.1	59.3	59.4
	10 day LTR	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0	58.0
	Ratio of 10 day LTR	0.73	0.86	1.06	1.03	0.94	0.91	1.05	0.99	0.97	0.98	0.98	0.98	0.98	0.99	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.01	1.01	1.01	1.01	1.02	1.02	1.02	1.02
	MVA LAR			3.4	1.9			3.0													0.1	0.2	0.4	0.5	0.7	0.8	1.0	1.1	1.3	1.4
Newton B	MVA	23.8	24.6	23.7	22.8	21.5	19.9	20.8	25.2	24.3	21.6	21.6	23.4	24.1	25.2	25.3	25.4	25.4	25.5	25.5	25.6	25.7	25.7	25.8	25.9	25.9	26.0	26.1	26.1	26.2
	10 day LTR	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2
	Ratio of 10 day LTR	0.66	0.68	0.65	0.63	0.59	0.55	0.57	0.70	0.67	0.60	0.60	0.65	0.67	0.70	0.70	0.70	0.70	0.70	0.71	0.71	0.71	0.71	0.71	0.71	0.72	0.72	0.72	0.72	0.72
	MVA LAR																													
Newton Y	MVA	20.8	23.6	24.5	21.8	19.2	19.3	20.9	23.2	20.7	20.3	20.3	20.4	20.4	20.5	20.5	20.6	20.7	20.7	20.8	20.8	20.9	20.9	21.0	21.0	21.1	21.1	21.2	21.2	21.3
	10 day LTR	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2
	Ratio of 10 day LTR	0.58	0.65	0.68	0.60	0.53	0.53	0.58	0.64	0.57	0.56	0.56	0.56	0.56	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.59	0.59
	MVA LAR																													
Stirton BY	MVA	25.5	30.2	28.0	37.8	27.9	35.3	31.5	24.7	22.2	21.9	22.0	22.0	22.1	22.2	22.2	22.3	22.3	22.4	22.4	22.5	22.5	22.6	22.7	22.7	22.8	22.8	22.9	22.9	23.0
	10 day LTR	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
	Ratio of 10 day LTR	0.50	0.59	0.55	0.74	0.55	0.69	0.62	0.48	0.44	0.43	0.43	0.43	0.43	0.43	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.45	0.45	0.45	0.45	0.45	0.45
	MVA LAR																													
Stirton QZ	MVA	26.1	31.3	30.7	35.2	25.7	26.7	29.0	29.6	25.7	25.0	25.1	25.1	25.2	25.3	25.3	25.4	25.5	25.5	25.6	25.7	25.7	25.8	25.8	25.9	26.0	26.0	26.1	26.2	26.2
	10 day LTR	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
	Ratio of 10 day LTR	0.51	0.61	0.60	0.69	0.50	0.52	0.57	0.58	0.50	0.49	0.49	0.49	0.49	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
	MVA LAR																													
Winona JQ	MVA	47.4	47.7	51.9	51.1	49.7	40.6	50.7	52.2	52.1	54.3	57.0	59.7	59.8	60.0	60.1	60.3	60.4	60.6	60.7	60.9	61.0	61.2	61.3	61.5	61.6	61.8	61.9	62.1	62.2
	10 day LTR	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0
	Ratio of 10 day LTR	0.45	0.45	0.49	0.48	0.47	0.38	0.48	0.49	0.49	0.51	0.54	0.56	0.56	0.57	0.57	0.57	0.57	0.57	0.57	0.57	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.59	0.59
	MVA LAR																													

HORIZON UTILITIES 25 YEAR LOAD FORECAST SUMMARY

Hydro One Supply Bus		Actual										Forecast																		
		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Bunting J1J2	MVA	0.0	40.5	35.2	33.4	29.9	24.1	36.5	35.4	35.5	31.7	31.7	31.8	31.9	32.0	32.1	32.1	32.2	32.3	32.4	32.5	32.6	32.6	32.7	32.8	32.9	33.0	33.0	33.1	33.2
	10 day LTR	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1
	Ratio of 10 day LTR	0.00	0.96	0.84	0.79	0.71	0.57	0.87	0.84	0.84	0.75	0.75	0.76	0.76	0.76	0.76	0.76	0.77	0.77	0.77	0.77	0.77	0.78	0.78	0.78	0.78	0.78	0.78	0.79	0.79
	MVA LAR																													
Bunting Q1Q2	MVA	0.0	45.4	39.2	36.1	34.6	32.5	37.5	33.7	33.0	34.2	34.3	34.4	34.4	34.5	34.6	34.7	34.8	34.9	35.0	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.8
	10 day LTR	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1
	Ratio of 10 day LTR	0.00	1.08	0.93	0.86	0.82	0.77	0.89	0.80	0.78	0.81	0.81	0.82	0.82	0.82	0.82	0.82	0.83	0.83	0.83	0.83	0.83	0.84	0.84	0.84	0.84	0.85	0.85	0.85	0.85
	MVA LAR		3.3																											
Carlton QE	MVA	0.0	48.1	38.9	20.7	19.2	15.5	19.1	7.9	4.1	3.8	3.8	3.8	3.8	3.8	3.8	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	4.0	4.0	4.0	4.0
	10 day LTR	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Ratio of 10 day LTR	0.00	1.12	0.90	0.48	0.45	0.36	0.44	0.18	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
	MVA LAR		5.1																											
Carlton HK	MVA	0.0	71.0	50.9	50.8	45.7	46.2	47.7	56.6	55.5	50.8	52.6	53.8	55.1	55.2	55.3	55.5	55.6	55.7	55.9	56.0	56.2	56.3	56.5	56.6	56.7	56.9	57.0	57.2	57.3
	10 day LTR	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0
	Ratio of 10 day LTR	0.00	1.34	0.96	0.96	0.86	0.87	0.90	1.07	1.05	0.96	0.99	1.02	1.04	1.04	1.04	1.05	1.05	1.05	1.05	1.06	1.06	1.06	1.07	1.07	1.07	1.07	1.08	1.08	1.08
	MVA LAR		18.0						3.6	2.5			0.8	2.1	2.2	2.3	2.5	2.6	2.7	2.9	3.0	3.2	3.3	3.5	3.6	3.7	3.9	4.0	4.2	4.3
Carlton BY	MVA	0.0	29.8	62.0	64.6	61.1	68.0	59.5	73.0	60.4	60.4	60.6	60.7	60.9	61.0	61.2	61.3	61.5	61.6	61.8	61.9	62.1	62.2	62.4	62.6	62.7	62.9	63.0	63.2	63.3
	10 day LTR	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5
	Ratio of 10 day LTR	0.00	0.54	1.12	1.16	1.10	1.23	1.07	1.32	1.09	1.09	1.09	1.09	1.10	1.10	1.10	1.10	1.11	1.11	1.11	1.12	1.12	1.12	1.12	1.13	1.13	1.13	1.14	1.14	1.14
	MVA LAR			6.5	9.1	5.6	12.5	4.0	17.5	4.9	4.9	5.1	5.2	5.4	5.5	5.7	5.8	6.0	6.1	6.3	6.4	6.6	6.7	6.9	7.1	7.2	7.4	7.5	7.7	7.8
Glendale BJ	MVA	0.0	35.6	27.3	28.7	28.9	25.7	27.4	26.0	27.6	26.6	26.6	26.7	26.8	26.8	26.9	27.0	27.0	27.1	27.2	27.2	27.3	27.4	27.5	27.5	27.6	27.7	27.7	27.8	27.9
	10 day LTR	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0
	Ratio of 10 day LTR	0.00	0.77	0.59	0.62	0.63	0.56	0.59	0.57	0.60	0.58	0.58	0.58	0.58	0.58	0.58	0.59	0.59	0.59	0.59	0.59	0.59	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.61
	MVA LAR																													
Glendale DQ	MVA	0.0	35.6	26.7	27.7	33.0	29.9	30.7	26.9	25.2	27.1	27.1	27.2	27.3	27.3	27.4	27.5	27.6	27.6	27.7	27.8	27.8	27.9	28.0	28.0	28.1	28.2	28.3	28.3	28.4
	10 day LTR	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0
	Ratio of 10 day LTR	0.00	0.77	0.58	0.60	0.72	0.65	0.67	0.58	0.55	0.59	0.59	0.59	0.59	0.59	0.60	0.60	0.60	0.60	0.60	0.60	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.62	0.62
	MVA LAR																													
Glendale EY	MVA	0.0	13.3	18.0	18.3	15.7	15.6	17.6	16.0	15.5	12.0	12.1	12.1	12.1	12.2	12.2	12.2	12.3	12.3	12.3	12.3	12.4	12.4	12.4	12.5	12.5	12.5	12.6	12.6	12.6
	10 day LTR	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8
	Ratio of 10 day LTR	0.00	0.67	0.91	0.92	0.79	0.79	0.89	0.81	0.78	0.61	0.61	0.61	0.61	0.61	0.62	0.62	0.62	0.62	0.62	0.62	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.64	0.64
	MVA LAR																													
Vansickle BY	MVA	0.0	45.8	38.0	42.4	40.5	44.3	44.2	38.3	38.4	33.0	34.0	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.6	34.7	34.8	34.9	35.0	35.1	35.2	35.3	35.3	35.4	35.5
	10 day LTR	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0
	Ratio of 10 day LTR	0.00	0.85	0.70	0.78	0.75	0.82	0.82	0.71	0.71	0.61	0.63	0.63	0.63	0.63	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.65	0.65	0.65	0.65	0.65	0.65	0.66	0.66
	MVA LAR																													
Vansickle JQ	MVA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.8	13.0	26.2	26.6	27.0	27.4	27.4	27.5	27.6	27.6	27.7	27.8	27.8	27.9	28.0	28.1	28.1	28.2	28.3	28.3	28.4	28.5
	10 day LTR	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0
	Ratio of 10 day LTR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.24	0.49	0.49	0.50	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.53	0.53
	MVA LAR																													

LTR = Limited Time Rating
LAR = Load at Risk

Notes:
2013 feeder peaks used to forecast 2014 onwards
Generation has been removed from feeders
Expected load growth has been accounted for based on information as of Nov 1, 2013
0.25% growth per year unless otherwise specified

Generators	
Bunting J1J2	Rankin Weir 1 & Weir 2 Generators Approx 3 MW combined
Carlton BY	Heywood Generating Station Approx 5.2 MW
Glendale EY	St.Lawrence Seaway Generator Approx 3.5 MW

Substation Transformer Lookup Table For Previous Year

Station	Peak Tx Current (A)				Tx Load Calculated (kVA)				TX Ratings				% Loaded				Loss of 1 Tx Excess (kVA)	Max Limit	Single Bus (No tie s/w)	Total # of Circuits	Circuits Feed by (per Tx)			
	TX1	TX2	TX3	TX4	TX1	TX2	TX3	TX4	TX1	TX2	TX3	TX4	TX1	TX2	TX3	TX4					TX1	TX2	TX3	TX4
Aberdeen	394	336	0	0	2838	2424	0	0	6667	6667			43%	36%				13334	N	4	2	2		
Baldwin	306	0	0	0	2204	0	0	0	7500				29%				2204	7500	Y	2	2			
Bartonville	677	0	0	0	4881	0	0	0	13333				37%				4881	13333	Y	5	5			
Caroline	360	49	0	0	2594	353	0	0	5000	5000			52%	7%				10000	N	3	2	1		
Central	586	410	0	0	4222	2958	0	0	13333	13333			32%	22%				26666	N	10	6	4		
Cope	439	298	481	0	3160	2148	3465	0	6667	6667	6667		47%	32%	52%			20001	N	9	3	3	3	
Deerhurst	118	0	0	0	849	0	0	0	7500				11%				849	7500	Y	3	3			
Dewitt	109	0	0	0	787	0	0	0	5000				16%				787	5000	Y	3	3			
Eastmount	570	205	433	261	4108	1479	3119	1879	6667	6667	6667	6667	62%	22%	47%	28%		26668	N	10	3	2	3	2
Elmwood	344	123	400	0	2476	885	2885	0	6667	6667	6667		37%	13%	43%			20001	N	7	3	1	3	
Galbraith	114	0	0	0	821	0	0	0	5600				15%				821	5600	Y	3	3			
Highland	319	0	0	0	2300	0	0	0	6667				34%				2300	6667	Y	3	3			
Hughson	271	0	0	199	1951	0	0	1431	6667	0	6667	6667	29%			21%		20001	N	3	1	1	0	1
John	331	0	0	0	2382	0	0	0	6667				36%				2382	6667	Y	2	2			
Kenilworth	469	338	0	0	3381	2437	0	0	6667	6667			51%	37%				13334	N	6	3	3		
Mohawk	668	481	0	0	4812	3464	0	0	13333	6667	6667		36%	52%				26667	N	8	5	3	0	
Mountain	842	370	0	0	6065	2663	0	0	13333	6667	6667		45%	40%				26667	N	8	5	3	0	
Ottawa	397	366	246	0	2861	2635	1773	0	6667	6667	6667		43%	40%	27%			20001	N	7	3	2	2	
Parkdale	624	359	0	0	4496	2586	0	0	13333	13333			34%	19%				26666	N	7	4	3		
Spadina	519	538	0	0	3737	3874	0	0	6667	6667	0		56%	58%			945	13334	N	6	3	3		
Strouds	408	320	0	0	2942	2303	0	0	6667	6667			44%	35%				13334	N	5	3	2		
~~Webster~~	0	0	0	0	0	0	0	0	0								0	0	Y	0	0			
Wellington	400	304	291	212	2882	2190	2094	1526	6667	6667	6667	6667	43%	33%	31%	23%		26668	N	10	3	3	2	2
Wentworth	631	0	728	275	4545	0	5243	1978	6667	0	6667	6667	68%		79%	30%		20001	N	11	3	3	2	3
Whitney	474	255	0	0	3419	1838	0	0	6667	6667			51%	28%				13334	N	6	3	3		
York	107	0	0	0	773	0	0	0	4000	5000			19%					9000	Y	2	2			
Vine	622	0	0	0	4484	0	0	0	7500	6667			60%					14167	Y	4	4			
Taylor	0	0	0	0	0	0	0	0	2499	2000	3000							7499	N	3	1	1	1	
Grantham	457	0	0	0	3292	0	0	0	6000	0			55%				3292	6000	N	3	3	0		
Welland	152	0	0	0	1095	0	0		3000	3000	3600		37%					9600	Y	3	1			

Note: Stations highlighted in Yellow are 8kV, all others are 4kV.

Appendix I – Hydro One Regional Planning Status Letter

Hydro One Network Inc.
483 Bay Street
15th Floor, South Tower
Toronto, ON M5G 2P5
www.HydroOne.com

Tel: (416) 345-5420
Fax: (416) 345-4141
ajay.garg@HydroOne.com

February 12, 2014

R. Bassindale
Supervisor, Engineering and Asset Management
Horizon Utilities Corporation Inc.
55 John Street North
Hamilton, Ontario, L8R 3M8

Dear Mr. Bassindale**:**

Subject: Regional Planning Status

In reference to your request for a regional planning status letter, please note that your Local Distribution Company (LDC) belongs to a) Burlington to Nanticoke Region in Group 1 and b) Niagara Region in Group 3. A map showing details with respect to the 21 Regions/Groups and list of LDCs in each Region is attached in Appendix A and B respectively.

This letter is to confirm that the regional planning process for Burlington to Nanticoke Region in Group 1 was initiated in January 2014 and the Needs Screening report is expected to be completed in the 2nd quarter of 2014. The regional planning process for Niagara Region in Group 3 has not been initiated nor has a Regional Infrastructure Plan (RIP) been developed for the sub-region within the Niagara Region affecting the Horizon Utilities. I am expecting that the regional planning process for the Niagara Region will be initiated in 4th quarter of 2016. Hydro One will formally notify your organization in advance, along with other stakeholders, prior to launching the regional planning process.

The new planning process provides flexibility, during the transition period to the new process, and will ensure that both distribution and transmission planning continue to address any short-term needs. Hydro One looks forward to working with Horizon Utilities Corporation Inc. in executing the new regional planning process.

If you have any further questions, please feel free to contact me.

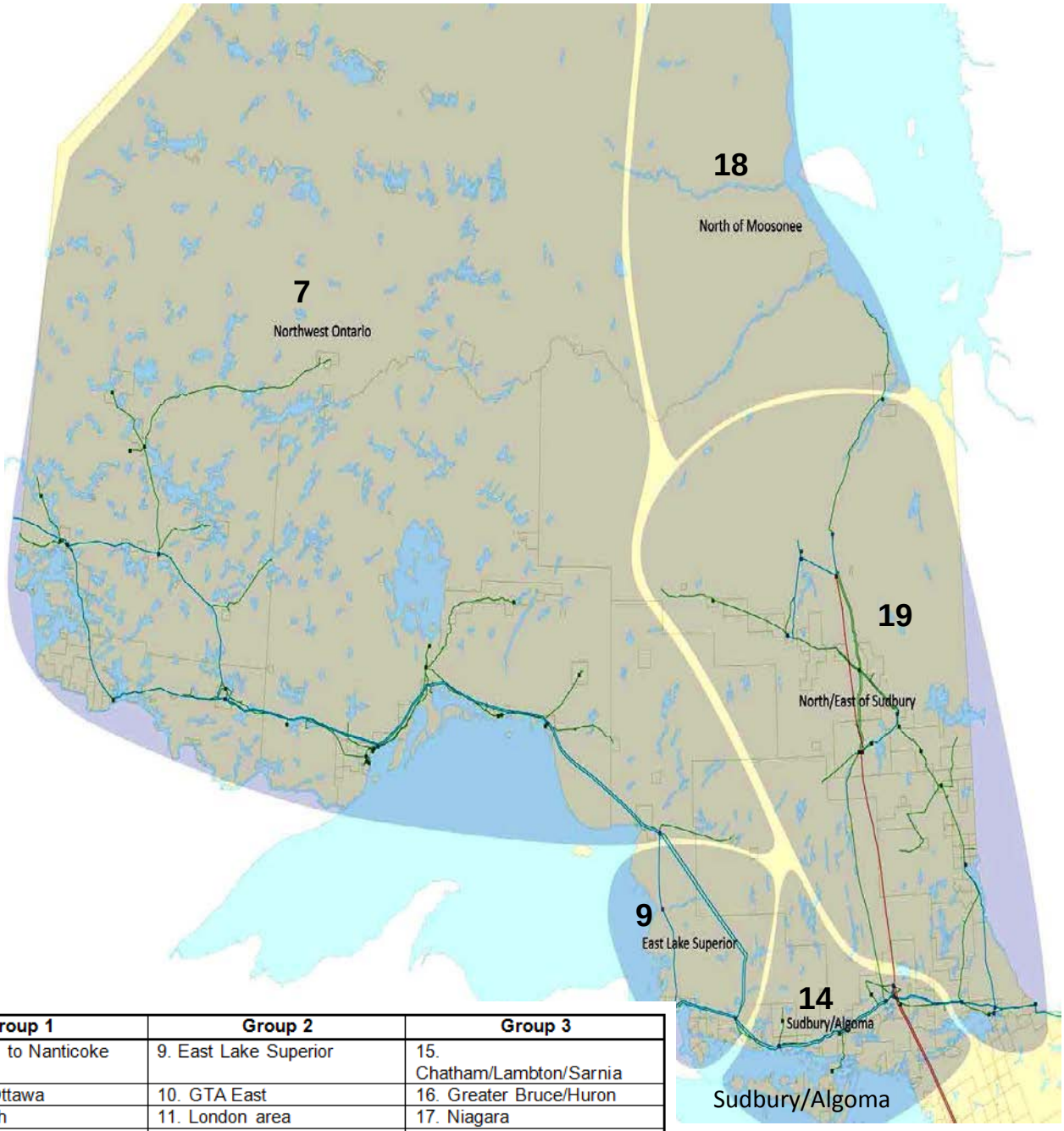
Sincerely,

Ajay Garg
Manager - Regional Planning and Transmission Load Connections
Hydro One Networks Inc.

Cc:
Brad Colden, Manager – Customer Business Relations

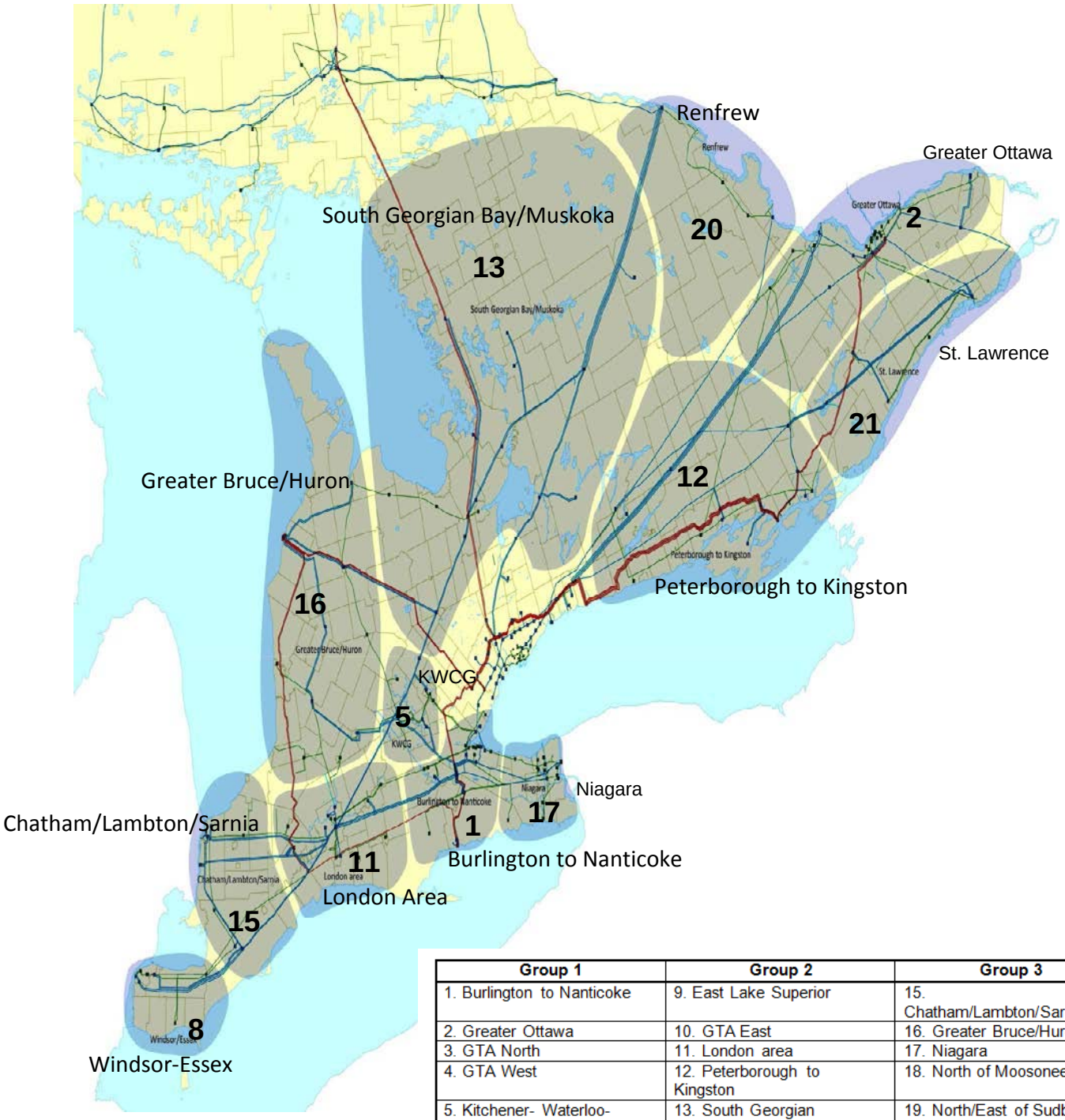
Appendix A: Map of Ontario's Planning Regions

Northern Ontario



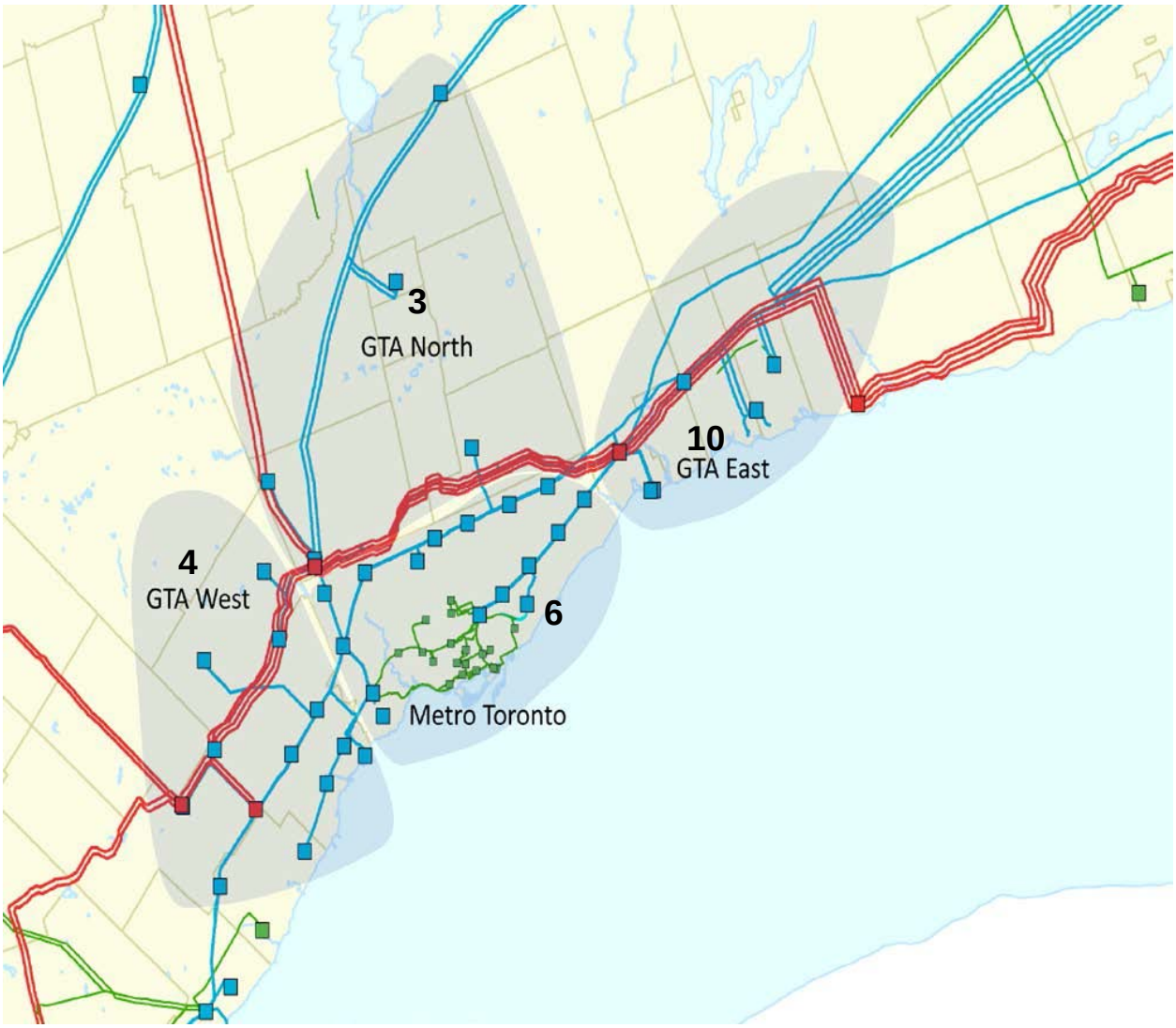
Group 1	Group 2	Group 3
1. Burlington to Nanticoke	9. East Lake Superior	15. Chatham/Lambton/Sarnia
2. Greater Ottawa	10. GTA East	16. Greater Bruce/Huron
3. GTA North	11. London area	17. Niagara
4. GTA West	12. Peterborough to Kingston	18. North of Moosonee
5. Kitchener- Waterloo-Cambridge-Guelph ("KWCG")	13. South Georgian Bay/Muskoka	19. North/East of Sudbury
6. Metro Toronto	14. Sudbury/Algoma	20. Renfrew
7. Northwest Ontario		21. St. Lawrence
8. Windsor-Essex		

Southern Ontario



Group 1	Group 2	Group 3
1. Burlington to Nanticoke	9. East Lake Superior	15. Chatham/Lambton/Sarnia
2. Greater Ottawa	10. GTA East	16. Greater Bruce/Huron
3. GTA North	11. London area	17. Niagara
4. GTA West	12. Peterborough to Kingston	18. North of Moosonee
5. Kitchener- Waterloo-Cambridge-Guelph ("KWCG")	13. South Georgian Bay/Muskoka	19. North/East of Sudbury
6. Metro Toronto	14. Sudbury/Algoma	20. Renfrew
7. Northwest Ontario		21. St. Lawrence
8. Windsor-Essex		

Greater Toronto Area (GTA)



Group 1	Group 2	Group 3
1. Burlington to Nanticoke	9. East Lake Superior	15. Chatham/Lambton/Sarnia
2. Greater Ottawa	10. GTA East	16. Greater Bruce/Huron
3. GTA North	11. London area	17. Niagara
4. GTA West	12. Peterborough to Kingston	18. North of Moosonee
5. Kitchener- Waterloo-Cambridge-Guelph ("KWCG")	13. South Georgian Bay/Muskoka	19. North/East of Sudbury
6. Metro Toronto	14. Sudbury/Algoma	20. Renfrew
7. Northwest Ontario		21. St. Lawrence
8. Windsor-Essex		

Appendix B: List of LDCs for Each Region

[Hydro One as Upstream Transmitter]

Region	LDCs
1. Burlington to Nanticoke	• Brant County Power Inc. • Brantford Power Inc. • Burlington Hydro Inc. • Haldimand County Hydro Inc. • Horizon Utilities Corporation • Hydro One Networks Inc. • Norfolk Power Distribution Inc. • Oakville Hydro Electricity Distribution Inc.
2. Greater Ottawa	• Hydro 2000 Inc. • Hydro Hawkesbury Inc. • Hydro One Networks Inc. • Hydro Ottawa Limited • Ottawa River Power Corporation • Renfrew Hydro Inc.
3. GTA North	• Enersource Hydro Mississauga Inc. • Hydro One Brampton Networks Inc. • Hydro One Networks Inc. • Newmarket-Tay Power Distribution Ltd. • PowerStream Inc. • PowerStream Inc. [Barrie] • Toronto Hydro Electric System Limited • Veridian Connections Inc.
4. GTA West	• Burlington Hydro Inc. • Enersource Hydro Mississauga Inc. • Halton Hills Hydro Inc. • Hydro One Brampton Networks Inc. • Hydro One Networks Inc. • Milton Hydro Distribution Inc. • Oakville Hydro Electricity Distribution Inc.

5. Kitchener- Waterloo-Cambridge-Guelph ("KWCG")	• Cambridge and North Dumfries Hydro Inc. • Centre Wellington Hydro Ltd. • Guelph Hydro Electric System - Rockwood Division • Guelph Hydro Electric Systems Inc. • Halton Hills Hydro Inc. • Hydro One Networks Inc. • Kitchener-Wilmot Hydro Inc. • Milton Hydro Distribution Inc. • Waterloo North Hydro Inc. • Wellington North Power Inc.
6. Metro Toronto	• Enersource Hydro Mississauga Inc. • Hydro One Networks Inc. • PowerStream Inc. • Toronto Hydro Electric System Limited • Veridian Connections Inc.
7. Northwest Ontario	• Atikokan Hydro Inc. • Chapleau Public Utilities Corporation • Fort Frances Power Corporation • Hydro One Networks Inc. • Kenora Hydro Electric Corporation Ltd. • Sioux Lookout Hydro Inc. • Thunder Bay Hydro Electricity Distribution Inc.
8. Windsor-Essex	• E.L.K. Energy Inc. • Entegrus Power Lines lnc. [Chatham-Kent] • EnWin Utilities Ltd. • Essex Powerlines Corporation • Hydro One Networks Inc.
9. East Lake Superior	N/A →This region is not within Hydro One's territory

10. GTA East	• Hydro One Networks Inc. • Oshawa PUC Networks Inc. • Veridian Connections Inc. • Whitby Hydro Electric Corporation
11. London area	• Entegrus Power Lines Inc. [Middlesex] • Erie Thames Power Lines Corporation • Hydro One Networks Inc. • London Hydro Inc. • Norfolk Power Distribution Inc. • St. Thomas Energy Inc. • Tillsonburg Hydro Inc. • Woodstock Hydro Services Inc.
12. Peterborough to Kingston	• Eastern Ontario Power Inc. • Hydro One Networks Inc. • Kingston Hydro Corporation • Lakefront Utilities Inc. • Peterborough Distribution Inc. • Veridian Connections Inc.
13. South Georgian Bay/Muskoka	• Collingwood PowerStream Utility Services Corp. (COLLUS PowerStream Corp.) • Hydro One Networks Inc. • Innisfil Hydro Distribution Systems Limited • Lakeland Power Distribution Ltd. • Midland Power Utility Corporation • Orangeville Hydro Limited • Orillia Power Distribution Corporation • Parry Sound Power Corp. • Powerstream Inc. [Barrie] • Tay Power • Veridian Connections Inc. • Veridian-Gravenhurst Hydro Electric Inc. • Wasaga Distribution Inc.

14. Sudbury/Algoma	• Espanola Regional Hydro Distribution Corp. • Greater Sudbury Hydro Inc. • Hydro One Networks Inc.
15. Chatham/Lambton/Sarnia	• Bluewater Power Distribution Corporation • Entegrus Power Lines Inc. [Chatham-Kent] • Hydro One Networks Inc.
16. Greater Bruce/Huron	• Entegrus Power Lines Inc. [Middlesex] • Erie Thames Power Lines Corporation • Festival Hydro Inc. • Hydro One Networks Inc. • Wellington North Power Inc. • West Coast Huron Energy Inc. • Westario Power Inc.
17. Niagara	• Canadian Niagara Power Inc. [Port Colborne] • Grimsby Power Inc. • Haldimand County Hydro Inc*. • Horizon Utilities Corporation • Hydro One Networks Inc. • Niagara Peninsula Energy Inc. • Niagara-On-The-Lake Hydro Inc. • Welland Hydro-Electric System Corp. *Changes to the May 17, 2013 OEB Planning Process Working Group Report.
18. North of Moosonee	N/A →This region is not within Hydro One's territory
19. North/East of Sudbury	• Greater Sudbury Hydro Inc. • Hearst Power Distribution Company Limited • Hydro One Networks Inc. • North Bay Hydro Distribution Ltd. • Northern Ontario Wires Inc.

20. Renfrew	• Hydro One Networks Inc. • Ottawa River Power Corporation • Renfrew Hydro Inc.
21. St. Lawrence	• Cooperative Hydro Embrun Inc. • Hydro One Networks Inc. • Rideau St. Lawrence Distribution Inc.

Appendix J – Resource and Office Space Utilization Study Report

horizon UTILITIES Looking beyond...

Resource and Office Space Utilization Study






PRISM Partners Inc

GARWOOD-JONES & HANHAM Architects

BnZ engineering

IRC GROUP Building Science Engineers & Consultants

PRISM Partners Inc

In collaboration with:

Garwood-Jones and Hanham Architects
IRC Group
BnZ Engineering

August 3, 2010

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1 PURPOSE

Horizon Utilities Corporation is one of the largest municipally owned electricity distribution companies in Ontario providing electrical and utility services to commercial and residential customers in the Hamilton, Stoney Creek and St. Catharines areas. Horizon is committed to providing safe, reliable electricity, customer value and creating a culture of energy conservation. The company employs over 400 employees that currently work out of Horizon-owned facilities located in Hamilton, Stoney Creek and St. Catharines.

Horizon is projecting a multi-business growth strategy through potential mergers and acquisitions and organic growth over the next five to ten year period. Potential growth areas include movement further into the Niagara region and northwest along the Highway 403 and 401 corridors to Cambridge. Horizon senior management predicts that with additional merger and acquisition activity, the staff complement could continue to increase to approximately 600 employees over the next five years and up to 900 employees in the next ten years. Without merger or acquisition growth, the organic staff complement is expected grow to 500 employees in the next five years.

In order to plan for this projected growth, Horizon management realizes the need to review its current real estate assets and facilities to ensure that future capacity for increased resources and equipment could be supported. At this time, some Horizon facilities are experiencing under-utilization of space, while other facilities are overcrowded and/or lacking in amenities or spaces to assist staff to work effectively.

Horizon has contracted PRISM Partners Inc (PRISM) to perform a Resource and Space Utilization Study to audit its existing buildings and facilities and to provide investment recommendations for the next five to ten years. The process included a staff engagement to determine departmental needs, interviews with key stakeholders and a review of current planning documents and site plans as well as site tours of all facilities. This report will outline challenges with existing facilities and space, and opportunities and efficiencies for Horizon Utilities staff to work and communicate more effectively, as well as identify opportunities for expansion potential at the sites.

1.1 Approach and Methodology

The Space Utilization Study investigated the current Horizon facilities (approximately 300,000 square feet), located on John Street and Nebo Road in Hamilton, Highway 8 in Stoney Creek and Vansickle Road in St. Catharines. The information found in this report was compiled based on information gleaned from the following activities:

- Site visits and photographic recording of all Horizon sites;
- Review of Horizon existing as-built drawings and building assessment reports;
- Visioning sessions with the CEO and Executives;

- Development of a needs assessment staff questionnaire and analysis of findings;
- Departmental user group interviews focusing on growth, adjacencies and clarification of questionnaire submissions; and
- Summary of user group information for updating CEO and Executives to highlight findings and obtaining further direction.

2 CURRENT STATE

2.1 Overview

Horizon Utilities Corporation currently owns four properties accommodating approximately 400 staff and 94 fleet vehicles. Properties include:

55 John Street, Hamilton – Head Office and Substation
450 Nebo Road, Hamilton – Service Centre and Main Stores
703 Highway 8, Stoney Creek – Overhead Lines, Stores and Training Centre
340 Vansickle Road, St. Catharines – Customer Service Centre, Service Centre and Stores

Within each of these facilities, there is potential area for growth; most notably at St. Catharines and Stoney Creek. In general, the facilities are in good shape and have been well maintained. Detailed architectural and engineering reports for all sites are included in Appendix A. Detailed information for each site will be discussed in the sections that follow.

2.2 John Street

The John Street facility primarily houses administrative offices and is considered the corporation's head office. There is a strong commitment to keep this location as the head office over the next ten years. The building is in good shape with all but the fourth floor having been recently renovated. The sixth floor is currently partially tenanted. Reorganization of the floors, reduction of onsite record storage, closure of the various lunch rooms and the upcoming departure of the tenant on the sixth floor will create potential to create the functions desired and allow for future growth.

2.2.1 Architectural Summary

The building was constructed in 1949. It is a steel framed structure with limestone facades on the north, east and west sides and brick on the south side. The building footprint is 41,000 square feet (including the Man building and substation). There is no construction record for the Man building. It appears to be a reinforced concrete structure. Gross floor areas are as follows:

Basement	36,000 square feet
Ground Floor	30,300 square feet (not including substation)
Levels 2-6	13,000 square feet
Second Floor Man	2,400 square feet

Most of the main tower has been renovated. Insulation has not been added to the perimeter walls to enhance its thermo performance. Man building exterior walls are original double-wythe brick with no insulation. Most of the exterior windows in the main tower were replaced in the early 1990's. There are still a few original single-glazed windows in the main tower, mainly exit stairs and service rooms. The Man building windows are the original single-glazed steel.

2.2.2 *Building Envelope Assessment*

Component	Composition	Observations/Recommendations
Exterior Wall 55 John Street	• Perimeter foundation walls are of cast-in-place concrete. • Upper level walls consist of limestone exterior veneer, clay tile back up and plaster interior. • Limestone veneer in 4" or 8" thicknesses depending on locations. Clay tile backup is in 4" or 8" thickness depending on locations. The clay tile backup is load-bearing as indicated on record drawings. • There is no thermal insulation in original exterior walls. There is no evidence that any exterior insulation was added in later dates.	• Adding insulation to exterior walls will reduce the heating/cooling load for this building and increase comfort for perimeter offices. • The recommended method of insulating the exterior walls is to: 1. Remove the existing plaster 2. Apply 2/12" of high performance sprayed polyurethane insulation to the existing clay tile (approx R13) 3. Line walls with 2/12" metal studs at 24" on centre 4. Apply 5/8" gypsum wallboard • Removal of existing plaster will ensure that there is no unvented cavity in the wall system which might cause deterioration of the stone and clay tile back up and will save space. • Electrical boxes along perimeter walls can be installed within the 2/12" stud space, perimeter heaters have to be moved inwards, and new window sills will be required. • It will be a difficult task for areas with heritage significance. The marble wall finishes and wood panels have to be carefully removed and reinstalled to suit the increased wall thickness. It is our understanding that this building is not officially designated, which makes the permit process relatively easier. It is possible to do this upgrade on a floor by floor basis.
Perimeter Windows 55 John Street	Majority of windows are double-glazed, operable aluminum windows similar in style to the original design. They were installed in the early 1990's. Some original single-glazed steel windows remain in service areas.	• Seals around the aluminum windows have deteriorated, causing drafty conditions and the windows are nearly twenty years old. It is recommended that they be replaced at the same time of exterior wall upgrades.
Exterior Wall Man Building	Double-wythe brick, no insulation, no cavity	• Insulating the existing perimeter walls will reduce energy bills and increase comfort for office space in this building. • The recommended method is to: 1. Apply 2/12" of high performance sprayed polyurethane insulation to the existing clay tile (approx R13) 2. Line walls with 2/12" metal studs at 24" on centre 3. Apply 5/8" gypsum wallboard
Perimeter Windows Man Building	Original single-glazed steel windows	• Replace with aluminum windows with sealed double-glazing units by Kawneer or Alumicor

2.2.3 Structural Summary

There are no obvious structural deficiencies with the building. The main building was originally designed to support an addition which was added to increase the main building height to 6 storeys. The structural design of the garage/receiving area is designed significantly different and does not appear to have included the capacity for additional floors. Buildings of this vintage are generally not designed to meet the requirements of present building codes particularly from a seismic perspective. Any plans that would significantly impact the structural systems should consider the structural modifications that might be imposed on the existing six storey structure to meet the new code requirements.

2.2.4 Mechanical and Electrical Summary

2.2.4.1 HVAC

Main Vehicle Area

The existing HVAC system in this portion of the facility consists mainly of infrared tube heaters mounted at the underside of the roof deck in the main vehicle area. There is a roof mounted exhaust fan on the first level (ground level) however it is believed that this fan is timer controlled.

First Floor Metering Department (Existing) - Proposed Command Centre

The existing HVAC system in this portion of the facility is serviced by AHU-6 which is located on the first floor adjacent to the paring area and this department. AHU-6 moves 7000 cfm of air throughout this space. AHU-6 was installed in 1997 and is in relatively good condition. Cooling capacities are sufficient and heating capacities should be sufficient for the current use.

First Floor Lobby/Second/Third Floor

These areas are served by AHU-2 & AHU-3 located in the basement mechanical room. These units were installed in 1995 and are in relatively good condition. The HVAC ductwork and terminal reheat/cooling coils in the lobby and second floor were redone in 2001/2002.

Fourth Floor

This area is served by AHU-4 located in the penthouse mechanical room. This unit was installed in 1995 and is in relatively good condition. The fourth floor is serviced by a pressurized supply air plenum and is neither particularly efficient nor effective. The HVAC ductwork and terminal reheat/cooling coils on the fourth floor have not been recently upgraded and will need to be addressed as part of any redevelopment of the fourth floor.

Fifth Floor

This area is served by AHU-4 and AHU-5 located in the penthouse mechanical room. AHU-4 was installed in 1995 and is in relatively good condition. AHU-5 is older and needs to be replaced in the near future. The HVAC ductwork and terminal reheat/cooling coils on the fifth floor has been recently upgraded (2004) and will not require any major work as a result of the proposed fifth floor redevelopment.

Sixth Floor

This area is served by HVAC-3, HVAC-4, HVAC-5, HVAC-6 and HVAC-7. These units are approximately ten years old and are still less than 50% of the way through their useful life. The sixth floor was renovated in 1998 and it appears that the ductwork and controls are in relatively good condition.

Man Building (2-storey)

This area is served by HVAC-1 (first floor) and HVAC-2 (second floor). HVAC-1 is approximately 17 years old and HVAC-2 is approximately 27 years old.

2.2.4.2 Plumbing

Domestic Cold and Hot Water

Domestic cold and hot water piping system, fixtures and tanks appear to be in good repair.

Sanitary Piping System

The sanitary piping system appears to be in good repair.

2.2.4.3 Fire Protection

The standpipe system in the facility appears to be in relatively good condition and receiving regular inspections and maintenance.

2.2.4.4 Lighting

The lighting system in the facility appears to be in relatively good condition. The majority of the office tower has been renovated and the lighting is relatively new. The emergency and exit lighting system in the facility appears to be in relatively good condition. The majority of the office tower has been renovated and this system is relatively new.

2.2.4.5 Power and Distribution

Electrical Distribution System

The electrical distribution system consisting of 13.8kV 600A load break switches, 2000 kVA 13.8 kV-347/600V substation and 500 kVA 600-120/208V transformation feeding a main 1200A 347/600V switchboard. Various feeds are then distributed throughout the

building including the basement mechanical room and the penthouse mechanical room. Some of the main equipment appears to be original and might be nearing its anticipated end of life.

Emergency power for critical loads is through a permanent emergency generator system tied with automatic transfer capability. Upon failure of the normal power system, all critical loads are transferred to the emergency generator system until such time as the normal power is restored.

2.2.4.6 Communications and Data

Telephone/Voice
This system was not reviewed at the time of the visit. Since this is primarily an operational system, it is anticipated that any maintenance, operational shortcomings or inadequacies are addressed by the appropriate division of the client.

Data/Network
This system was not reviewed at the time of the visit. Since this is primarily an operational system, it is anticipated that any maintenance, operational shortcomings or inadequacies are addressed by the appropriate division of the client.

2.2.4.7 Fire Alarm

Fire Alarm System
There is an existing Notifier 5000 series Fire alarm system in the facility. The fire alarm system in the facility appears to be in relatively good condition, receiving regular inspections and maintenance.

2.3 Nebo Road

Built in 1981, the Nebo Road facility was originally constructed as a service centre to house fleet parking, a mechanic garage, stores and support services such as lunch room and locker rooms for the service staff. Over time offices and other workspaces have been constructed to accommodate growth. There are a number of issues associated with the HVAC systems and the ability to exhaust fumes. With the number of staff at the location increasing, PRISM recommends that Horizon look to redevelop the space to improve its utilization, but more importantly, to upgrade mechanical systems to improve the airflow within the building.

The Stores department has an excellent plan to reduce stock and move towards more just-in-time inventory management. Implementation of this plan will provide Horizon the opportunity to construct properly built and ventilated workspaces on the south mezzanine. Other opportunities include: more support space for the service staff such as larger locker spaces and hotelling spaces for the staff to work from at the start and end of their shifts; improved indoor fleet parking (larger and more spaces); upgraded security and pedestrian safety for exterior parking and storage spaces; and improved external traffic and staff flows to ensure a safe environment.

The Nebo facility is in a good location to service the Hamilton customers and as such, is a good candidate for upgrades and expansion.

2.3.1 Architectural Summary

The Nebo facility is a pre-engineered steel main frame structure, steel framed mezzanine structure, 6' and 9' mezzanine floor slab. The building is one-storey, plus mezzanines on the north and south sides. The building footprint is 72,900 square feet. Gross floor areas are as follows:

Ground floor	72,900 square feet
Mezzanines	35,300 square feet

2.3.2 Building Envelope Assessment

Component	Composition	Observations/Recommendations
Exterior Walls (all areas except offices)	Prefinished steel panels with 3" insulation, 26 GA prefinished steel interior liner panel	• Rated approximately R10 when new. ASHRAE 90.1-2004 requires R13.
Exterior Walls (at perimeter office spaces)	Prefinished steel panels, painted drywall interior	• Uncertain if 3" insulation exists behind drywall finish. • Upgrading necessary if office spaces are to remain.
Perimeter Office Windows	Original sliding aluminum windows	• Past life expectancy and should be replaced
Perimeter Man Doors	Hollow metal doors and frames	• Doors may have been replaced/added in the past. Unknown if insulated • If original, should be replaced with insulated metal doors and all frames complete with proper weather stripping.
Perimeter Overhead Doors		• If original, should be replaced with insulated sectional doors with new weather seal around perimeter of the door opening.
Roof	Aluminized steel panel 3" vinyl covered insulation	• No evidence of leaks. • Rated approximately R10 when new. ASHRAE 90.1-2004 requires R13

2.3.3 Structural Summary

There are no obvious structural deficiencies with the building. From a structural perspective building can be enlarged and/or reconfigured. Mezzanine areas could be removed and/or reworked as required to accommodate an architectural redesign. A separate office building is an option, but redevelopment is more driven by zoning and architectural requirements rather than structural inadequacies.

2.3.4 Mechanical and Electrical Summary

2.3.4.1 HVAC

Main Vehicle Area

The exhaust rate is code compliant, however it is designed at the low end of the acceptable limits. It was not likely intended to serve as more than vehicle use. Current use of this space includes occupied offices and in its current capacity, the emission exhaust system does not provide acceptable performance. Continued and future use of this building for office areas will necessitate improving the performance of the emission exhaust system along with other good engineering measures to ensure a comfortable and safe working environment for the employees at this site.

The existing HVAC system in this portion of the facility consists mainly of infrared tube heaters mounted at the underside of the roof deck in the main vehicle and storage areas and exhaust fans and intake louvers with motorized dampers for CO and NOX from vehicles. The emissions exhaust system is controlled via CO sensors, NOX sensors (for diesel) and timers.

The rollup doors are not interlocked with heating system. The motorized damper at A7/8 is not operational.

Maintenance Shop

There is no fresh air intake louver in the maintenance shop. There is a roof mounted extraction fan and a wall mounted extraction fan leaving the room in significant negative pressure and the fans cavitating when the doors are closed. The fans were disconnected several years ago from the control system. The system is currently operated via manual switches mounted on the walls of the maintenance shop. Heating is provided by means of electric unit heaters mounted along the walls. There is a welding exhaust system at the welding station which seems to function adequately.

Offices 129, 130, 131 and 132

The HVAC system serving this space consists of an old Lennox horizontal natural gas fired furnace with duct mounted air conditioning coil. There is no fresh air for this system, thus it is not possible to pressurize these offices to eliminate exhaust odours. The system is old, does not have sufficient fan capacity for the spaces served and does not do an adequate job of maintaining comfort for the occupied spaces.

Offices 133, 134, 135 and 136

The HVAC system serving this space consists of a newer horizontal natural gas fired furnace with duct mounted air conditioning coil. There is no fresh air for this system, thus it is not possible to pressurize these offices to eliminate exhaust odours. The system does not have sufficient fan capacity for the spaces served and does not do an adequate job of maintaining comfort for the occupied spaces.

Mezzanine Offices

The portable structures mounted on the mezzanine are ducted from a system mounted on the roof of the portable structures. Fresh air is from a common plenum ducted through the roof. All of the ducting consists of flexible insulated ductwork loosely installed along the top of the structures. These offices are extremely dirty from airborne particulate and it appears that they are very poorly sealed and not properly pressurized. The existing system is inadequate and poorly installed. The air quality is continuously monitored to ensure limits are not exceeded.

Lunch Room, Washrooms, Showers

These areas are served by roof mounted gas fired packaged HVAC units which have replaced the original heat pumps with electric duct heaters. Exhaust is mainly through the side walls. Ducting travels vertically through the ceiling, up through the mezzanine and to the roof mounted equipment. Two units are utilized to service all the noted areas. The main challenge within these spaces is that there are different heating/cooling requirements and comfort/air balance is severely compromised.

2.3.4.2 Plumbing

Domestic Cold and Hot Water

Domestic cold and hot water piping systems, fixtures and tanks appear to be in good repair.

Sanitary Piping System

Sanitary piping system appears to be in good repair. Trench drains in the vehicle area appear to be in good working condition and in fair repair.

2.3.4.3 Process Piping

Shop Air Compressor Piping

The maintenance garage air compressor system and piping appears to be in good condition.

2.3.4.4 Fire Protection

The standpipe system in the facility appears to be in relatively good condition and receiving regular inspections and maintenance.

2.3.4.5 Lighting

The lighting system in the facility appears to be in relatively good condition. The vehicle/storage area consists of high pressure sodium high bay lighting. Office areas are fluorescent. Emergency and exit lighting units appear to be in relatively good condition, receiving regular inspections and maintenance.

2.3.4.6 Power and Distribution

The electrical distribution system consisting of 1200A 347/60 0V switchboard, transformation and various distribution panels in the facility appears to be in relatively good condition and receiving regular inspections and maintenance.

2.3.4.7 Communications and Data

Telephone/Voice

This system was not reviewed at the time of the visit. Since this is primarily an operational system, it is anticipated that any maintenance, operational shortcomings or inadequacies are addressed by the appropriate division of the client.

Data/Network

This system was not reviewed at the time of the visit. Since this is primarily an operational system, it is anticipated that any maintenance, operational shortcomings or inadequacies are addressed by the appropriate division of the client.

2.3.4.8 Fire Alarm

The fire alarm system in the facility appears to be in relatively good condition, and receiving regular inspections and maintenance.

2.4 Stoney Creek

Built in 1985, the Stoney Creek site was obtained through a merger and is primarily used as a service centre with a stores department and fleet parking. This site consists of 10 acres of land of which the building and operations currently use one quarter of the space. The majority of the space is vacant or is used as an ad hoc training facility. The building is in excellent condition and has potential to be better utilized. Its location, ideal as it is centrally located between the Hamilton and St. Catharines facilities, sits in a rural area just outside of residential neighbourhoods. As Stoney Creek develops, especially with residential growth, there may be an opportunity for Horizon to divest this property and relocate to another location within Stoney Creek that is more conducive to light industrial use. For the short term, PRISM recommends that this facility is retained. Issues with the current site include vandalism of fleet vehicles and theft of outdoor stock. Upgraded security measures are recommended.

2.4.1 Architectural Summary

The facility's administrative area is load bearing masonry and steel structure. The shop area is a pre-engineered steel main frame structure. The building is one-storey, with a footprint of 30,900 square feet. The gross floor areas are as follows:

- Administrative area 11,300 square feet
- Shop area 19,600 square feet

2.4.2 Building Envelope Assessment

Component	Composition	Observations/Recommendations
Exterior Walls Administrative	3 ½" brick veneer, 3/8" air space, 2" rigid insulation, 7 ½" concrete block, interior	• In excellent condition. • No upgrades necessary.
Exterior Walls Administrative area above windows	3 ½" brick veneer, 3 ½" concrete block, soffit cavity +/- 24", 2 ½" rigid insulation, 2x4 wood studs	• In excellent condition. • No upgrades necessary.
Perimeter Windows Administrative	Aluminum windows with sealed double glazing units, non-operable	• In good condition. No visible seal deterioration or condensation. • Owner may consider installing operable units at certain areas to allow natural ventilation.
Perimeter Doors Administrative	Original double-glazed aluminum entrances	• In good condition. No visible seal deterioration or condensation. • No upgrading necessary.
Roof Administrative	Gravel, single ply roofing, 4" rigid insulation, vapour barrier, galvanized metal deck	• No evidence of leaks observed. • No upgrading necessary.
Roof Shop Area	Prefinished standing seam metal roof, R20 batt insulation, prefinished metal liner panels	• No evidence of leaks observed. • No upgrading necessary.

2.4.3 Structural Summary

There are no obvious structural deficiencies with the building. From a structural perspective, the building can be enlarged and/or reconfigured as required to accommodate an architectural redesign.

2.4.4 Mechanical and Electrical Summary

2.4.4.1 HVAC

Main Vehicle Area

The existing HVAC system in this portion of the facility consists mainly of infrared tube heaters mounted around the perimeter on the underside of the roof deck in the main vehicle and storage areas. These are supplemented by electric unit heaters mounted in the interior of the space. Exhaust fans and intake louvers with motorized dampers for carbon monoxide and nitrogen oxide from vehicles are installed. The emissions exhaust system is manually controlled. The rollup doors are not interlocked with the heating system.

Stores/Storage

The existing HVAC system in this portion of the facility consists mainly of infrared tube heaters mounted around the perimeter on the underside of the roof deck and supplemented by electric unit heaters in the interior area. There is an exhaust fan in the space which is anticipated for general use only. Vehicles are not operated inside this space with the exception of a small propane powered fork lift. The rollup receiving door is not interlocked with the heating system.

Office Area
These areas are served by four roof mounted heat packaged heat pump units with electric heating.

2.4.4.2 Plumbing

Domestic Water
Domestic cold and hot water piping systems, tanks and fixtures appear to be in good repair.

Sanitary Piping System
The sanitary piping system appears to be in good repair.

2.4.4.3 Fire Protection

Fire Standpipe System
The office and operations areas have a standpipe system. There are two main fire pumps, one for standpipe and one for sprinkler system. The standpipe system in the facility appears to be in relatively good condition and receiving regular inspections and maintenance.

Fire Sprinkler System
Both areas have a zoned sprinkler system. There are two main fire pumps, one for standpipe and one for the sprinkler system. The sprinkler system in the facility appears to be in relatively good condition, having been modified over the years to suit various renovations and receiving regular inspections and maintenance.

2.4.4.4 Lighting

The lighting system in the facility appears to be in relatively good condition. Typically, lighting is serviced by the 347V panels. The vehicle/storage area consists of metal halide high bay lighting. The stores and office areas utilize T-12 fluorescent lighting.

Emergency and Exit Lighting
Despite their age, the units appear to be in relatively good condition, receiving regular inspections and maintenance.

2.4.4.5 Electrical Distribution System

The electrical distribution system consists of a 750 kVA pad mounted utility transformer feeding a main 1200A 347/600V switchboard. The transformation and distribution panels in the facility appear to be in relatively good condition and receiving regular inspections and maintenance.

2.4.4.6 Communications and Data

Telephone/Voice
This system was not reviewed at the time of the visit. Since this is primarily an operational system, it is anticipated that any maintenance, operational shortcomings or inadequacies are addressed by the appropriate division of the client.

Data/Network
This system was not reviewed at the time of the visit. Since this is primarily an operational system, it is anticipated that any maintenance, operational shortcomings or inadequacies are addressed by the appropriate division of the client.

2.4.4.7 Fire Alarm

There is an existing Mircom fire alarm system in the facility. The system appears to be in relatively good condition and receiving regular inspections and maintenance.

2.4.4.8 Exterior Security System

There is an issue with theft at this location.

2.5 St. Catharines

The original facility (north building) was built in 1977 to serve as an office and service centre. An addition (south building) was constructed in 2002 to provide additional administrative office space. Horizon obtained the St. Catharines facility through a merger, and primarily uses it as the main customer call centre supporting all Horizon customers and a full operations service centre including fleet parking, mechanic garage and stores. Customer service, Lines and Metering departments that support St. Catharines are located at this site.

Horizon senior management has made a commitment to keep a presence in St. Catharines to support its customers in the area. There is logic in this decision, whereas customer response times from Horizon's Hamilton facilities would be unreasonable, in consideration of the 54 km distance between communities. Further the situation of the company Call Centre in St. Catharines has proven strategic. There are multiple privately owned call centres in the area that provide a qualified feed-in pool for new hires. The buildings are in good condition and the second floor of the north building is vacant. The site's floor area is adequate to support the departments and staff activities, however it is poorly configured and utilized, thus efficient use of space to support productive work by the staff is compromised. A number of issues are present:

- The Overhead Lines area is not large enough to support the staff. A larger area to meet as a team and more hotelling stations for the service staff are required.
- The Customer Service area requires more room to support the staff and allow for more space to help with noise issues.

- The indoor fleet parking area does not support the number of vehicles as they have grown in size and quantity over time. There is some concern with leaving the vehicles outdoors as they have been vandalized and exposure to the elements shortens the vehicle usable lifespan.
- Ongoing issues with vandalism and theft of outdoor stock. A security system has recently been installed.

2.5.1 Architectural Summary

The north building office/shop is a steel framed structure. The south building addition is load bearing masonry with supporting steel beams and OWSJ roof joists. The north building has two storeys and the south building has one storey. The two buildings have a total of 55,500 square feet. The gross floor areas are as follows:

- South building (admin) 28,800 square feet
- North building (office/garage/storage) 36,800 square feet

2.5.2 Building Envelope Assessment

Component	Composition	Observations/Recommendations
Exterior Walls North Building	4" architectural concrete block, 2" rigid insulation, 6" concrete block	• Exterior block is in good condition • Non-cavity wall contains asbestos in wall insulation. Avoid disturbing this wall type if possible.
Exterior Walls South Building	8" load bearing concrete block, Tyvec membrane, 1" air space, 3-5/8" stud wall batt insulation, 6 mil poly vapour barrier, 5/8" drywall	• In good condition. • No upgrades necessary.
Perimeter Windows North Building	Original single-glazed aluminum windows	• Past their life expectancy, do not meet current thermal performance standard and should be replaced.
Perimeter Doors South Building	Original double-glazed aluminum windows, non operable	• In good condition. • Owner may consider replacing them with new sealed double-glazed windows with an operable section to allow some natural ventilation in shoulder seasons.
Perimeter Overhead Doors		• If original, should be replaced with insulated sectional doors with new weather seal around perimeter of the opening.
Roof North Building	Built up roofing, 2 ½" rigid insulation, vapour barrier, 1 ½ " metal deck	• No evidence of leaks observed • Less than R10 when new. ASHRAE 90.1-2004 requires R19. Upgrading recommended.
Roof South Building	Information not available	• Considering the building is less than 10 years old, roof construction and insulation level should meet current standards.

2.5.3 Structural Summary

There are no obvious structural deficiencies with the building. From a structural perspective the building can be enlarged and/or reconfigured as required to accommodate architectural redesign. An elevator can be installed within, or as an addition to the existing structure.

2.5.4 Mechanical and Electrical Summary

2.5.4.1 HVAC

Main Vehicle Area, North Building

The existing HVAC system in this portion of the facility consists mainly of infrared tube heaters mounted around the perimeter on the underside of the roof deck in the main vehicle and storage areas. These are supplemented by electric unit heaters mounted in the interior of the space. Exhaust fans and intake louvers with motorized dampers for carbon monoxide and nitrogen oxide from vehicles are installed. The emissions exhaust system is manually controlled. The rollup doors are not interlocked with the heating system.

Garage, North Building

There is no fresh air intake louver in the garage. There is a roof mounted extraction fan leaving the room in significant negative pressure and the fans cavitating when the doors are closed. There is a small source capture vehicle exhaust system on a swivel assembly as well. Heating is provided by means of electric unit heaters mounted along the walls.

Stores/Storage, North Building

Heating is provided by an overhead ducted system. The stores storage area uses natural gas fired infrared tube heaters along the perimeter of the space. Access to the roof was not permitted, and the documentation does not show this system, however it is anticipated that there is a roof mounted HVAC unit above the stores office which feeds the stores office and the stores area.

First Floor, Meter Shop and Office, North Building

These areas are served by eight air handling units with electric duct heaters and a roof mounted condenser. Exhaust is handled mainly through the roof.

Second Floor, North Building

These areas are served by seven air handling units with electric duct heaters and a roof mounted condenser. Exhaust is handled mainly through roof.

Existing Call Centre, South Building

This area is serviced by five roof mounted natural gas units.

2.5.4.2 Plumbing

Domestic Water

Domestic cold and hot water piping systems, tanks and fixtures appear to be in good repair.

Sanitary Piping System

The sanitary piping system appears to be in good repair. Trench drains in the vehicle appear to be in good working condition and fair repair.

2.5.4.3 Fire Protection

The sprinkler system in the facility appears to be in relatively good condition, having been inspected and maintained regularly. The system consists of an excess pressure pump, and an all annunciators tie to the fire alarm system. There are two sprinkler trees, one in the office area and one in the stores area of the north building. The south building is sprinkled, however it is not certain where it connects to the sprinkler system from the north building.

2.5.4.4 Lighting

The lighting system in the facility appears to be in relatively good condition. The vehicle/garage area consists of metal halide high bay lighting. Office areas are fluorescent.

Despite their age, the emergency and exit lighting units appear to be in relatively good condition, receiving regular inspections and maintenance.

2.5.4.5 Electrical Distribution System

The electrical distribution system consisting of 1000A 347/600V switchboard, transformation and various distribution panels in the facility. There are multiple transformers for various parts of the system. Generally, the system appears to be in relatively good condition, receiving regular inspections and maintenance.

Emergency Power System

The emergency power system in the building is provided by means of a 350kW 347/600V emergency generator (natural gas) and various transfer switches/interlocks in the facility. This system has its own transformation and panel boards and appears to be in relatively good condition, receiving regular inspections and maintenance.

2.5.4.6 Communications and Data

Telephone/Voice

This system was not reviewed at the time of the visit. Since this is primarily an operational system, it is anticipated that any maintenance, operational shortcomings or inadequacies are addressed by the appropriate division of the client.

Data/Network

This system was not reviewed at the time of the visit. Since this is primarily an operational system, it is anticipated that any maintenance, operational shortcomings or inadequacies are addressed by the appropriate division of the client.

2.5.4.7 Fire Alarm

The fire alarm system in the north building is a Simplex 4010 control panel with all appropriate detection, monitoring and annunciation devices and appears to be in relatively good condition, receiving regular inspections and maintenance. It appears that this system has been extended into the south building and zones added to accommodate this expansion.

2.5.4.8 Exterior Security System

There is an issue with theft at this location.

3 COMMON THEMES SURVEY

The following summarizes common themes from the staff surveys and interviews***, have not been substantiated through this report and do not necessarily form the recommendations in this report.*** More details can be found in Appendix B.

3.1 General

- Main environmental concerns were related to HVAC, lighting and access to natural light.
- There is a desire to have more indoor fleet parking at Nebo, Stoney Creek and St. Catharines.
- Hotelling space is required at each site for staff who work out of multiple sites or their vehicles and students. Although less so at the John Street and Stoney Creek Facility.
- More meeting rooms are required at all sites, including small rooms where staff without offices can meet one-on-one or make personal calls. All meeting rooms should be equipped with appropriate telephones and AV equipment.
- Some feel it is unfair that the satellite sites have free parking for the staff, while John Street does not. Improved bicycle parking and some designated spots to encourage car pooling at John Street may help.
- Most departments have projected staffing growth plans. The addition of more apprentices is the main reason. Some departments feel they will grow if Horizon has more acquisitions over time. Some flexibility must be planned for this in the space projections for each site.
- Document storage is not managed well and taking up valuable real estate. Purging of records should be considered.
- Most feel communication is working well. Would like to see more use of teleconferencing and video conferencing to reduce travel time.
- Amenities such as lunch room/cafeteria, quiet space and exercise space is important to the staff. John Street would like to see the elimination of the small lunch rooms and the creation of a communal area to encourage staff interaction. Ideally some food service would be provided. Improved locker facilities, especially at Nebo, should be considered. Most departments indicated the desire to have exercise facilities at each site.
- Security is a concern after hours at John Street. Theft and vehicle damage is a concern at Nebo, Stoney Creek and St. Catharines.

3.2 Site Specific Themes

3.2.1 John Street

- Network Operating would like to relocate the Control Centre from the fourth floor to the first floor Customer Connections area. The area has the required HVAC and is safer so that staff do not feel isolated as they work 24/7.
- Consolidate the executive team on the sixth floor with a new boardroom.
- Renovate the fourth floor as it is the only floor not redeveloped.

- There is a desire to better consolidate some departments to be more effective.
- Create a centralized lunch room, preferably with some food service provisions on one of the upper floors.
- Improved locker facilities that are fully accessible and barrier-free.
- Improve use of lobby to make it more welcoming and to provide space for educational and archival material.

3.2.2 Nebo Road

- It is felt that more indoor parking for large trucks is required. Vandalism is an issue with outdoor fleet parking.
- Office areas are small, dirty and noisy due to proximity of vehicles in building. The building's HVAC system is ineffective, so diesel fumes are circulating throughout the building.
- Office areas are not adequate for team meetings.
- There are not enough hotelling spaces for staff who are visiting or who work from their vehicles, and staff growth is anticipated.
- Potential staff safety issues exist with external parking and storage areas.
- Locker rooms are not large enough to accommodate all of the staff and their belongings.
- Stores are working on a plan to reduce stock over time creating the potential for more useable space at this site.

3.2.3 Stoney Creek

- Customer Connections would like to consolidate the John Street and St. Catharines groups to this site to improve efficiencies in staffing, coverage and communication.
- There is a desire to extend the garage and indoor parking area to accommodate the increase in vehicles and vehicle size.
- The large training centre is in a convenient location between Hamilton and St. Catharines.

3.2.4 St. Catharines

- There is a desire to extend the garage and indoor parking area at St. Catharines to accommodate the increase in the number of vehicles and vehicle size.
- An elevator is required to utilize the second floor.
- Overhead Lines require more space to meet as a team and hotelling spaces for the service staff to work from when on site.
- Customer service area is crowded and noise in an issue, there is also no male washroom in the south building.

4 SPACE TABLES

JOHN STREET LEVEL 6

Room/Space	Department	QTY	NSF	Total	Comments
Executive Suite					
Office, CEO	Executive	1	240	240	
Workstation, Executive Assistant	Executive	3	100	300	
Office, VP	Executive	1	160	160	
Office, VP	Executive	1	160	160	
Office, VP	Executive	1	160	160	
Office, VP	Executive	1	160	160	
File Storage	Executive	1	50	50	
Boardroom	Executive	1	850	850	Seats 30 with AV and teleconferencing
Waiting/Coat Closet	Executive	1	20	20	near boardroom
Network Printer/Fax	Executive	1	50	50	
Washroom	Executive	1	50	50	
	TOTAL EXECUTIVE			**2,200**	
Office, VP, Regulatory	Regulatory Services	1	160	160	
Office, Director	Regulatory Services	1	140	140	
Office, Manager, Rates and Reporting	Rates and PBR	1	120	120	
Workstation, Rates Analyst	Rates and PBR	2	64	128	File Cabinets
Workstation, Regulatory Coordinator	Rates and PBR	1	64	64	
Office, Manager, Regulatory Compliance	Regulatory Services	1	120	120	
File Storage		1	100	100	
	TOTAL REGULATORY			**832**	
Office, VP Finance	Finance	1	160	160	
Workstation, Executive Assistant, Finance	Finance	1	100	100	
Workstation, Accountant	Accounting	3	80	240	
Workstation, Accounting Analyst Red Circled	Accounting	1	64	64	
Workstation, Accounting Clerk	Accounting	2	64	128	
Office, Manager, Treasury & Taxation	Finance	1	120	120	
Office, Manager, Accounting	Accounting	1	120	120	
Workstation, Student, Finance	Accounting	2	64	128	
Workstation, Supervisor, Accounting	Accounting	1	80	80	
Workstation, Accounting Analyst	Business Analysis	1	64	64	
Office, Director, Budgeting & Business Analysis	Business Analysis	1	140	140	
Workstation, Lead Budgeting & ABC	Business Analysis	1	64	64	
Office, Manager, Business Analysis	Business Analysis	1	120	120	
File Storage	Finance	1	150	150	
	TOTAL FINANCE			**1,678**	

JOHN STREET LEVEL 6

Room/Space	Department	QTY	NSF	Total	Comments
Office, Director, Corporate Communications	Corporate Communications	1	140	140	
Office, Manager, Corporate Communications	Corporate Communications	1	120	120	
Workstation, Public Relations Clerk	Corporate Communications	1	64	64	
Workstation, Specialist, Communications	Corporate Communications	1	64	64	
Workstation, Advisor, Human Resources	Human Resources	1	64	64	
Workstation, Coordinator, Human Resources	Human Resources	1	64	64	
Workstation, Coordinator, Training	Human Resources	1	64	64	
Office, Director, Human Resources	Human Resources	1	140	140	
Workstation, Lead, Training & Development	Human Resources	1	64	64	
Office, Manager, Employee Relations	Human Resources	1	120	120	
Workstation, Advisor, Human Resources	Human Resources	1	64	64	
Workstation, Specialist, Payroll	Human Resources	1	64	64	
Workstation, Specialist, Process & Change Mgmt	Human Resources	1	80	80	
Workstation, Computer Testing Carrel	Human Resources	2	30	60	
Reference Library, Lockable Storage	Human Resources	1	70	70	Near Reception
File Storage	Human Resources	1	120	120	
Interview Room, Enclosed	Human Resources	1	120	120	Near Reception
Change Management Team Workroom	Human Resources	1	180	180	
	TOTAL CORPORATE SERVICES			**1,662**	
Reception for Floor		1	144	144	small area to wait
Central Printer, Fax and Storage Area		1	150	150	Partially enclosed
Washroom, Male, Barrier-free		1	170	170	Multi-stall, existing good
Washroom, Female, Barrier-free		1	170	170	Multi-stall, existing good
Servery		1	80	80	With counter, sink, coffee/tea/microwave, full size fridge
Coat Closet		1	50	50	For staff with workstations
Housekeeping Closet		1	70	70	With sink
	TOTAL SHARED			**834**	
	Total Net Square Feet (NSF)			**7,544**	
	NSF : GSF Grossing Factor			1.42	
	Total Gross Square Feet (GSF)			**10,712**	
	Available			**10,795**	
	Difference			**83**	

JOHN STREET LEVEL 5

Room/Space	Department	QTY	NSF	Total	Comments
Office, Chief Conservation Officer	CDM	1	140	140	
Workstation, Conservation Clerk	CDM	3	64	192	Including 1 workstation for temp conservation clerk
Workstation, Events Team Specialist, Temp	CDM	1	64	64	
Office, Manager, Commercial Programs	CDM	1	120	120	
Office, Manager, Marketing	CDM	1	120	120	
Workstation, Specialist, Conservation	CDM	1	80	80	
Display Trade Show Storage, Level 1 at Dock	CDM	1	0	0	
File Cabinets for File Storage	CDM	1	100	100	
Workstation, Student	CDM	1	64	64	
Workstation, Residential Specialist	CDM	1	64	64	**FUTURE**
Workstation, Communications Specialist	CDM	1	64	64	**FUTURE**
Workstation, Smart Grid Student	CDM	1	64	64	**FUTURE**
Workstation, Smart Grid Supervisor	CDM	1	64	64	**FUTURE**
Workstation, Energy Advisor	CDM	1	64	64	**FUTURE**
Project Workroom and Meeting Table	CDM	1	200	200	Seats 8 with AV, smartboard, whiteboards
	TOTAL CDM			**1,400**	
Workstation, Analyst, Report Data	Business Applications	1	64	64	
Workstation, Console Operator	Business Applications	1	64	64	
Workstation, Database Administrator	Business Applications	1	64	64	
Office, Director, Info Systems & Technology	Business Applications	1	140	140	
Officer, Manager, Business Applications	Business Applications	1	120	120	
Office, Manager, Business Projects	Business Applications	1	120	120	
Workstation, Senior Programmer Analyst	Business Applications	3	80	240	
Workstation, Specialist, Business and Project	Business Applications	1	80	80	
Workstation, Systems Administrator	Business Applications	1	64	64	
Office, Manager, Technical Services	Technical Services	1	120	120	
Workstation, Network Administrator	Technical Services	1	64	64	
Workstation, PC Technician	Technical Services	3	64	192	
Workstation, Web Developer	Technical Services	1	64	64	
Workstation	Technical Services	2	64	128	**FUTURE 2010**
Workstation	Technical Services	4	64	256	**FUTURE 2011**
Locked Room, Equipment Staging/Testing Area	Technical Services	1	300	300	
Locked Room, Record Storage	IT	1	200	200	
Data Centre/SCADA & UPS Rooms	IT	1	917	917	
	TOTAL IT			**3,197**	
Training Room		1	2,230	2,230	Seats 60 - 70, AV, chair storage, servery
Meeting Room, Large		1	330	330	Seats 10-12 people with AV, teleconferencing equipment, whiteboards
Central Printer, Fax and Storage Area		1	140	140	Partially enclosed
Washroom, Male, Barrier-free		1	170	170	
Washroom, Female, Barrier-free		1	250	250	
Quiet Room		1	80	80	Small table, seats 4, with telephone
Servery		1	100	100	Counter, sink, coffee/tea/microwave, full size fridge
Coat Closet, enclosed		1	50	50	For staff with workstations
Hotelling Stations		4	30	120	
Housekeeping Closet		1	70	70	With sink
	TOTAL SHARED			**3,540**	
	Total Net Square Feet (NSF)			**8,137**	
	NSF : GSF Grossing Factor			1.35	
	Total Gross Square Feet (GSF)			**10,985**	
	Available			**11,065**	
	Difference			**80**	

JOHN STREET LEVEL 4

Room/Space	Department	QTY	NSF	Total	Comments
Team Room, Facilities	Facilities	6	30	180	For 6 staff, including **1 FUTURE staff**
Workstation, Lead Hand, Facilities	Facilities	1	64	64	
Office, Manager, Facilities	Facilities	1	120	120	
Workstation, Student, Facilities	Facilities	2	30	60	
Workstation, Supervisor	Facilities	1	80	80	**FUTURE**
Record Storage		1	80	80	
	TOTAL FACILITIES			**584**	
Office, Manager, Healthy Workplace and Safety	Healthy Workplace and Safety	1	120	120	
Workstation, Specialist Health and Safety	Healthy Workplace and Safety	1	80	80	
Workstation, Student, Health and Safety	Healthy Workplace and Safety	1	64	64	
Locked, File Storage	Healthy Workplace and Safety	1	80	80	
	TOTAL WORKPLACE & SAFETY			**344**	
Workstation, Assistant, Purchasing	Procurement	1	64	64	
Workstation, Manager, Procurement	Procurement	1	120	120	
Workstation, Specialist, Commodity Management	Procurement	1	80	80	
Workstation, Specialist, Projects	Procurement	1	80	80	
Workstation, Student, Procurement	Procurement	1	64	64	
Workstation, Procurement	Procurement	2	64	128	**FUTURE**
Interview/Meeting Team Room	Procurement	1	180	180	
Filing	Procurement	1	250	250	
Reference Library	Procurement	1	60	60	
Workstation, Storekeeper	Logistics	1	64	64	
Office, Director, Supply Chain	Supply Chain	1	140	140	
Workstation, Environmental Mgmt & Sustainable Dev Specialist	Supply Chain	1	64	64	
Workstation, Specialist, Master Data & Document	Supply Chain	1	80	80	
Workstation, Student, Supply Chain	Supply Chain	1	64	64	
	TOTAL SUPPLY CHAIN			**1,438**	
Corporate Lunch Room		1	3,030	3,030	With food service?
Meeting Room, Medium		1	280	280	Seats 12 people with AV, teleconferencing equipment, whiteboards
Central Printer/Fax Storage Area		1	170	170	Partially enclosed
Washroom, at Cafeteria		1	140	140	
Washroom, Male, Barrier-free		1	180	180	Multi-stall, new
Washroom, Female, Barrier-free		1	160	160	Multi-stall, new
Quiet Room		1	80	80	Small table, seats 4, with telephone
Multifaith Prayer Room		1	180	180	
First Aid/Rest Room		1	120	120	Recliner, sink, visitor chair
Servery		1	100	100	Counter, sink, coffee/tea, microwave, full size fridge
Coat Closet		1	50	50	For staff with workstations
Hotelling Stations		3	30	90	
Housekeeping Closet		1	70	70	With sink
	TOTAL SHARED			**4,650**	
	Total Net Square Feet (NSF)			**7,016**	
	NSF : GSF Grossing Factor			1.35	
	Total Gross Square Feet (GSF)			**9,472**	
	Available			**10,955**	DGSF confirmed
	Difference			**1,483**	

JOHN STREET LEVEL 3

Room/Space	Department	QTY	NSF	Total	Comments
Office, VP, Utility Operations	Utility Operations	1	160	160	
Workstation, Engineering Technician	Capital Projects	9	80	720	
Office, Manager	Capital Projects	1	120	120	
Workstation, Student	Capital Projects	1	80	80	
Workstation, Supervisor, Engineering Design	Capital Projects	2	80	160	
Workstation, for expansion	Capital Projects	5	80	400	**FUTURE**
Workstation, Distribution Engineer	Network Assets	1	80	80	
Workstation, Engineer in Training, Project	Network Assets	2	80	160	
Workstation, Engineering Intern	Network Assets	1	80	80	
Office, Manager, Network	Network Assets	1	120	120	
Workstation, for expansion	Network Assets	5	80	400	
Workstation, AM/FM Technician	Network Records	2	64	128	
Workstation, Co-op Student, Network Records	Network Records	2	64	128	
Workstation, Draftsperson	Network Records	4	80	320	
Workstation, Network Records Clerk	Network Records	1	80	80	
Workstation, Records Coordinator	Network Records	2	80	160	
Workstation, Supervisor, Network Records	Network Records	1	80	80	
Office, Manager, Operational	Operational Improvement	1	120	120	
Workstation, Project Specialist	Operational Improvement	1	80	80	
Office, Director, Engineering	Eng, Op & Op Imp	1	140	140	
TOTAL ENGINEERING & OPERATIONAL IMPROVEMENT				**3,716**	
Reference Library/Drawing Storage		1	200	200	
Plotter, Light Table, Large Table to Review		1	260	260	
Project Team Workroom		1	310	310	Seats 8 people
Meeting Room, Large		1	500	500	Seats 20 people with AV, teleconferencing equipment, whiteboards
Meeting Room, Medium		1	290	290	Seats 10-12 people with AV, teleconferencing equipment, whiteboards
Central Printer/Fax Storage Area		1	120	120	Partially enclosed
Washroom, Male, Barrier-free		1	170	170	Multi-stall, existing good
Washroom, Female, Barrier-free		1	245	245	Multi-stall, existing good, includes 1 enclosed barrier-free washroom
Quiet Room		1	80	80	Small table seats 4, with telephone
Servery		1	100	100	Counter, sink, coffee/tea/microwave, full size fridge
Coat Closet		1	50	50	For staff with workstations
Hotelling Stations		6	30	180	
Data Centre Phone Room		1	270	270	Existing
Housekeeping Closet		1	70	70	With sink
	TOTAL SHARED			**2,845**	
	Total Net Square Feet (NSF)			**6,561**	
	NSF : GSF Grossing Factor			1.53	
	Total Gross Square Feet (GSF)			**10,038**	
	Available			**10,948**	
	Difference			**910**	

JOHN STREET LEVEL 2

Room/Space	Department	QTY	NSF	Total	Comments
Office, VP, Customer Services	Customer Service & Connections	1	180	180	
Workstation, Student	Collections	1	30	30	Swing Space
Office, Manager	Billing	1	120	120	
Workstation, Billing Clerk	Billing	11	64	704	
Workstation, Key Clerk	Billing	1	64	64	
Workstation, Mail Clerk	Billing	3	64	192	
Workstation, Student	Billing	1	64	64	
Workstation Supervisor	Billing	1	80	80	
Workstations	Daffron	5	64	320	
Office, Acting Director	Customer Service	1	140	140	
Workstation, Cashier	Customer Service	1	64	64	from Lobby
Workstation, Creditron Operator	Customer Service	1	64	64	from Lobby
Workstation, Customer Service Coordinator	Customer Service	1	64	64	from Lobby
Workstation, Cashier Student	Customer Service	1	30	30	from Lobby
Workstation, CIS Analyst	Customer Service	1	64	64	
Worstation, CS AMI Operator	Customer Service	1	64	64	
Workstation, General Clerk	Customer Service	5	64	320	
Workstation, Senior Cashier	Customer Service	1	80	80	
Workstation, Senior Customer Service Clerk	Customer Service	1	64	64	
Workstation, Student	Customer Service	5	30	150	
Workstation, Collections Clerk	Credits and Collections	5	64	320	
Workstation, Head Billing Clerk	Credits and Collections	2	80	160	
Workstation, Pre-Authorized Clerk	Credits and Collections	1	64	64	
Workstation, Collections Supervisor	Credits and Collections	1	80	80	
Vault	Customer Service	1	100	100	
File Storage	Customer Service	1	300	300	
	TOTAL CUSTOMER SERVICE			**3,702**	
Office, VP, Business Development	Business Development	1	160	160	
Workstation, Financial Analyst	Business Development	1	64	64	
Workstation, Policy Advisor	Business Development	1	64	64	
Storage, Pamphlets/Brochures	Business Development	1	50	50	
	TOTAL BUSINESS DEVELOPMENT			**338**	
Meeting Room, Large		1	440	440	With AV, teleconferencing equipment, whiteboards
Central Printer/Fax Storage Area		1	150	150	Partially enclosed
Washroom, Male, Barrier-free		1	170	170	Multi-stall, existing stalls aren't barrier-free
Washroom, Female, Barrier-free		1	230	230	Multi-stall, existing stalls aren't barrier-free
Quiet Room		2	80	160	Small table seats 4, with telephone
Servery		1	100	100	Counter, sink, coffee/tea/microwave, full size fridge
Coat Closet		1	50	50	For staff with workstations
Hotelling Stations		4	30	120	
Housekeeping Closet		1	40	40	With sink
	TOTAL SHARED			**1,460**	
	Total Net Square Feet (NSF)			**5,500**	
	NSF : GSF Grossing Factor			1.53	
	Total Gross Square Feet (GSF)			**8,415**	
	Available			**12,635**	
	Difference			**4,220**	

JOHN STREET LEVEL 1

Room/Space	Department	QTY	NSF	Total	Comments
Workstation, Security Officer	Corporate	2	64	128	Open desk welcoming
Workstation, Customer Service Desk	Customer Service	1	80	80	Panels for privacy seating for 2
Open Area, Visitor Waiting/Reception		1	120	120	Seating for 8, located near Security Desk
Open Area, Customer PC and Drop Box	Corporate	1	60	60	Open area
Open Area, Brochure Racks/Educational Info	Corporate	1	250	250	Open area
Open Area, Display	CDM	1	250	250	Open Area
Open Area, Archival Display	Corporate	1	250	250	Old meters/photos, etc
Public Washroom		1	70	70	Barrier-free
	TOTAL JOHN ST ENTRANCE			**1,208**	
			Total Net Square Feet (NSF)	**1,208**	
			NSF : GSF Grossing Factor	1.71	
			Total Gross Square Feet (GSF)	**2,066**	
			Available	**2,885**	
			Difference	**819**	
John Street Current Metering/Loading Dock					
Office, Manager Network Operating	Network Operating	1	120	120	**Moved from Level 3**
Workstation, Operating Group	Network Operating	5	100	500	Multi-screened consoles (replacing 16, as shiftwork)
Workstation, Operating Group	Network Operating	3	100	300	Multi-screened consoles **FUTURE**
Enclosed, Servery	Network Operating	1	80	80	In Control Centre
Meeting Room for 20	Network Operating	1	350	350	Can be emergency command centre. Requires phones, PCs, large table
Storage Area	Network Operating	1	100	100	Locked, in Control Centre
Washroom, Barrier-free	Network Operating	1	65	65	In Control Centre **NEW CONSTRUCTION**
Lockers	Network Operating	1	150	150	Qty 20, In Control Centre
Alcove with Mobile Filing Pedestal Units	Network Operating	1	80	80	20 mobile filing units for staff to pull to desk
	TOTAL NETWORK OPERATING			**1,745**	
Storage Area for Display/Trade Materials	CDM	1	500	500	
Housekeeping Closet		1	70	70	With sink
Loading Dock		1	650	650	
Gym/Exersize Room		1	700	700	
Bicycle Parking		1	400	400	
Lockers and Showers, Male		1	1,100	1,100	Barrier-free
Lockers and Showers, Female		1	1,000	1,000	Barrier-free
	TOTAL SHARED			**4,420**	
			Total Net Square Feet (NSF)	**6,165**	
			NSF : GSF Grossing Factor	1.35	
			Total Gross Square Feet (GSF)	**8,323**	**DGSF confirmed**
			Available	**8,350**	
			Difference	**27**	

Does note include water rates offices	**1,548 sf**
Does not include Man building	**1,935 sf**
Does not include substation	**7,545 sf**
Does not include parking garage	

JOHN STREET BASEMENT LEVEL

Room/Space	Department	QTY	NSF	Total	Comments
Locker Room, Male	Corporate	1	960	960	Could convert use in future
Locker Room, Female	Corporate	1	500	500	Could convert use in future
Mail Room	Customer Service	1	420	420	Includes mailing machine, sorting area, ventilation
Billing Machine	Customer Service	1	200	200	in same area as mailroom
Billing & Mail Supplies	Customer Service	1	150	150	
Storage	Corporate	1	480	480	
Housekeeping Closet		1	70	70	With sink
	TOTAL			**2,780**	

Total Net Square Feet (NSF)	**2,780**
NSF : GSF Grossing Factor	1.40
Total Gross Square Feet (GSF)	**3,892**
Available	**3,906**
Difference	**14**

NEBO SERVICE CENTRE

Room/Space	Department	QTY	NSF	Total	Comments
Office, Manager Substations	Substations	1	120	120	
Team Room, Substation Maintainers & Apprentices	Substations	3	30	90	Accommodates 3 stations **NEW**
Test Lab	Substations	1	80	80	
Storage, Technical Info and Archives	Substations	1	120	120	
Hotelling Station, Troublemen	Capital Projects	3	30	90	
	TOTAL SUBSTATIONS			**500**	
Workstation, Maintenance Clerk	Facilities	1	64	64	
Workstation, Lineman/Clerk	Overhead	2	64	128	
Office, Manager, Lines - Overhead	Overhead	1	120	120	
Workstation, Overhead Clerk	Overhead	1	100	100	
Office, Supervisor, OH	Overhead	4	80	320	
Team Room, OH Groups, Apprentices		28	30	840	Accommodates 28 stations **NEW**
Record Storage, Filing		1	80	80	Files
	TOTAL OVERHEAD			**1,652**	
Workstation, Clerk	Underground	1	100	100	
Office, Supervisor, Duct Crew	Underground	1	80	80	
Office, Supervisor, Pulling Crew	Underground	1	80	80	
Office, Supervisor, Underground	Underground	2	80	160	
Office, Supervisor	Outside Contractors	1	80	80	
Workstation, Contractor Inspector	Outside Contractors	3	64	192	
Team Room, Duct Crew, Operators, UG Groups, Apprentices		18	30	540	Accommodates 18 stations **NEW**
Record Storage, Filing		1	80	80	Files
	TOTAL UNDERGROUND			**1,312**	
Workstation, Fleet Clerk	Fleet	1	100	100	
Workstation, Fleet Coordinator	Fleet	1	100	100	
Workstation, Lead Hand Mechanic	Fleet	1	64	64	
Office, Manager, Fleet	Fleet	1	120	120	
Hotelling Station, Mechanic	Fleet	3		0	In Garage
Workstation, Inventory Control Clerk	Logistics	1	64	64	
Office, Manager, Logistics	Logistics	1	120	120	
Workstation, Specialist, Material Planner & Expediter	Logistics	1	64	64	
Hotelling Station, Storekeeper	Logistics	6	0	0	In Stores
Hotelling Station, Student	Logistics	1	0	0	In Stores
Office, Supervisor, Warehouse	Logistics	1	80	80	
Hotelling Station, Transformer Maintainer	Logistics	1	30	30	
Hotelling Station		1	30	30	Accommodates 1 station **NEW**
Hotelling Station in Stores		4	0	0	Accommodates 4 stations **NEW** in stores
	TOTAL SUPPLY CHAIN			**772**	

NEBO SERVICE CENTRE

Room/Space	Department	QTY	NSF	Total	Comments
Workstation, Reception/Waiting		1	120	120	New
Locked Room, Data Centre	Network Operating	1	200	200	
Locker Room, Male		1	2,500	2,500	
Locker Room, Female		1	925	925	Could be upgraded
Drying Room		1	200	200	
Hotelling Stations for Staff	Corporate	6	30	180	For offsite staff
Office, HR Interview Room	Human Resources	1	120	120	Seats 4, locked, with PC and phone
Large Meeting Room		1	470	470	Seats 24 people, with AV, teleconferencing equipment, whiteboards
Central Printer, Fax, Storage Area		1	150	150	Partially enclosed
Washroom, Male, Barrier-free		1	180	180	
Washroom, Female, Barrier-free		1	180	180	
Quiet Room		1	90	90	Small table seats 4, with telephone
Multifaith Prayer Room		1	215	215	
First Aid Room		1	215	215	Recliner, sink, storage
Lunchroom		1	1,700	1,700	
	TOTAL SHARED			**7,445**	
	Total Net Square Feet (NSF)			**11,681**	
	NSF : GSF Grossing Factor			1.35	
	Total Gross Square Feet (GSF)			**15,769**	
Mechanic, Garage	Fleet	1	5,800	5,800	
Storage, North Mezzanine	Logistics	1	10,400	10,400	
Stores, Main Level	Logistics	1	5,000	5,000	
Stores, Mezzanine	Logistics	1	3,700	3,700	
Transformer Testing	Logistics	1	1,530	1,530	
	TOTAL			**26,430**	
	Total Area Required			**42,199**	
	Area Available			**53,111**	**Note: Does not include indoor fleet parking (50,900 GSF)**
	Difference			**10,912**	**Note: Additional areas not on chart: 2 new stairs and elevator**

STONEY CREEK

Room/Space	Department	QTY	NSF	Total	Comments
Office, Director, Customer Connections	Customer Connections	1	140	140	
Workstation, Lead Hand, Quality Mgmt, System Metering	Meter Assets and Inside Service	1	64	64	
Office, Manager, Meter Assets & Inside Services	Meter Assets and Inside Service	1	120	120	
Workstation, Meter Support Clerk - Meter Assets	Meter Assets and Inside Service	1	100	100	
Workstation, Specialist, Revenue Protection	Meter Assets and Inside Service	1	64	64	
Workstation, Student, Meter Assets & Inside Services	Meter Assets and Inside Service	1	30	30	
Workstation, Engineering Technician	Customer Connections	4	64	256	
Office, Manager, Customer Connections	Customer Connections	1	120	120	
Workstation, Meter Support Clerk	Customer Connections	3	100	300	
Workstation, Meterperson, Lead Hand	Customer Connections	1	64	64	
Workstation, Student, Customer Connections	Customer Connections	1	30	30	
Workstation, Supervisor, Customer Connections	Customer Connections	1	80	80	
Workstation, Time of Use Street Team Lead	Smart Metering	1	64	64	
Workstation, CIS Analyst	AMI/MDMR	1	64	64	
Office, Manager, Meter Comm & Tech	AMI/MDMR	1	120	120	
Workstation, Student, Meter Comm & Tech	AMI/MDMR	1	30	30	
Workstation, Supervisor, Meter Comm & Tech	AMI/MDMR	1	80	80	
	TOTAL JOHN ST STAFF			**1,726**	
Workstation, Engineering Technician	Customer Connections	2	80	160	
Workstation, Meter Support Clerk	Customer Connections	1	100	100	
Workstation, General Clerk, St. Catharines	Smart Metering	4	64	256	
	TOTAL ST. CATHARINES STAFF			**516**	
Team Room, Hotelling Stations for Staff	Customer Connections	12	30	360	For 22 staff
Stores	Customer Connections	1	0	0	Use part of existing Stores
Secure Tool Storage	Customer Connections	1	100	100	
Workshop Area	Customer Connections	1	200	200	
Testing Board Area	Customer Connections	1	500	500	
	TOTAL SHARED			**1,160**	
Network Closet	Network Operating	1	150	150	
Locker Room, Male		1	675	675	
Locker Room, Female		1	100	100	
Corporate Training Centre		1	1,600	1,600	With AV and chair storage
Hotelling Stations for Staff		6	30	180	For offsite staff
HR Office/Interview Room	Corporate	1	100	100	Seats 4, Locked with PC and telephone
Meeting Room	Human Resources	1	270	270	Seats 10-12 with AV, teleconferencing equipment, whiteboards
Central Printer, Fax, Storage Area		1	150	150	Partially enclosed
Washroom, Male, Barrier-free		1	170	170	
Washroom, Female, Barrier-free		1	170	170	
Quiet Room		1	80	80	
Multifaith Prayer Room		1	80	80	Seats 4, small table, with telephone
First Aid Room		1	80	80	
Lunchroom		1	320	320	
Housekeeping Closet		1	70	70	
	TOTAL OTHER RESOURCES FOR FACILITY			**4,195**	
	Total Net Square Feet (NSF)			**7,597**	
	NSF : GSF Grossing Factor			1.35	
	Total Gross Square Feet (GSF)			**10,256**	
		Stores		**7,300**	
	Area Available			**17,855**	**Not including parking garage**
	Difference			**299**	

ST CATHARINES LEVEL 1 NORTH BUILDING

Room/Space	Department	QTY	NSF	Total	Comments
Workstation, Lines Clerk	595 - Lines	1	100	100	
Office, Manager, Lines	595 - Lines	1	120	120	
Hotelling Station, Student, Overhead	595 - Lines	2	30	60	
Office, Supervisor, Lines	595 - Lines	3	80	240	
Hotelling Station, Engineering, Capital Projects	Engineering	3	30	90	For when on site
Hotelling Station, Underground	Underground	2	30	60	
Workroom, Lead Hands		5	30	150	
Team Room, All Lines Groups and Apprentices		1	600	600	Gathering area for shift start/end for 35 staff, with PCs and telephones
TOTAL OVERHEAD AND UNDERGROUND LINES				**1,420**	
Reception Area	Customer Service	1	360	360	At entrance with desk, waiting and storage
Locker Room, Male		1	1,940	1,940	Current
Locker Room, Female		1	270	270	New on 1st Floor
Janitor Closet		1	63	63	Current
Copy Room		1	65	65	Current
Washroom, Male, Barrier-free		1	135	135	
Washroom, Female, Barrier-free		1	135	135	
First Aid Room		1	125	125	With recliner, sink and storage
Quiet Room		1	125	125	Small table, seats 4, with telephone
Lunchroom		1	1,300	1,300	Current, could be upgraded
	TOTAL SHARED			**4,158**	
	Total Net Square Feet (NSF)			**5,578**	
	NSF : GSF Grossing Factor			1.35	
	Total Gross Square Feet (GSF)			**7,530**	
	Admin Area Available			**9,160**	
	Difference			**1,630**	

ST. CATHARINES LEVEL 1 GARAGE/STORES

Room/Space	Department	QTY	NSF	Total	Comments
Office, Manager, Supply Chain	Stores	1	0	0	Work 1 day/week from Nebo, In Stores
Workstation, Storekeeper	Logistics	1	0	0	In Stores area
Workstation, Storekeeper	Logistics	1	0	0	In Stores area
Hotelling Station, Student, Stores	Logistics	1	0	0	In Stores area
Stores	Logistics	1	15,980	15,980	More room than req'd
Loading Dock		1	0	0	SF Included In Stores
Indoor Parking		1	15,900	15,900	
Mezzanine	Lines	1	410	410	Current
Mechanic Garage	Lines	1	2,800	2,800	Current
Hotelling Station, Lead Hand Mechanic	Supply Chain Management	1	0	0	In Garage
	TOTAL			**35,090**	
	Total Net Square Feet (NSF)			**35,090**	
	NSF : GSF Grossing Factor			0.00	
	Total Gross Square Feet (GSF)			**35,090**	**Includes indoor parking and mechanic garage**
	Area Available			**35,680**	
	Difference			**590**	

ST. CATHARINES LEVEL 2 NORTH BUILDING

Room/Space	Department	QTY	NSF	Total	Comments
Workstation, Call Centre Coordinator	Customer Service	1	64	64	
Workstation, Customer Service Representative	Customer Service	21	64	1,344	
Workstation, General Clerk	Customer Service	2	64	128	
Office, Supervisor, Customer Service, John St	Customer Service	1	80	80	
Office, Supervisor, Customer Service, St. Catharines	Customer Service	1	80	80	
Workstation, Operating Group	Network Operating	1	64	64	
Locked Room, Data Centre	Network Operating	1	150	150	
Record Storage	Customer Service	1	200	200	
Quiet Room	Customer Service	1	80	80	Small table seating for 2, with telephone
	TOTAL CUSTOMER SERVICE			**2,190**	
Coat Storage		1	75	75	For staff with workstations
Housekeeping Closet		1	70	70	New
Meeting Room, Medium		1	240	240	Seats 10-12 people, with AV, teleconferencing equipment,
Large Training Room		1	1015	1015	Servery / Chair A/V Storage CURRENT
Hotelling Stations for Staff	Corporate	6	30	180	
HR Office/Interview Room	Human Resources	1	110	110	Seats 4, locked, PC and phone
Copy, Printer, Storage Room		1	130	130	New
Washroom, Male, Barrier-free		1	180	180	
Washroom, Female, Barrier-free		1	270	270	New
File Storage		1	250	250	
Servery		1	85	85	Existing
	TOTAL SHARED			**2,605**	
	Total Net Square Feet (NSF)			**4,795**	
	NSF : GSF Grossing Factor			1.35	
	Total Gross Square Feet (GSF)			**6,473**	
	Area Available			**10,000**	
	Difference			**3,527**	

ST. CATHARINES LEVEL 1 SOUTH BUILDING

Room/Space	Department	QTY	NSF	Total	Comments
Generation Group Lease		1	1,046	1,046	
Boardroom		1	470	470	
	TOTAL			**1,516**	
	Total Net Square Feet (NSF)			**1,516**	
	NSF : GSF Grossing Factor			1.35	
	Total Gross Square Feet (GSF)			**2,047**	
	Area Available			**7,640**	
	Difference			**5,593**	Available for Lease

5 ADJACENCIES

Results from the staff surveys and management interviews identified physical adjacencies for each site. Where possible, PRISM reflected requested adjacencies in the space tables and block schematic plans. The following tables summarize recommended adjacencies:

5.1 John Street

Level	Departments	Adjacency Rationale
Basement	1. Mail Room 2. Mostly storage, building infrastructure, parking	
1	**Lobby** 3. Security Reception, Waiting 4. Customer Service Desk and phones 5. Drop box and PC for customers 6. Archival and educational display areas **Current Customer Connections Area** 7. Secure Network Operating Command Centre for all staff including Manager and meeting room for Disaster Control Management 8. New locker rooms, exercise area and bicycle parking 9. Secure storage for CDM trade show materials and displays at loading dock	3. More welcoming environment 7. Provides required space that is less isolated and has dedicated HVAC running 24/7 8. Barrier-free to meet current codes 9. Parking for van on main level
2	10. Customer Service including Billing Clerks from first floor lobby 11. Business Development	10. Existing provides area to expand
3	12. Engineering and Operational Improvement (consolidated except for Network Operating on first floor)	12. Consolidates department and area for expansion
4	13. Supply Chain/Procurement 14. Facilities 15. Healthy Workplace and Safety 16. Corporate lunch room, sick room, multifaith prayer room	13. These departments do similar projects allowing better interaction and communication 16. Area available
5	17. Information Technology (consolidated from various locations) 18. Conservation Distribution Management	17. Consolidate department 18. Close to Executive on 6th floor and allows for planned growth
6	19. Executive Team (including all Vice Presidents) 20. Finance 21. Regulatory 22. Human Resources/Corporate Communication 23. Boardroom	19. Consolidates Executive team and adjacencies identified by CEO

5.2 Nebo Road

Level	Departments/Services	Adjacency Rationale
1	1. Stores and Stores Office 2. Transformer testing area 3. Locker rooms 4. Lunch room 5. New reception with elevator and stairs to mezzanine 6. Data centre, multifaith prayer room, sick room 7. Indoor fleet parking 8. Mechanic garage	1. Most functions are existing. Allows for creation of main entrance and reception to control access 7. Allows for parking area expansion
2 North Mezzanine	9. Stores and Lift	9. Existing
2 South Mezzanine	10. Overhead Lines (Stoney Creek and Nebo combined) 11. Underground Lines 12. Substation Manager 13. Construction and Maintenance 14. Fleet and Stores offices 15. Hotelling spaces for visiting staff	10. Newly constructed spaces with dedicated HVAC and exterior windows on south side. 11. Will address air quality concerns and provide spaces for staff currently hotelling 15. New

5.3 Stoney Creek

Level	Departments/Services	Amenities
1	1. Customer Connections (consolidate from St. Catharines and John Street) 2. Stores 3. Corporate Training Centre 4. Hotelling spaces 5. Sick room, multifaith prayer room, data centre 6. Indoor fleet parking	1. Improved operational efficiency, supervision, inventory management and employee morale 3. Centrally located between St. Catharines and Hamilton 5. New

5.4 St. Catharines

Level	Departments/Services	Amenities
1 North Building	1. Expansion space for Overhead Lines with hotelling spaces and training 2. New entrance and reception for Customer Service 3. New stair and elevator to second floor. 4. Stores 5. Mechanic garage 6. Indoor fleet parking 7. Lunch room / locker rooms 8. Quiet room, sick room, multifaith prayer room	1. Most existing with some upgrades 7. Upgraded 8. New
2 North Building	9. Customer Service 10. Training Centre/Conference Rooms 11. Hotelling spaces	9. Relocated to expand and provide spaces currently lacking 10. Existing 11. New
1 South Building	12. Continue with current tenant 13. Lease out remainder	

6 RECOMMENDATIONS

6.1 Cost Benefit Methodology

PRISM and the consulting teams have provided recommendations for each site and for a few areas of consideration in corporate operations. During discussion with Executive Management Team, the consulting team recognized the need to include an informal cost/benefit analysis for each of the site recommendations. The team understands that the sites do not operate in a vacuum and that changes to one site may well impact on another.

In order to complete the cost benefit analysis, the PRISM team has made a number of qualitative assumptions to define costs and benefits; these are:

Costs

- Initial capital costs – includes the one time capital costs for renovations, additions, enhancements, new equipment, etc;
- Ongoing maintenance costs – upgrades to existing systems, annual maintenance costs for equipment, vehicles, etc;
- Ongoing leasing costs – includes IT equipment, photocopiers, AV equipment, if applicable;
- Loss of productivity/employee morale – includes staff time related to relocations, additional travel time to jobs;
- Health and Safety – includes issues related to maintaining safe and healthy workplaces; and
- Regulation and Legislation – compliance with regulatory and legislative requirements such as Ontario Disabilities Act.

Benefits

- Building performance – improved energy performance of buildings including building systems and infrastructure;
- Decreased maintenance costs – includes vehicles;
- Increased flexibility in space – additional space or better use of space;
- Improved productivity due to adjacencies and co-location of teams;
- Improved employee morale;
- Decreased vandalism and loss of materials;
- Meeting accessibility guidelines and regulations; and
- Improved health and safety aspects of workplace.

The PRISM team has also made a number of quantitative assumptions to determine the costs associated with recommendations. Some internal information such as salary and benefits, maintenance and leasing costs was not available to the consulting team, therefore absolute cost for some initiatives is not known. In these cases, PRISM made a qualitative assumption as a proxy. For example, the cost of staff relocation is estimated with moving and relocation costs, however because productivity loss is not quantifiable for this report, an assumption that a day's work will be lost with the relocation was made.

A cost/benefit matrix is included with the site recommendations provided below. The following scale was used to create the matrix:

Cost

Low - less than $149,999
Medium - $150,000 to $499,999
High – greater than $500,000

Benefits

Low - less than three (3) benefits met
Medium – 3 or 4 benefits met
High – more than five (5) benefits met

Note that the costing provided is construction only. Furniture, equipment, permits, architectural and engineering fees, consultant fees, moving or other soft costs are not included. Additional detail to support the analysis can be found in Appendix G.

6.2 Corporate Operational Recommendations

6.2.1 Space Planning and Furniture Standards

The development of a Master Space Strategy would offer Horizon the ability to plan, implement and adapt various site locations while bringing a high level of consistency and unified identity of a *Horizons* brand to all facilities.

A universal planning approach will respond to future and unpredictable change, and allow staff to move to accommodate change rather than the expense and time to redesign space. The furniture may have different components defining departmental job functions, but the principle of a kit of parts for easy change would allow Horizon to respond to change by moving people instead of furniture, resulting in a low churn rate and providing ultimate flexibility.

Workplace furniture guidelines will bring not only a high level of consistency and strong corporate identity to the workplace, but will provide Horizon with a flexible furniture inventory. Current furniture standards will also ensure that issues of health and safety, environmental opportunities such as LEED, and ongoing technological changes are addressed. Appendix D provides recommendations for space allocation standards and estimated furniture pricing.

6.2.2 Meeting Rooms

To make better use of current and future meeting rooms, Horizon should consider upgrading its audiovisual equipment, including more white boards and smart boards, teleconferencing and videoconferencing equipment for all meeting rooms at all sites. The technology will enable more productive meetings by providing the ability for staff members to meet remotely, thus potentially reducing travel time. (Note, cost is not covered in this report).

6.2.3 Information Technology

Currently, IT equipment is purchased and managed by individual departments. PRISM recommends that Horizon consider centralizing the management, purchasing and maintenance of all IT equipment for better control and improved annual operating capital planning.

A number of single departmental printers or workstation printers exist throughout the corporation. Provision of more networked multi-use devices will require less space and potentially reduce operating costs over time. PRISM recommends Horizon prepare a corporate printer/fax/copier allocation policy and an implementation plan with the goal of reducing the number of devices and moving to more multipurpose, networked devices. (Note, cost is not covered in this report).

6.2.4 Records Management

PRISM believes that Horizon is at risk due to its current records management practice. A records management strategy has been prepared by Horizon's Facilities department which includes partnering with an external records management firm to properly organize and manage the business records, including established retention standards. Benefits of implementing this proposal include:

1. Minimizing Litigation Risk

   Records are stored in secure facilities and disposed of, as set in Horizon's retention strategy. An offsite records management solution will provide a safe location for files as well as a managed record database.

   Presently, records are stored in various locations at all sites and are not managed effectively.

2. Ensuring Regulatory Compliance

   Proper control of record management and disposal would be established, ensuring fast retrieval of documents when necessary.

3. Reducing Operating Costs

   A records management system will reduce the use of valuable real estate to store records. There will also be a reduction in time spent by staff searching for and maintaining records.

4. Establishing new records management technologies such as electronic records management.

   Refer to the Horizon Utilities Records Management proposal in Appendix E.

6.2.5 John Street

6.2.5.1 Short Term Plans

1. Renovate the sixth floor as the Executive suite and include Human Resources, Regulatory and Finance, as well as a new properly sized and equipped boardroom.

   The current tenant is vacating and this provides an opportunity to start the phasing of internal renovations at John Street and establish the adjacencies and needs identified by the CEO.

2. Relocate Customer Connections to Stoney Creek from John Street and St. Catharines.

   Refer to the rationale under Stoney Creek proposals.

3. Renovate John Street Customer Connections space and move Network Operating to the first floor.

   Network Operating is the main command centre monitoring Horizon's network of services. They are the only 24/7 operation at John Street. Due to the nature of their work and sensitive computer systems, the department requires controlled HVAC 24/7. Currently located on the fourth floor, the main building HVAC system runs to support the operation. The staff have also noted security concerns due to the location within the building after hours.

   The current Customer Connections area on the first floor would be ideal to house this group. The space is currently supported by a dedicated HVAC system, thus the main building system could be shut down after hours, potentially resulting in operational efficiencies. The location, adjacent to the main entrance with security support, is ideal for the 24/7 operation. The area is large enough to accommodate planned growth and current service needs to operate as a truly isolated unit. It has been confirmed that the existing server, located on the fifth floor, can remain and support Network Operating in the first floor location.

4. Create new locker rooms, bicycle storage and gym on the first floor at the loading dock.

   The current locker rooms are not fully accessible as access to the space is via stairs. New locker rooms could be constructed within the current Customer Connections space. The existing lunch room could be converted into an exercise facility.

5. Conservation Distribution Management Storage

   The existing meter storage cage is convenient to the loading dock, thus making it a good location to house the trade show materials and display units for Conservation Distribution Management.

6. Renovate fourth floor and occupy.

   This is the only floor in the building that has not been upgraded. Once the Command Centre, Finance and Regulatory departments relocate, most of the floor would be available for upgrading. The washrooms will need to be retrofitted to meet accessibility codes. PRISM recommends that Facilities, Supply Chain and Health and Safety be relocated on this floor. Additionally, there is an opportunity to create a corporate lunch room/cafeteria, multifaith prayer room and sick room on this floor.

7. Reconfiguration of the second, third and fifth floors.

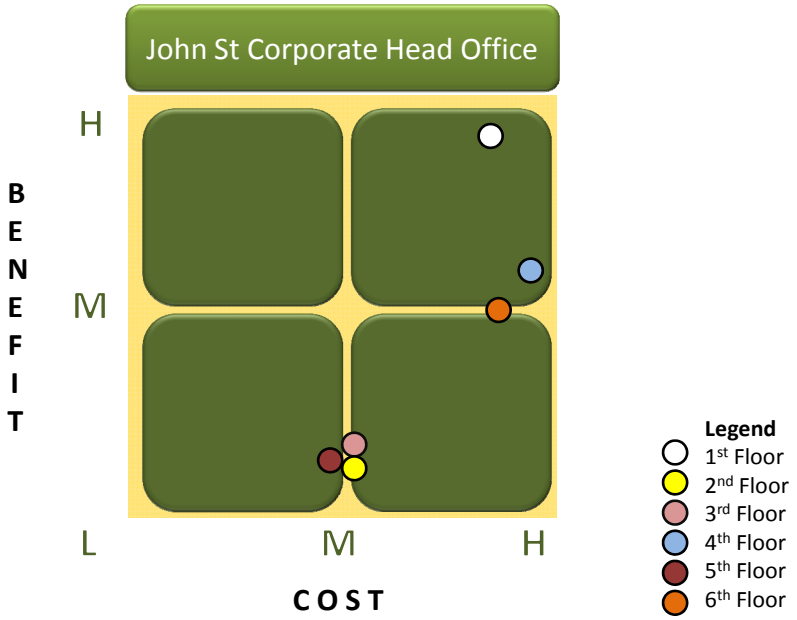
   Minor renovations and workstation reconfiguration can be done over time to accommodate growth and new room requirements.

8. Retrofit Lobby

   Create a more welcoming reception area, customer service area and security desk. Use the area to create an educational and archival information centre.

   Use Man building primarily for storage.

   Estimated Cost: $3,612,050



6.2.5.2 Five to Ten Year Plans

1. Upgrades to electrical distribution system and replacement of fifth floor HVAC.

2. Major changes to the building over longer term are not expected. There is area to grow in future with minor renovations.

3. Depending on growth with acquisitions and mergers, Head Office location may change.

Estimated Cost: $225,000

6.2.6 Nebo Road

6.2.6.1 Short Term Plans

1. Upgrade the garage exhaust system.

2. Stores to implement plan to reduce inventory freeing up the south mezzanine.

3. Relocate the Overhead Lines team from Stoney Creek to this facility to consolidate the Hamilton Overhead Lines team.

4. Renovate the south mezzanine to accommodate all offices, meeting spaces and new team rooms complete with dedicated HVAC system.

5. Construct a new elevator and stairs to the south mezzanine and create a reception and new main entrance at the current staff entrance.

6. Renovate the main floor to expand locker rooms, upgrade the lunch room and add multifaith prayer and first aid rooms.

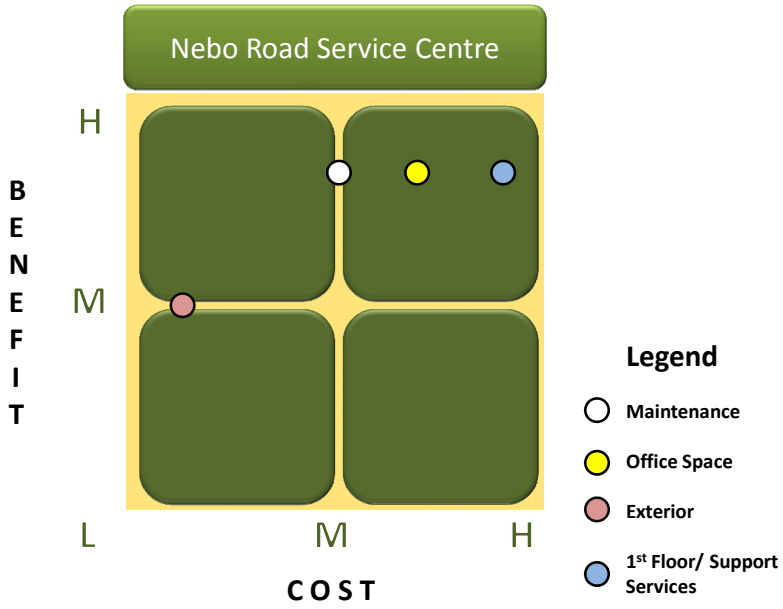
7. Proceed with the external reconfiguration plan for parking, storage and flow. This plan includes a new secure entrance from Nebo Road. Reconfiguration of external parking by moving staff and visitor parking to the south side and fleet parking to the west side will allow for a total of 170 parking spaces:

    - 136 staff parking spaces
    - 10 visitor spaces
    - 24 fleet spaces

8. The main floor garage can be renovated to accommodate 33 new parking spaces once the office and support spaces move to the mezzanine. If implemented, the internal parking count will increase to 92 spaces.

9. Add a security alarm system to the external fencing for stores and card readers for the entrances.

Estimated Cost: $2,634,375



6.2.6.2 Five to Ten Year Plans

1. Retrofit the garage level for more indoor parking and new exhaust system, if not done in short term plan.

2. There is 9,000 square feet of space available on the south mezzanine for future growth.

Estimated Cost: $900,000

6.2.7 Stoney Creek

6.2.7.1 Short Term Plans

1. Consolidate Customer Connections to Stoney Creek with teams relocating from John Street and St. Catharines. Stoney Creek is underutilized and provides an ideal location for the consolidation of the Customer Connections groups, due to its proximity between all service areas. Consolidating the team will result in operational efficiency, improved supervision, better inventory management and staff satisfaction. See proposed business case in Appendix F.

2. Reorganize Stores for better utilization and accommodation of meter stock.

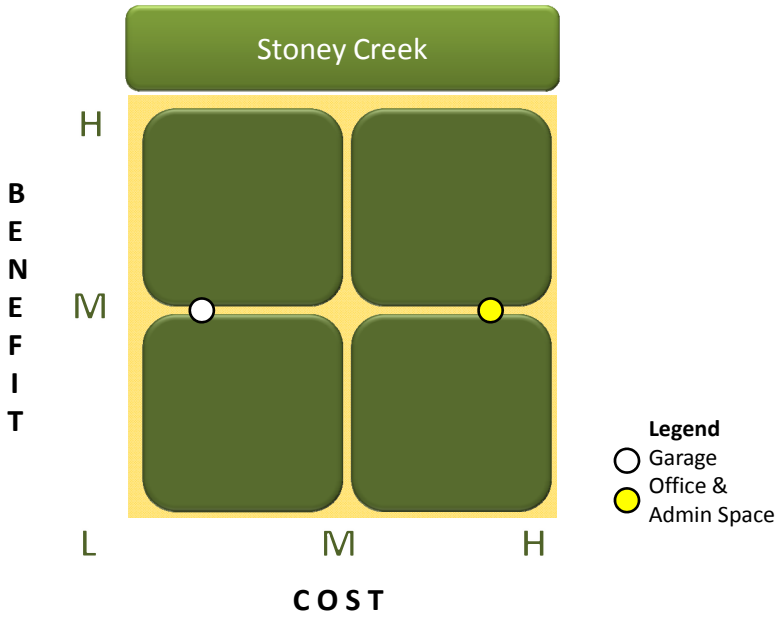
3. Create a permanent training centre with servery and easy access from the front of building, so it does not interfere with Costumer Connections workspaces.

4. Create hotelling stations for staff from other sites at the entrance.

5. Create a shared lunch room for staff.

6. Add a security alarm system to external fencing for stores.

Estimated Cost: $1,406,000



6.2.7.2 Five to Ten Year Plans

1. Expand the mechanic garage to accommodate larger fleet vehicles. (Not required if Overhead relocates to Nebo Road).

Estimated Cost: $650,000

6.2.8 St. Catharines

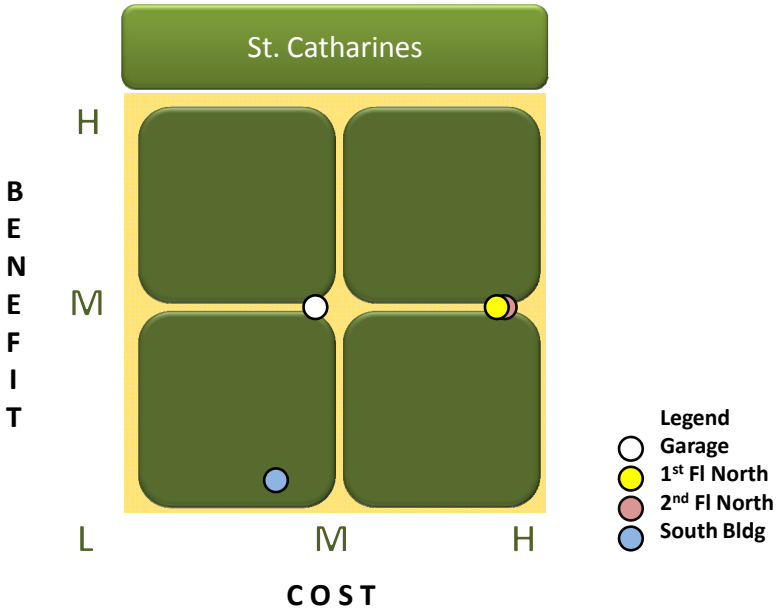
6.2.8.1 Short Term Plans

1. Build new elevator and stairs to second floor (north building).
2. Retrofit main floor entrance and reception at the current staff entrance.
3. Renovate the space to the south of the new entrance for barrier-free washrooms, first aid room and multifaith room.
4. Upgrade locker rooms including the construction of a linewomen's washroom and locker room on the first floor.
5. Renovate second floor to accommodate Customer Service and other functions as per space table.
6. Retrofit the main floor area to allow for Overhead expansion requirements as per space table.

7. Reorganize Stores for better utilization, providing a potential area for small vehicle parking such as vans.

8. Vacate the south building, and lease out the space, or sever and sell. Severing and selling does impact staff parking, therefore a review of the external property should be conducted to determine parking accommodation. Severing does not allow for future growth if required.

Estimated Cost: $2,857,000



6.2.8.2 Five to Ten Year Plans

1. Expand the indoor parking garage to accommodate more fleet parking. Expansion of the garage with 8,860 square feet of more space will accommodate approximately 14 more vehicles.

2. Expand the mechanic shop to accommodate larger vehicles.

3. Fit up vacant space in the North building, levels 1 and 2.

Estimated Cost: $2,860,000

6.3 Priority Phasing Recommendations

The following outlines PRISM's recommended priorities for implementation of the resource and space utilization project. Recommendations not listed here but that are included in the five year plan can be prioritized and planned with annual capital as it becomes available. These priorities are numbered from highest to lowest importance.

6.3.1 Nebo Road

Nebo accommodates a large number of staff, fleet and stores for the organization and has the highest safety risks due to poor indoor air quality and external flow of staff and fleet vehicles and stock. There are challenges working in a cramped facility managing the flow of people, stock and vehicles. Although the air quality is monitored on a regular basis the offices on the first floor do not have the provision of fresh air and there is no way to pressurize the offices to eliminate the exhaust odours. The main vehicle exhaust system is code compliant; however it is designed at the low end of acceptable limits. It was not likely intended to serve as more than vehicle use. The emission exhaust system does not provide acceptable performance. Continued and future use of the building for office areas will necessitate improving the exhaust system along with other good engineering measures to ensure a comfortable and safe working environment for the employees at this site.

Externally there are safety concerns with movement of stock, staff and fleet vehicles crossing paths. We feel that this site should take priority for improvement.

The following should be undertaken:

1. Proceed with Stores plan to reduce stock and move towards a more just-in-time system. This would free up the south mezzanine.

2. Build the offices, meeting rooms and team spaces on the south mezzanine level complete with dedicated HVAC to meet office environment standards. This includes the construction of a new stair and elevator to meet code requirements. This area will accommodate the offices from the garage area, accommodate planned staffing increases and enable the consolidation of Overhead Lines from Stoney Creek and leave approximately 9000 square feet for stores or future growth.

3. Upgrade the garage exhaust system.

4. Relocation of the office and meeting spaces from the first floor provides space to create a new main entrance at the south staff entrance and expansion of the locker facilities and addition of a first aid room and multi-faith room.

5. Reconfigure the external site to separate fleet and staff parking and stores to improve flow and safety.

6.3.2 John Street Sixth Floor

Renovate the sixth floor of John Street. With the current tenant leaving shortly this provides the opportunity to address the congestion and future growth in staff at the John Street facility, creating a phasing plan to address other floors. Most floors have been renovated with the exception of the fourth floor. Levels 2, 3 and 5 can be reconfigured with minimal renovations and mostly the reallocation of existing space to create desired adjacencies. The following is recommended for John Street:

1. Renovate the sixth floor to accommodate the Executive Suite, Human Resources, Finance and Regulatory. This frees up a good portion of the fourth and fifth floors.

6.3.3 Stoney Creek

Stoney Creek is a valuable asset to Horizons and is currently underutilized. Other than stores and fleet parking, only one quarter of the administrative area is being utilized for training. Relocating Customer Connections from John Street and St. Catharines to Stoney Creek will result in operational efficiency, improved supervision, better inventory management and staff satisfaction. This location is ideal for training and a proper training facility should be established at this site. PRISM recommends the following should be undertaken:

1. Relocate Overhead Lines to Nebo, as noted above.

2. Renovate the building to accommodate a proper training facility, Customer Connections and some hotelling stations.

3. Renovate the Customer Connections at John Street to accommodate the requirements for the Command Centre currently on the 4th floor of John Street. They require more space and plan for growth over time. As the only function at John Street working 24/7 they are isolated on the 4th floor after hours. The main building HVAC is running 24/7 to accommodate them on the 4th floor. The 1st floor area has its own dedicated HVAC unit which would result in operational savings with the ability to shut down the main system after hours and provide the staff a safe working environment.

4. Renovate the 4th floor to bring to code including barrier-free washrooms. Consolidate Supply Chain, Facilities and Health and Safety departments to this floor as they work closely and on similar projects which will improve communication and interaction. There is space available on this floor to create a consolidated cafeteria for the building which could be a good source of revenue generation. If not used as a cafeteria it provides future growth space.

6.3.4 St. Catharines

The second floor of St. Catharines north building is used occasionally for training, and is empty except for a female locker room. Customer Service is cramped and noisy on the main level. The

Overhead Lines area is overcrowded. The supervisors do not have a proper area to meet with their teams and there is no area for the service staff to work from when on site. The following is recommended:

1. Renovate the second floor to accommodate Customer Service, a proper meeting/training area and hotelling spaces for staff from other sites. This includes the construction of a new stair and elevator to access the second floor and a new reception in the north building.

2. Renovate the current Customer Connections area to provide additional space for Overhead Lines.

3. Lease the south building to provide additional revenue and ensure future growth needs can be met.

7 ESTIMATED BUDGET COSTING

ESTIMATED BUDGET COSTING

Note: Costing is for construction only and does not include architectural and engineering fees, furniture, equipment, fees, permits, moving or other soft costs or contingency.

Legend

High Urgency Recommendation

Medium Urgency Recommendation

Low Urgency Recommendation

Corporate	Sq Ft	Cost per Sq Ft	Total	Urgency	Notes
Space Planning and Furniture Standards				Medium	
Refer to Budget Costing Breakdowns in Appendix D					
Meeting Room Technology				Medium	
To be prepared by Horizon's Information Technology Department					
IT Equipment Management				Medium	
To be prepared by Horizon's Information Technology Department					
Records Management				High	
Start Up			$7,750		
Annual Operating Cost			$8,100		

John Street Short Term Recommendations	Sq Ft	Cost per Sq Ft	Total	Urgency	Notes
Retrofit Lobby	2,885	$100	$288,500	High	
1st Floor Network Operating Command Centre	1,780	$100	$178,000	High	
1st Floor New Locker Rooms	2,835	$175	$496,125	Medium	
1st Floor Bike Storage and Gym	1,485	$35	$51,975	Low	
1st Floor CDM Storage at Loading Dock	1,000	$5	$5,000	Low	Locked metal storage cage
Subtotal 1st Floor			**$1,019,600**		
2nd Floor Minor Renovations Customer Service	12,635	$25	$315,875	Low	
3rd Floor Minor Renovations Engineering and Op	10,948	$25	$273,700	Low	
4th Floor New Cafeteria and Support Service Depts	10,955	$75	$821,625	Medium	Price does not include cafeteria kitchen
5th Floor Minor Renovations IT Department	11,065	$25	$276,625	Low	
6th Floor Executive Suite	10,795	$75	$809,625	High	
Vehicle Area HVAC add CO/NOX Controls and Timers	1	$15,000	$15,000	Medium	
Man Building HVAC Upgrades	1	$80,000	$80,000	Medium	Dependent on planned use of space
Insulate Walls	1	$536,000	$536,000	Medium	To be done as floors are renovated
Replace Windows	1	$675,000	$675,000	Medium	To be done as floors are renovated
Total John Street Short Term Recommendations			***$4,823,050***		

John Street 5-10 Year Recommendations	Sq Ft	Cost per Sq Ft	Total	Urgency	Notes
Electrical Power Distribution System Upgrades	1	$150,000	$150,000		
5th Floor Long Term Replace HVAC	1	$75,000	$75,000		
Subtotal			**$225,000**		
Total John Street 5-10 Year Recommendations			***$225,000***		

ESTIMATED BUDGET COSTING

Note: Costing is for construction only and does not include architectural and engineering fees, furniture, equipment, fees, permits, moving or other soft costs or contingency.

Legend

High Urgency Recommendation

Medium Urgency Recommendation

Low Urgency Recommendation

Nebo Short Term Recommendations	Sq Ft	Cost per Sq Ft	Total	Urgency	Notes
Garage					
Parking Garage HVAC and Roll-Up Doors	1	$307,000	$307,000	High	
Maintenance Shop HVAC	1	$22,000	$22,000	High	
Emergency and Exit Lighting Upgrades	1	$2,000	$2,000	Medium	
Expand Indoor Parking including demo offices	1	$42,000	$42,000	Medium	Removal of 1st floor offices
Stores Inventory Management	-	$0	$0	High	
Subtotal Garage			**$373,000**		
Mezzanine Offices					
South Mezzanine Converted to Offices	6,600	$115	$759,000	High	leaves 9000 sf future growth
New Elevator and Stair	1	$305,000	$305,000	High	
Subtotal Mezzanine Offices			**$1,064,000**		
First Floor					
First Floor Improvements and New Reception	1	$857,375	$857,375	Medium	includes locker room upgrades and new lunchroom
Subtotal First Floor			**$857,375**		
External Site Work					
External Parking/Storage Safety Flow Improvements	1	$300,000	$300,000	High	
Security System to External Storage and Entrances	1	$40,000	$40,000	High	
Subtotal External Site Work			**$340,000**		
Total Nebo Road Short Term Recommendations			***$2,634,375***		

Nebo Road 5-10 Year Recommendations	Sq Ft	Cost per Sq Ft	Total	Urgency	Notes
Fit up 9000 available at South Mezzanine	9,000	$100	$900,000	Low	
Total Nebo Road 5-10 Year Recommendations			***$900,000***		

ESTIMATED BUDGET COSTING

Note: Costing is for construction only and does not include architectural and engineering fees, furniture, equipment, fees, permits, moving or other soft costs or contingency.

Legend

High Urgency Recommendation

Medium Urgency Recommendation

Low Urgency Recommendation

Stoney Creek Short Term Recommendations	Sq Ft	Cost per Sq Ft	Total	Urgency	Notes
Garage/Stores					
Main Vehicle HVAC and Roll-Up Door improvements	1	$20,000	$20,000	Medium	
Stores reorganization to accommodate meter equipment	1	$5,000	$5,000	Medium	
Subtotal Garage/Stores			**$25,000**		
Office/Training Centre					
Office Area including Customer Connections, Training, hotelling	11,300	$120	$1,356,000	High	
Subtotal Office/Training Centre			**$1,356,000**		
External Site Work					
Security System to External Storage & Entrances	1	$25,000	$25,000	High	
Subtotal Site Work			**$25,000**		
Total Stoney Creek Short Term Recommendations			**$1,406,000**		

Stoney Creek 5-10 Year Recommendations	Sq Ft	Cost per Sq Ft	Total	Urgency	Notes
Expand Parking Garage and Stores	1	$650,000	$650,000	Low	May not be required if Overhead moves to Nebo
Subtotal Stoney Creek			**$650,000**		
Total Stoney Creek 5-10 Year Recommendations			**$650,000**		

ESTIMATED BUDGET COSTING

Note: Costing is for construction only and does not include architectural and engineering fees, furniture, equipment, fees, permits, moving or other soft costs or contingency.

Legend

High Urgency Recommendation

Medium Urgency Recommendation

Low Urgency Recommendation

St. Catharines Short Term Recommendations	Sq Ft	Cost per Sq Ft	Total	Urgency	Notes
Garage/Stores					
Vehicle Area HVAC Upgrades	1	$152,000	$152,000	Medium	
Garage HVAC Upgrades	1	$22,000	$22,000	Medium	
Photocell Sensor for Garage	1	$5,000	$5,000	Medium	
Stores Reorganization	1	$5,000	$5,000	Medium	
Subtotal Garage/Stores			**$184,000**		
Office Areas North Building					
1st Floor North Building Renovations	7,650	$120	$918,000	High	
2nd Floor Renovations North Building Customer Service	11,000	$120	$1,320,000	High	Including new windows/skylight
New Elevator and Stair to 2nd Floor	1	$300,000	$300,000	High	
Subtotal Office Area North Building			**$2,538,000**		
Site work to create more parking	1	$120,000	$120,000	Low	
Subtotal			**$120,000**		
South Building					
Revenue Lease out South Building	7,640	$14	$106,960		Annual Revenue Estimate
Separate Gas Supply Line for Separate Metering	1	$10,000	$10,000	High	
Separate Plumbing Systems for Separate Metering	1	$5,000	$5,000	High	
Subtotal South Building			**$15,000**		
Total St. Catharines Short Term Recommendations			**$2,857,000**		

St. Catharines 5-10 Year Recommendations	Sq Ft	Cost per Sq Ft	Total	Urgency	Notes
Office Areas North and South Buildings					
Fit Up Additional Space 1st Floor North Building	1,840	$50	$92,000	Low	
Fit Up Additional Space 2nd Floor North Building	1,540	$50	$77,000	Low	
Minor Modifications to Use South Building	7,640	$25	$191,000	Low	
Subtotal Office Areas			**$360,000**		
Expand Parking Garage and Mechanic Garage	**1**	**$2,500,000**	**$2,500,000**	Low	
Total St. Catharines 5-10 Year Recommendations			***$2,860,000***		

Appendix K – Building Condition Assessment 2013

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Appendix A – 20 Year Forecast Summary Sheet

Summary Report
Horizon Utilities

1. Introduction

Horizon Utilities commissioned *Evans Consulting Services* in June 2013 to conduct a building condition assessment for 27 facilities owned and operated by the Utility. [1]The purpose of a building condition assessment is to give a measure of the effectiveness of the current maintenance programs because it determines the remaining useful life of components or systems and compares it with the full economic life expected, give good maintenance practices.

Early detection of possible problems in a building is important in preventing deterioration, damage to neighbouring components or systems and the failure of components; leading to increased (costs in) operations and even capital expenditures.

The end objective of a building condition assessment is to forecast replacement costs for major components in a building based on their predicable life. Life Cycle Analysis (LCA) is based on the premise that every component has a predicable life. Several organizations such as R.S. Means, BOMA and IFMA publish lifecycle charts that forecast the expected service life of a building component given its past performance. Building components include items such as roofing, Architectural interior and exterior elements, Heating Ventilation and Air conditioning components and so on.

Another issue that impacts the life of a building component is the effectiveness of *the preventative maintenance program* being applied. For the purpose of this report, we define [2]Preventative maintenance as 'planned actions undertaken to retain an item at a specified level of performance by providing repetitive scheduled tasks which prolong system operation and useful life and prevent premature failures. Typically PM includes inspection, lubrication, adjustment, cleaning, non-destructive testing, and periodic maintenance, usually minor component replacement'.

The balance of any successful preventative maintenance program is deciding the extent of maintenance that needs to be applied. Over maintaining a building is too expensive, while under maintaining can be catastrophic. As a result, the measure of the buildings' condition through a building condition assessment is one way to measure the maintenance program.

[1] Taken from the (IRC) _Institute for Research in Construction – Guidelines for building audits.
[2] Taken from The Facility Management Handbook, David G. Cotts Michael Lee.

The other method for measurement is to embark on a regimented *maintenance management* program that through predetermined reporting, continually analyses items such as the rate of reliability, breakdowns, call backs, ratios of demand maintenance to preventative maintenance, emergency maintenance calls, and utilization of resources to name a few.

While the scope of work for this project did not encompass reviewing Horizon Utility's operational practices, we understand that a maintenance management system is available for use by the Facilities Management maintenance section. Information from a facility management system would enhance the results and findings of a building condition assessment in the future.

Another method for stating a building's' overall condition is to specify a facility's condition in terms of FCI. *A Facility Condition Index (FCI)* is an industry standard asset management tool which measures the constructed asset's condition at a specific point in time. It is a functional indicator resulting from an analysis of different but related operational indicators (such as building repair needs) to obtain an overview of a buildings condition as a numerical value.

FCI is obtained by aggregating the total cost of any needed or outstanding repairs, renewal or upgrade requirements of a building compared to the current replacement value of the building components. It is the ratio of the repair needs to replacement value expressed in percentage needs. In the case of Horizon Utilities, these would include code compliance issues, deferred maintenance backlog, system upgrades and legislative requirements such as Accessibility for Ontarians with Disabilities Act (AODA). When determining the FCI of a building, the calculation shown below provides the numeric value.

$$\frac{\text{Total of Building Repair/Upgrade/Renewal Needs}}{\text{Current Replacement Value of Building}}$$

The lower the value of FCI, the better condition that a building is considered to be. Current industry benchmarks indicate the following condition ratings for facilities with various ranges of FCI.

0 to 5% FCI Asset is in good condition
6 to 10% FCI Asset is in fair condition
10 to 30% FCI Asset is in poor condition

Utilizing FCI provides a professional and consistent method of measurement to determine the relative condition index of a single building. As the numeric value of the FCI increases, the assets will experience:

- Increased risk of component failure

- Increased facility maintenance and operating costs
- Greater negative impacts to staff and residents.[3]

As Horizon Utilities is presently undergoing upgrades and renovations in a number of its facilities, this maybe an exercise undertaken in the future along with the results of the next condition assessment findings.

2. Findings and Recommendations

The findings and recommendations in this summary are broken into three areas; General Administration, Major Facilities and Substation Facilities.

2.1 General Administration

Findings:

1. While many of the staff have related experience in facilities maintenance or are ticketed trades staff, there is still a void in life safety and particularly in understanding the Ontario Fire Code and the Ontario Building Code as it applies to the overall responsibility of the facilities they manage. Within the facility reports there are **many incidents** where there is a requirement to upgrade or to review items such as fire stopping, fire extinguishers, exiting practices and upgrades to fire systems. It was quite apparent that staff is not well versed in this area. This knowledge gap presents an opportunity to provide some basic instruction to staff on what makes up a fire separation, proper labeling of fire doors and general maintenance items that are directly related to fire and life safety such as the maintenance of exit signs, rated labels on doors and so on.

2. In a number of instances, maintenance staff was asked questions about the operational characteristics of the facilities, but were unable to answer, or simply indicated that they did not know. This included questions about systems in the building such as HVAC, equipment panels and so on. There is a need for some of the maintainers to become more familiar with the equipment in their buildings. One of the common problems with operators in buildings, (**not specific to Horizon**), is that they become complacent with their environment. More time needs to be spent on orientation and learning the systems and characteristics in their facilities; possibly through the use of drawings, inventory updates or systems validation.

[3] *Taken from Capital Asset Management Asset Strategies,2011*

3. There is a requirement to provide the Supervisor of Facilities with a reference library that would include items such as the Ontario Building Code, Ontario Electrical Code, Ontario Fire Code. – (abbreviated versions, etc.), technical updates on code compliance, Designated substance legislation, AODA reference materials etcetera.

4. Labeling of HVAC equipment was not well done; particularly on equipment located on the roof tops. This is a very important issue when it comes to identifying or trouble shooting equipment. Staff indicated that labels fade and are affected by the sunlight. We submit that it is an industry best practice to label equipment to identify its purpose and its function within the building. It is a best practice that should be encouraged. Equipment should be labeled to coincide with the design and construction drawing information.

5. Similar to the equipment labeling, we noticed that doors and specific rooms are not labeled within the facilities. It would be helpful to put a proper labeling program to into practice. It is easier when referencing drawings to determine HVAC systems performance, and general guidance through the building. Equipment rooms are by code required to be labeled.

6. An opportunity exists to develop building maintenance and renovation standards for construction and ongoing change in the facilities. For example, items such as fire-stopping of penetrations through a fire separation, both vertical and horizontal. It was found numerous times where trades, either through renovations or maintenance, have created penetrations through a fire wall or floor/ceiling into a protected separation and fire stopping had not been used to backfill the opening. This should be an standard practice. Other examples include insulating of piping after a repair or change has been made; it should be part of the initial project cost. Stating types of valves, specifying wire management practices for all cabling including electrical, telecom, computer cable management etc. Once again, this is not a problem unique to Horizon Utilities. Wiring in ceiling spaces within most buildings can be difficult enough to sort out; and contractors especially don't care.

7. Within the major facilities it is important to note that all of the mechanical rooms were in very good order from a best practices perspective. Equipment was labeled and properly identified; the rooms were neat, tidy and orderly as a mechanical room should be. Piping runs were labeled with content and directional flows. Your maintainers are doing a good job in this area.

8. Roof areas in the major buildings were also very well maintained. The roof areas were free from any debris including limbs from trees, fasteners, spare parts etc. This type of care extends the life of a roof membrane.

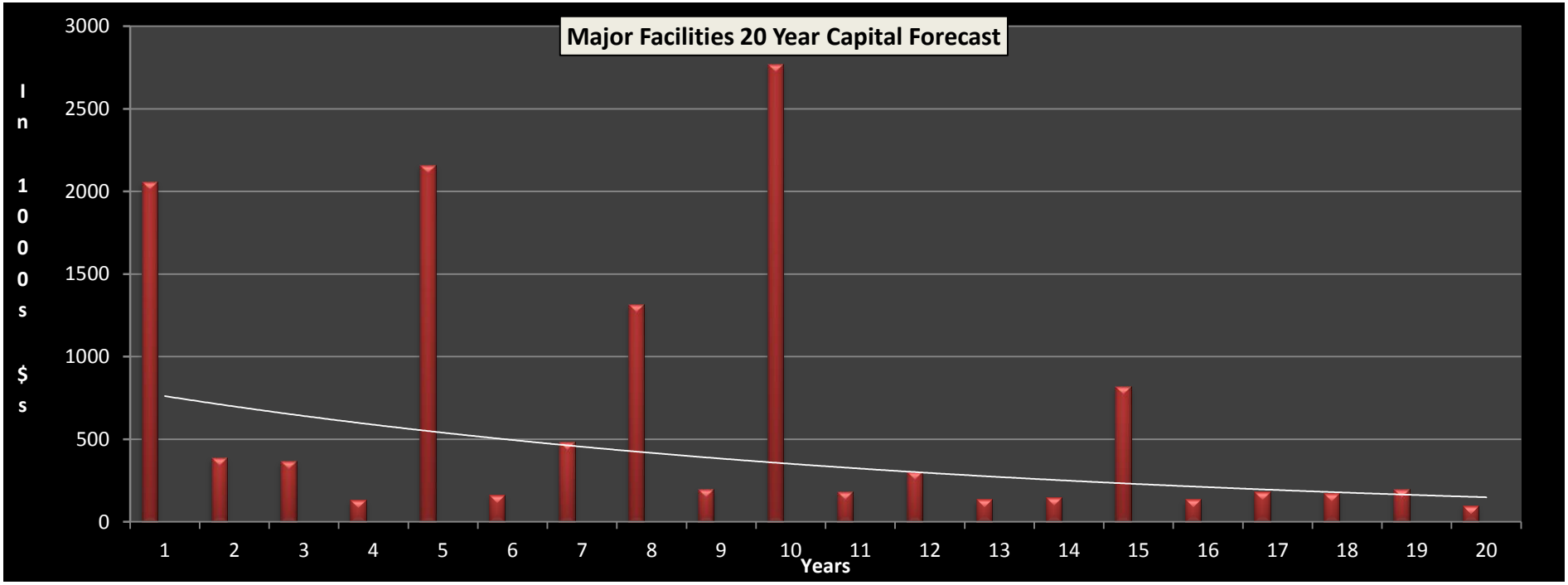
2.2 Major Facilities

A key objective of the building condition assessment report was to create a Capital Forecast Budget for each of the major facilities. For Horizon Utilities, the results call for a long term investment in excess of $12.4 M over the next 20 year period when totaling all four of the locations. (Horizon Headquarters, Stoney Creek Yard, Hamilton, Nebo Yard, and the St. Catharines Office).

Closer examination of the capital expenditures indicates that there are a number of one time expenditure lines in the budgets for costs that are not likely to reoccur. Examples would be fire code upgrades, lighting and electrical upgrades, a ventilation study and upgrades for the lower level of the Head Office building etc. These are elaborated within the sections below.

Table 1 - 20 Year Forecast Major Facilities – in 1.000's

Building	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	total
Hq	956.3	257.6	103.6	73.6	1033.1	91.7	103.1	1197.1	62.6	603.1	40.7	160.6	46.6	69.1	298.1	31.4	55.1	44.1	79.6	37.6	5,345
SC Yrd	351.4	29	123.6	21.6	184.1	10.1	30.6	5	25.6	537.1	45.1	54.6	67.6	15.6	55.6	13.1	5.6	0.6	70.6	0.6	1,647
Ham Yd	443.5	25	129	25	176	20	73	15	15	1153	58	89.5	20	6	207	6	5	66	0	51	2,583
St. Cath	305.6	76.1	12.1	12.1	768.6	40.8	277.8	98.9	95.8	477.1	36.4	0.6	0.6	58	258.6	84.3	114.3	61.8	46.8	5.6	2,832
total	**$ 2,057**	**$ 388**	**$ 368**	**$ 132**	**$ 2,162**	**$ 163**	**$ 485**	**$ 1,316**	**$ 199**	**$ 2,770**	**$ 180**	**$ 305**	**$ 135**	**$ 149**	**$ 819**	**$ 135**	**$ 180**	**$ 173**	**$ 197**	**$ 95**	**$ 12,407**



One of the challenges in developing a capital forecast budget that aligns with the company's strategic business plan, is to flat line expenditures at the same time as keeping priorities in check. We would recommend identifying those areas where life safety issues receive the highest priority and are dealt with in an expeditious manner. A life safety issue can consist of potential for risk, building evacuation, exiting practices and demarcation, fire code violations for door hardware and so on.

Within each of the building condition assessment reports, the excel spreadsheet is capable of being used to sort each individual expenditure with a defined priority. The list of capital expenditures also includes AODA items; AODA expenditures have some discretion and could be re-prioritized to more accurately coincide with either work accommodation requirements or be more in line with the AODA strategy set out by the company to meet the legislation mandate by the year 2025. In the spreadsheets provided, AODA is shown in the first year as it was not in our purview to set these priorities.

HORIZON HEADOFFICE

55 John Street North, Hamilton

Findings

The Horizon Headquarters facility is the main office centre for the Electric Utility located in downtown core of the City of Hamilton. The building's primary use is to provide office and administrative accommodation. There are also some operational activities that are based at this location. The building is approximately 170,000 square feet and dates back to the early and mid -1900's.

According to the information contained in the building condition assessment report, Horizon Utilities will need to invest approximately **$5.344M** in this building asset over the next 20 year period.

Of note in the report are **FIRE AND LIFE SAFETY** related issues which are elaborated on in more depth within the report itself.

- Many areas of the building, especially in the basement areas, require fire stopping for services that pass through a fire rated assembly.

- Requirement to Revise entrances into north and west exit stairwells in order to meet OBC requirements for landings, door swings, hardware and clearances to risers (OBC 3.4.6.11, 3.4.3.4(2), 3.4.6.10 and 3.4.6.3).

- Replace or rate doors and frames which require a fire rating (OBC 3.1.8.4). See section 4 in this report for examples of areas which require rating.

- Add, revise or remove exit signs as outlined in the report to meet OBC requirements for exiting (OBC 3.4.5.1 (2) and 3.3.1.12 (2))

- The fire separation around the generator room needs to be maintained (OBC 3.6.2.8). Currently the door is not rated, there is a gap between the door frame and block wall, and the structural steel did not appear to be rated.

- Floor numbers must be visible at each level of an exit stairwell. Add floor numbers where they currently do not exist (OBC 3.4.6.18).

In addition to fire and life safety in the report is the question of storage and use of the Timber room in the basement area. There are several types of storage occurring in this area, and the `collection area' seems to be accepted as **AN INFORMAL STORAGE/ARCHIVE ROOM AREA**. The Ontario Building and Fire Codes have much stricter requirements than those that exist in the immediate area for this type of use. It was also noted during the site visits that the Stoney Creek Yard has a large amount of informal storage occurring in the vacated area of that facility.

Similarly, in the Stoney Creek Yard report, it is cited that a more formal storage/ archive area needs to be defined. It is therefore recommended in each of the reports that a properly designed **CENTRALIZED ARCHIVE AND ASSET STORAGE AREA** be created at the Stoney Creek Yard/Centre. It would solve the problem of improper use of the space at the Head Office facility at the same time as freeing up some space for other uses. Considerations in the re-design of the space should consider risk management, liability, storage practices, document management policies, security requirements, records management practices and protocols, lighting, material handling, fire safety, fire protection, code compliance. Although this would call for a redesign and repurposing of the space, It is clear that at this time there is no proper or centralized facility for archive or asset storage and the Stoney Creek Yard/Centre would be a good choice.

BUILDING AUTOMATION SYSTEM (BAS)

From the information provided by the Facility Maintainers, Horizon Utilities have a Johnson Medisis system in place at the John Street Headquarters facility that manages the HVAC system and is also extended out to the St. Catharines Office and the Stoney Creek Yard. Within the capital forecast, some funds have been provided to upgrade the software, points on the system and to incorporate any hardware requirements for the development of the Building Automation System. As the Horizon operations are decentralized, it is important to take advantage and to explore the opportunities that can be derived from expanding the BAS. Opportunities include remote access and visibility, energy efficiencies, troubleshooting before dispatching, and making changes in temperature or air flows remotely.

These are all cost saving opportunities. It is further recommended that the development of a visionary plan for this system be completed by the Facilities Management team to determine the future role of the BAS in their operations.

LARGE EXPENDITURES AND IMPACT ON CAPITAL FORECAST

Other line items that stand out in the capital forecast and cause spiking in the total expenditures include:

- Recommendation to review and upgrade the ventilation system in the lower level of the facility; expenditure is shown in 2014 and should be considered a priority. ($100,000)
- Recommendation to upgrade the ventilation system in the facility to a Variable Air Volume System in 2021 ($500,000)
- Numerous electrical upgrades that could be deferred; but lighting and electrical upgrades often have an energy payback associated with them. A more strategic approach should be taken.
- Recommendation to make physical changes to meet the requirement of the fire code; currently out of compliance with stair wells and landings.
- Recommendation to meet AODA ; could be deferred closer to 2025 but still be in compliance.
- Replace exterior windows, ($600,000) 2018; recommend verifying condition closer to replacement timeline.
- Replace brick face ($150,000) 2015; the brick face is in poor condition and should be re-bricked.

ST. CATHARINES OFFICE

340 Vansickle Road

Findings

The St. Catharines Office facility is the most southerly office location for the Electric Utility located in the City of St. Catharines. The building's primary use is to provide a satellite office, repair garage and stores area. There are also maintenance operational activities that are based at this location. The building is approximately 63,367 square feet (gross).

According to the information contained in the building condition assessment report, Horizon Utilities will need to invest approximately **$2.8M** in this building asset over the next 20 year period. During the assessment, the second level of the original building was undergoing renovation and in the demolition stage. Any replacement costs outlined in the report do not include the second floor area.

Most of the items noted in the report are typical lifecycle events. However, there is a requirement to upgrade many of the interior fire separations with fire rated doors; that includes the door, upgrade the frames and door hardware. As a matter of interest, it is possible to engage a consultant to rate the doors and frames with labels assuming they do meet the code requirement. This is especially beneficial when dealing with door frames embedded in concrete block walls.

The same report recommends fire dampers be installed where ductwork penetrates a fire rated assembly. The mechanical engineer also expresses concern that there is not sufficient negative air pressure in the garage area to ensure there is no migration of fumes into the office areas.

There is also a concern for the water damage in the perimeter block walls in the stores area that should be followed up.

Some of the Recommendations in this report for the next twenty year period include the following;

- Post signage on the east side of the parking garage warning workers of vehicle traffic
- Resurface North and East asphalt lots in the next 5 years
- Resurface South and East asphalts parking lots in the next 7 years
- Replace exterior windows of the original building in the next 2 years
- Replace skylights in the next 5 years
- Replace roof hatch in the next 5 years
- Replace carpet flooring throughout both buildings in the next 7 years
- Paint structural ceiling in the garage and stores areas in the next 7 years
- Paint interior block walls throughout both buildings in the next 7 years and every 10 years after
- Paint drywall in the next 7 years.
- Replace interior garage and stores area doors in the next 5 years

- Replace interior doors which require a fire rating and do not currently have one (OBC 3.1.8.4). Doors noted include the door from the meter room into the main hallway, from the meter room into the parking garage, from the change room into the back hallway, from the main hallway into the repair garage and doors leading from the parking garage into the repair garage and stores area.

- Install an exit sign in the change room directing traffic to the back hallway (OBC 3.4.5.1)

- Install manual pull station in the back hallway of the change room (OBC 3.2.4.17)

- Replace exit signs in the stores area with illuminated signs (OBC 3.4.5.1(2))

- Move fire extinguisher in the stores area so that it is located under its sign

- Move fire extinguisher in the call centre so that it is easily accessible

- Fire dampers should be provided at all locations where the duct penetrates a fire-rated enclosure. For example, there is no fire damper on the duct penetrating the wall between the office area and repair garage. As well, there is no fire damper on the duct penetrating the wall between the parking garage and stores area. A detailed study should be completed reviewing drawings, and checking the physical conditions to ensure fire dampers are installed at all the locations where the duct penetrates a fire separation.

- Proper ventilation should be provided to all the rooms to comply with OBC section 6.2.2.1. Outdoor air supplied in the building by ventilation systems shall be not less than the rates required by ASHRAE 62.1 Table 6-1 based on room occupancy category.

- Proper mechanical ventilation systems with proper control should be provided to the repair garage. The Exhaust fan should be controlled by CO/NOx sensors and be in communication with the Building Automation System.

- The mechanical ventilation systems must be designed and balanced to provide air pressure in parking garage and repair garage that is less than the air pressure in the office and storage rooms. The parking garage and repair garage should be ***negative air pressure*** compared to the (positive) air pressure in the office and stores area to prevent air flowing from the parking garage or repair garage into the office area. It is recommended a review of ventilation systems in this area be completed.

- Engine exhaust system should be provided in repair garage to reduce the general exhaust requirement for the repair garage and increase the energy efficiency.

- Perimeter heating or linear diffusers should be provided at the perimeter zone along the large window area.

- The transite pipes (asbestos containing material) on level 2 should be replaced during the ongoing renovation.
- Provide blank-off plates in panels to isolate the panel bussing.
- Provide covers for all junction boxes, pull boxes, etc. that currently do not have these and have exposed wiring.
- Remove material being stored on the transformer in the meter shop.
- Replace all receptacles within 1.5m of a water source with a GFI type receptacle if this type is not currently installed.
- Re-wire the equipment that is permanently supplied with an extension cord in the main Storage Area.
- Remove the disconnected cabling at the entrance gate.
- Replace all exit lights that have tube style lamps with new energy efficient LED types.
- Clean and re-lamp/re-ballast all existing light fixtures that have been recently installed or are not planned to be replaced in the immediate future.
- Replace light fixtures in change room/washroom areas that contain showers with light fixtures that are suitable for damp locations.
- Confirm the operation of the secondary fire alarm annunciator at the Call Center entrance and relocate closer to the main Call Center entrance.
- Provide additional fire alarm annunciation devices to achieve the audibility requirements as per OBC 3.2.4.19. It is suggested that a full building audibility test be conducted by a certified fire alarm system verification company.
- Re-work the fire alarm pull station layouts in the exit corridors to be in accordance with the OBC.

Items that require additional investigation are;

- Further investigation is required to determine the cause of the interior water damage on the block located in the stores area. The investigation may require some lifting of the roof membrane and repair work afterward. The water damage investigation should include details in how to prevent any further water penetration.

- The location and installation of fire extinguishers should be reviewed to meet current Ontario Building Code and Ontario Fire Code.
- Engineering study should be completed to confirm if any flammable material storage cabinet requires increased ventilation.
- Mechanical ventilation systems serving the building should be able to provide (positive air pressure) so that the pressure in parking garage and repair garage is less than the pressure in the office and storage rooms. The parking garage and repair garage should be negative pressure compare to the pressure in the office area and Store to prevent air flowing from parking garage or repair garage to office area.
- Replace or add new electrical panels to address the existing panels throughout the facility that have no available breaker spaces and are potentially at full capacity. Further investigation is required to determine which panels should be replaced and which ones are potentially overloaded.
- Remove the Vector 3000 panel that is part of an old security system. Further investigation is required to determine if this panel is still active.
- Replace all electrical equipment that is deteriorating, damaged or appears to be approaching the end of its serviceable lifetime. This includes receptacles, switches, light fixtures, conduit, wiring, panels, disconnects, etc. Further investigation is required to determine exact equipment that is currently at the end of its lifetime.
- Provide better access to the significant amount of electrical distribution equipment located on a mezzanine level in the Garage. Further investigation is required to determine the best method to gain access to this area.
- Replace all old, inefficient exterior lighting including pole-mounted fixtures and wall-mounted fixtures with new energy efficient types complete with day lighting and timing controls. It is suggested that a full lighting study be complete for the building's exterior areas. The value of $70,000 is a high level value that includes for an engineering study and design, complete removal of all existing lighting including poles, underground conduits and trenching and new pole-mounted fixtures and wall packs located throughout the property.

Additional Comments:

We rate this building as being in ***good condition*** overall. The building has several life safety concerns as noted in the body of the report. Of significance are the fire exiting and fire separation doors, demarcation of exits, location of fire extinguishers and annunciation of fire bells. The condition assessment also indicates there are concerns with respect to the life of the electrical systems inside the building.

NEBO YARD

Nebo Road, Hamilton

Findings

The Nebo Road Service Yard facility was constructed in 1981. The building is used as a storage garage, repair garage and office area and is located in the City of Hamilton. The building is approximately 107,000 gross square feet.

According to the information contained in the building condition assessment report, Horizon Utilities will need to invest approximately **$2.3M** in this building asset over the next 20 year period.

Of note are **FIRE AND LIFE SAFETY** related issues which are elaborated on in more depth within the report itself dealing with exit signage, fire stopping and upgrading the fire alarm annunciation system.

Other items are minor in nature, but include requirement to install cover plates on electrical junction boxes, pull boxes and receptacles.

Some of the Life Safety Recommendations in this report for the next twenty year period include the following;

- Relocate exit sign at the stairs of the second level stores area (OBC 3.4.5.1(2)).
- Add / Revise exit signs around the mezzanine areas (OBC 3.4.5.1 (2)).
- Add signage for visibility of portable extinguishers (Fire Code 6.2.1.5).
- Remove storage on floor in front of eye wash station in stores area to provide a clear path of travel to the station (OH&S Act, S.124).
- Replace doors from repair garage to adjacent rooms with fire rated doors (OBC 3.3.5.5.)
- Replace doors into elevator machine rooms with fire rated doors (OBC 3.5.3.3)
- Fire stop penetrations going into the elevator machine rooms (OBC 3.1.9.1).
- Install guard rail near roof access (OBC 3.3.1.17)

- Replace doors between the stores area and main garage with fire rated doors (OBC 3.3.5.6)
- Replace windows between the stores area and the main garage with properly rated windows (OBC 3.3.5.6)
- Move pull station at the south east door of the repair garage and conduct alarm verification
- Fire dampers should be provided at all locations where the duct penetrating fire-rated enclosure.
- Proper mechanical ventilation systems with proper control should be provided to Main vehicle parking area and Vehicle maintenance shop.
- Mechanical ventilation systems serving the building should be able to provide that the pressure in the Vehicle maintenance shop and Main vehicle parking area is less than the pressure in the office and storage rooms.
- Engine exhaust system should be provided in Vehicle Maintenance Shop to reduce the general exhaust requirement for this area and increase the energy efficiency.
- Provide covers or enclosures so that only authorized staff have access to circuit breakers for the electrical panels in the office areas.
- Provide blank-off plates in panels to isolate the panel bussing.
- Replace the PVC conduit that is located inside the building and does not comply with OESC. Further investigation is required to determine whether the existing conduit meets the flame spread requirements identified in this rule.
- Clean up areas that have excessive storage in front of electrical equipment to ensure adequate space for access.
- Provide covers for all junction boxes, pull boxes, etc., that currently do not have these and have exposed wiring.
- Provide cover plates for all receptacles, switches and other devices.
- Provide additional emergency lighting to meet the minimum luminance requirements of the OBC.
- Disconnect the old fire alarm monitoring panel and have the newer panel fully monitor the building. Relocate the main control panel to the designated main entrance to be used for fire fighters operation. Replace the fire alarm initiation and notification devices at the end of their projected lifetime in approximately 15 years.

- Provide additional fire alarm annunciation devices to achieve the audibility requirements as per OBC 3.2.4.19. It is suggested that a full building audibility test be conducted by a certified fire alarm system verification company. Provide additional fire alarm detection devices in storage rooms and all other areas as required by the OBC.

Items that include additional investigation include;

- The location and installation of fire extinguishers should be reviewed to meet current Ontario Building Code and Ontario Fire Code.
- Engineering study should be completed to confirm ventilation requirements for chemical storage cabinets.
- Mechanical ventilation systems serving the building should be able to provide that the pressure in the Vehicle maintenance shop and Main vehicle parking area is less than the pressure in the office and storage rooms.
- Engine exhaust system should be provided in Vehicle maintenance shop to reduce the general exhaust requirement for this area and increase the energy efficiency.
- Conduct a study to determine which panels should be replaced and which panels are potentially overloaded. (Replace or add new electrical panels to address the existing panels throughout the facility that have no available breaker spaces and potentially at full capacity).
- Replace all electrical equipment that is deteriorating, damaged or appears to be approaching the end of its serviceable lifetime. (This includes receptacles, switches, light fixtures, conduit, wiring, panels, disconnects, etc.) Further investigation is required to determine exact equipment that is currently at the end of its lifetime.
- Replace the PVC conduit that is located inside the building and does not comply with OESC. Further investigation is required to determine whether the existing conduit meets the flame spread requirements identified in this rule.
- Provide additional fire alarm annunciation devices to achieve the audibility requirements as per OBC 3.2.4.19. It is suggested that a full building audibility test be conducted by a certified fire alarm system verification company. Further investigation is required to determine if additional equipment is required. Should the system not meet the requirements of the OBC, there are potentially significant additional costs that could be incurred.

Additional Comments:

We rate this building as being in ***good condition*** overall.

STONEY CREEK YARD
(Hamilton)

Findings
The Stoney Creek Yard is a satellite operations facility located in the City of Hamilton (SC). The building's primary use is to provide office and administrative accommodation, a parking garage and stores facility. There are also some operational maintenance activities that are based at this location. The building is approximately 36,412 square feet.

According to the information contained in the building condition assessment report, Horizon Utilities will need to invest approximately **$1.7M** in this building asset over the next 20 year period.

The findings of this assessment discovered three abandoned in ground storage tanks along the front elevation of the property; the lids were not properly fastened or secured to the tank's substrate. The recommendation in the report is to remove the tanks to perminantly eliminate the risk.

The Stoney Creek Yard presents an ideal opportunity to create a newly designed storage facility for records retention and the storage of furniture and equipment assets. It is recommended that proper standards and storage facilities would resolve the improper storage of equipment in the Head Office and resolve the compliance issue with the fire code and building code for both facilities.

Other items include fire stopping penetrations in the generator room walls, and balancing the ventilation systems to ensure there is negative air pressure in the garage parking areas.

In addition, the report recommends extending the building automation system to be more active in the Stoney Creek yard for the purpose of remotely controlling the centre and taking advantage of any energy efficiencies in its operation.

Some of the Recommendations in this report for the next twenty year period include the following;

- Decommission and remove the three in ground abandon tanks along the front elevation to the building. This presents a very high risk to Horizon Utilities. **We strongly recommend** removal for life safety and due diligence purposes.
- Replace main entrance concrete walkway in the next 5 years
- Caulk windows seals
- Replace sloped brick under windows in the next year
- Reseal exterior foundation wall
- Replace skylights in the next 3 years.
- Replace vinyl tile flooring in the next 5 years
- Reseal concrete floors in the garage and stores area in the next 7 years and every 10 years after
- Replace the 2x4 suspended acoustic ceiling tiles in the west portion of the building in the next 7 years and in the east portion of the building in the next 3 years.
- Paint drywall ceilings in the next 3 years and every 10 years after
- Paint drywall walls in the next 3 years and every 10 years after.
- Repaint block walls in the next 7 years
- Replace exterior door providing access to the roof in the next 2 years.
- Replace exit sign in the meeting room in the west area of the building (OBC 3.4.5.1(2)).
- Replace door hardware on the door leading from the **current** archive room to the main lobby (OBC 3.4.6.12 and OBC 3.4.6.15(1)). Immediately.
- Replace doors into the generator room (OBC 3.6.2.8) immediately.

- Fire stop penetrations through the generator room walls (OBC 3.1.9.1) immediately
- Fix the door between the office area and parking garage which currently does not fully shut (OBC 3.1.8.4) immediately.
- Replace double doors between the parking garage and stores area (OBC 3.1.8.4 and OBC 3.4.6.12). immediately
- Replace door into the electrical room (OBC 3.1.8.4). immediately
- Remove storage from electrical room (OBC 3.6.1.3) immediately
- Proper ventilation should be provided to all the rooms to comply with OBC section 6.2.2.1. Outdoor air supplied in the building by ventilation systems shall be not less than the rates required by ASHRAE 62.1 Table 6-1 based on room occupancy category.
- Mechanical ventilation systems serving the building should be balanced to provide negative air pressure in parking garage and positive air pressure in the parking garage to prevent air flowing from the parking garage into adjacent spaces.
- The Building Automation System at 55 John Street should be extended to the Stoney Creek Yard to provide remote access, control and monitoring of the control systems in Stoney Creek; i.e. ventilation rates, equipment on / off notifications, energy efficiency and so on.

- The main electrical distribution equipment visually appears to be in acceptable condition; however, it is recommended that a certified electrical contractor be retained to perform a detailed inspection of this equipment. No concerns were raised by the Horizon representative regarding the age of the equipment, however, some of the equipment may be approaching the end of its serviceable lifetime as it may be 30+ years old. It is assumed that the equipment has 10 years of functional life remaining.
- Replace or add new electrical panels to address the existing panels throughout the facility that have no available breaker spaces. These panels are potentially at full capacity or are approaching the end of their useful lifetime. Further investigation is required to determine which panels should be replaced and which ones are potentially overloaded.
- Provide labels for all equipment that is not currently labeled. This includes receptacles, telecom pull boxes, conduits, junction boxes, etc.
- Provide coverplates for all receptacles, switches and other devices.
- Ensure that all receptacles and similar devices in office areas are secured to the walls to which they are mounted to.

- Remove the exposed wiring in the kitchenette under the vanity or enclose in a suitable junction box.
- Remove the public address system in the boardroom area that is no longer in use.
- Clean up the extension cords and power bars that have been run across the floors in the boardroom area. Consider adding additional receptacles in strategic locations to address this issue.
- Replace all receptacles within 1.5m of a water source with a GFI type receptacle if this type is not currently installed.
- Remove the junction box and conduit that is directly over the sink in the kitchenette.
- Provide covers for all junction boxes, pull boxes, etc. that currently do not have these and have exposed wiring.
- Provide caps or covers for unused conduits.
- Enclose the overhead door wiring in conduit or junction box.
- Clean up the disorganized and cluttered telecom distribution equipment.
- Repair damaged conduits on the east side of the building.
- Remove the abandoned wiring and junction boxes adjacent to the site sign.
- Provide damp-location certified light fixtures in the washroom/change room area that contains showering facilities and are subject to significant moisture.
- Fill the gap between the fire alarm annunciator and the wall that it is secured to. Determine the use of the low-voltage junction box and LED indicators that are adjacent to the annunciator. Further investigation is required to determine the exact use of the junction box and LED indicators.
- Provide additional fire alarm annunciation devices to achieve the audibility requirements as per OBC 3.2.4.19. It is suggested that a full building audibility test be conducted by a certified fire alarm system verification company. Further investigation is required to determine if additional equipment is required. Should the system not meet the requirements of the OBC, there are potentially significant additional costs that could be incurred.

Items that require additional investigation are;

- Further study required to determine if proper exiting is currently achieved in the stores area.

- A study of the room currently used as an archive room should be completed to determine the extent of work required to change the room from an office use to a storage area. It is not acceptable to leave the room(s) in this condition.

- The location and installation of portable fire extinguishers should be reviewed to meet current Ontario Building Code and Ontario Fire Code.

- Mechanical ventilation systems serving the building should be able to provide Positive Air pressure in the office and stores areas and Negative air pressure in the parking garage to ensure there is no flow of air from the parking areas to the office areas.

- The quantity of diesel stored in the tanks should be confirmed that it is not more than the maximum quantity allowed in the building by Ontario Fire Code 4.2.4. Outdoor storage tank is required if the quantity stored in the building is more than the maximum quantity allowed.

- Replace or add new electrical panels to address the existing panels throughout the facility that have no available breaker spaces, are potentially at full capacity or are approaching the end of their usable lifetime. Further investigation is required to determine which panels should be replaced and which ones are potentially overloaded.

- Replace all electrical equipment that is deteriorating, damaged or appears to be approaching the end of its serviceable lifetime. This includes receptacles, switches, light fixtures, conduit, wiring, panels, disconnects, etc. Further investigation is required to determine exact equipment that is currently at the end of its lifetime.

- Provide additional fire alarm annunciation devices to achieve the audibility requirements as per OBC 3.2.4.19. It is suggested that a full building audibility test be conducted by a certified fire alarm system verification company. Further investigation is required to determine if additional equipment is required. Should the system not meet the requirements of the OBC, there are potentially significant additional costs that could be incurred.

Additional Comments:

We rate this building as being in ***good condition*** overall. The building has several life safety concerns as noted in the body of the report. Of significance are the fire exiting, rated doors, repurposed use of the office area for archival storage and hardware and fire extinguishers. We encourage Horizon Utilities to highlight all life safety issues in this report and act on these areas first.

2.3 Substation Facilities

FINDINGS

Part of the terms of reference of the building condition assessment was to conduct a review of 23 substations to evaluate the architectural, structural, electrical and mechanical disciplines of each facility. The findings of the condition assessments were all very similar at each of the sites. The substations are on average between 1,500 and 2,500 gross square feet in size; some with a basement level and some without.

The capital forecast indicates that the expected investment over the next 20 years will total over $2.8 million for all substations. On average that is $143K per year.

The transformer bays were similar with a metal blast wall on at least one elevation enclosing the sites. One item that was consistent in the report was the requirement for Horizon Utilities to revisit their security measures for each of the sites and determine standards for signage and fencing. It is our opinion that the sites are lacking in terms of adequate signage, and that the Corporation should provide some direction in this area. Further most of the locations require some landscape maintnace as well as the trimming back of vines trees and schrubbery.

We are **very stronglying recommending** that Horizon Utilities consult with their insurer or internal risk management people to develop standard security measures especially for electrical substations. Those standards should include controlling access onto the site, fencing standards (e.g. barbed wire or none, height of fencing), wording and types of signage and amount of signage in a given distance along the perimeter for each site.

It was also noticed that there are two street addresses posted on some of the substations, and that many of the substations are identified differently. We recommend that a signage standard be adopted for the identification of Horizon Utility properties and in particular electrical substations.

With regard to **battery storage and charging rooms;** the Ontario Building Code is somewhat vague in this area. This is of some concern as the storage, handling and charging of batteries can present some hazardous conditions such as fire or explosion. In particular, we note that some of the substations with battery charging rooms have a fire rated assembly separating the area from the rest of the building that includes walls and doors, while other sites do not.

We recommend that Horizon Utilities create and set a design standard *in excess of what the Ontario Building Code stipulates*. That design standard might include a 45 minute fire rated separation for a rated door and frame with positive latch, door closer, rated wall assembly and warning signage on the exterior of the door.

The Ontario Electrical Code and the [4]ASHRAE standard stipulate ventilation rates for battery charging rooms. In our reports, we note that not all substations meet this requirement and that regular maintenance of the ventilation systems should also be provided.

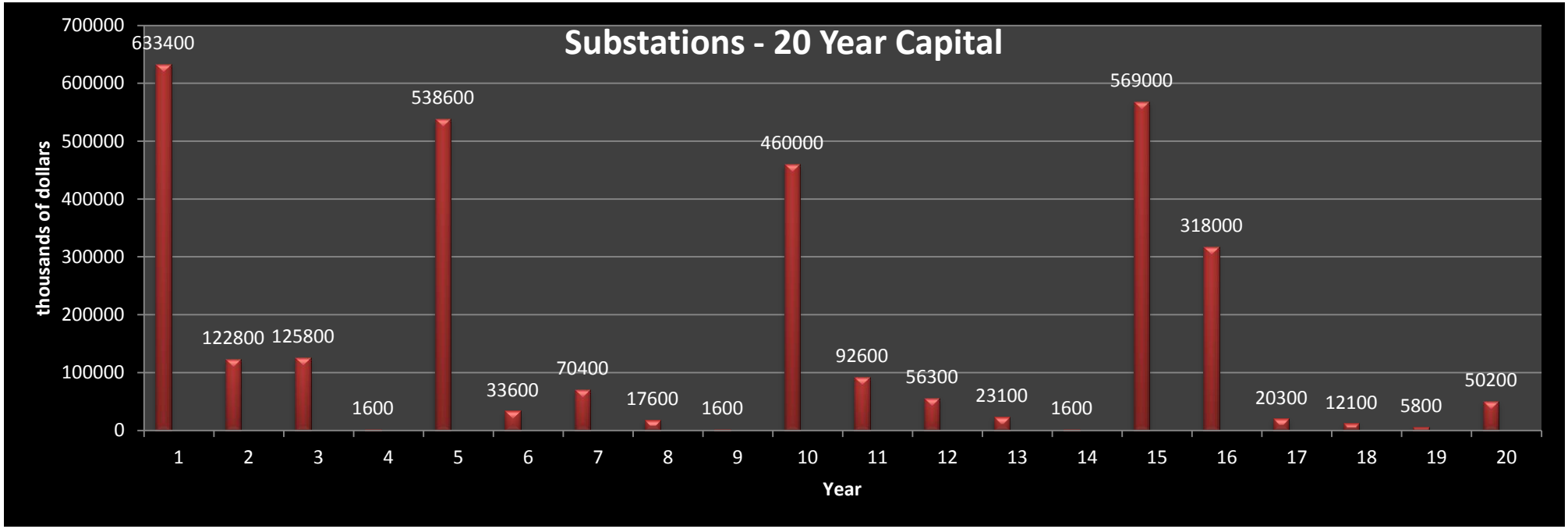
On the subject of **eyewash stations;** some of the Substations only had the *bottle station* which does not meet the 15 minute flushing time required. The bottles can only be used in conjunction with a proper eyewash or deluge shower station. Portable eye wash stations were also found in some sites which do meet the flushing time. However, with portable eyewash stations, the solution must be monitored and replaced regularly. Fixed/plumbed eye wash stations are the recommended option if the water is available. This is an area that should be reviewed more closely by Horizon's Health and Safety Department.

Most of the Substations appear to be having some difficulties with ***Landscape Maintenance***. It was noted during the assessments that most of the properties do not maintain their grounds to a standard that is representative of the neighboring properties. Most grounds were full of weeds, void of grass, untrimmed, overgrown with trees and vines on the fence lines and generally in poor condition. We submit that this is an area where Horizon can improve its image in the community.

In the area of maintenance and preventative maintenance, the inventory equipment listing in this report can be used as a start up for the asset information system that Horizon Utilities is currently running. From this data base, preventative maintenance tasks can be developed and initiated. As an example, if the coils on the electric heaters in the substations were vacuumed each year, it would stop the staining from the burning dust above the units on the walls.

[4] *ASHRAE – American Society of Heating Refrigeration and Air Conditioning Engineers*

Stations	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	total
Aberdeen,	30000	16200	200	200	20300	700	200	200	200	18300	4200	5200	200	200	31700	700	200	200	200	1400	130700
Bartonville,	37200	18400	1500	0	3500	2000	5000	12000	0	5500	2000	0	1500	0	13500	2000	0	4000	0	3200	111300
Caroline,	20600	6000	2500	0	23400	500	0	0	0	32900	500	6000	2500	0	22700	500	0	0	0	1200	119300
Central,	25700	3200	200	200	22200	2200	5400	200	200	17000	2200	3200	200	200	26200	2200	5400	200	200	2900	119400
Cope,	35100	0	16000	0	3700	2000	0	0	0	21400	3500	0	1000	0	28200	2000	0	2500	0	1200	116600
Eastmount	24200	1300	9000	0	28500	500	0	0	0	17900	2600	1000	3000	0	33000	500	0	0	0	2000	123500
Elmwood,	38000	19500	0	0	16300	500	2100	0	0	14200	500	0	0	0	25900	500	0	0	0	1200	118700
Highland,	32300	4000	4000	0	7000	2000	4000	0	0	1500	2000	4000	0	0	17600	2000	0	0	0	1500	81900
Hughson,	61700	0	8000	0	23000	0	2000	0	0	26000	43000	0	4000	0	26600	0	0	0	4200	0	198500
Kenilworth	23500	2200	21700	200	4200	2200	2200	200	200	26900	4700	200	200	200	25700	2200	200	200	200	3100	120400
Mohawk,	32000	7700	200	200	19700	2200	5200	200	200	28200	2200	7400	200	200	50000	2200	5200	200	200	2400	166000
Mountain,	22500	3000	4000	0	17500	500	5000	0	0	18800	500	0	0	0	32100	500	0	0	0	5200	109600
Ottawa,	12750	200	200	200	39000	2200	3200	200	200	27200	700	200	200	200	22700	700	200	200	200	1400	112050
Parkdale,	22900	0	17000	0	22300	500	4000	0	0	9900	3500	0	2000	0	22700	500	0	0	0	1200	106500
Spadina,	30200	0	6500	0	35500	2000	0	0	0	22800	2000	0	7500	0	25500	500	1500	0	0	1200	135200
Strouds Lane,	16200	5000	0	0	35300	2000	14500	2000	0	7000	2000	7500	0	0	17000	2000	0	2000	0	1200	113700
Whitney,	22000	3000	9000	0	27300	500	4000	0	0	9700	500	3000	0	0	13300	500	4000	0	0	1200	98000
Wellington	38600	6200	10200	200	88200	700	10200	2200	200	47000	700	6200	200	200	58200	1900	3200	2200	200	15400	292100
Wentworth,	16550	200	4200	200	35400	2200	200	200	200	39600	2200	200	200	200	27700	2200	200	200	200	1400	133650
Grantham,	26200	2700	11400	200	21300	2700	200	200	200	7700	2700	200	200	200	17600	2700	200	200	200	200	97200
Taylor,	23400	0	0	0	11000	1500	3000	0	0	18500	6400	0	0	0	1500	1500	0	0	0	1700	68500
Vine,	21300	7000	0	0	32000	2000	0	0	0	10100	2000	3000	0	0	14000	2000	0	0	0	0	93400
Welland,	20500	17000	0	0	2000	2000	0	0	0	31900	2000	9000	0	0	15600	2000	0	0	0	0	102000
Totals	**633400**	**122800**	**125800**	**1600**	**538600**	**33600**	**70400**	**17600**	**1600**	**460000**	**92600**	**56300**	**23100**	**1600**	**569000**	**31800**	**20300**	**12100**	**5800**	**50200**	**2868200**



Finally any reference to the assessment should be taken directly from the individual reports. These are only excerpts from the assessments for convenience purposes.

APPENDIX A – 20 CAPITAL FORECAST ALL FACILITIES

Notes:

Appendix L – Horizon Utilities Physical Security Report

This report in its entirety is being filed confidentially.

Appendix M – Horizon Utilities Head Office Window Assessment

MMM Group Limited



Horizon Utilities Head Office

Window Assessment

Prepared for: Horizon Utilities
Month Year | Jan 2014

MMM GROUP

EXECUTIVE SUMMARY

MMM Group Ltd. was contracted by Horizon Utilities to assess the current state of the windows and evaluate upgrade options for their head office in Hamilton, Ontario. A site visit was conducted to visually inspect the windows and obtain information about the buildings systems to be used for the energy model. An air leakage test of three different windows was conducted in accordance with the test methods of ASTM E783-02 *"Standard Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors".* The results of these tests were then used in the energy model to determine the energy loss through air leakage of the existing windows.

The results show that the existing operable windows in the John St. office tower require attention as they have revealed excessive air leakage and heat loss through the assembly. Remediation options prove to yield reasonable returns on the investment; however given the age of the windows, it may not be short enough to put off the replacement of the windows. The best investment for replacement windows is in a mix of operable and fixed windows with fiberglass frames and high performance glazing (low-e (Solarban 60), argon filled, and warm-edge spacers). It is also recommended that any operable windows use an awning operator as it comes with slightly better efficiencies and is more durable than a double hung window.

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1.0 EVALUATION OF EXISTING WINDOWS

Our investigation of the existing windows was conducted through visual inspection, air leakage testing and building energy simulations.

1.1 AIR LEAKAGE TEST

During the site inspection, it was noted that in many cases the double hung windows that comprise of the majority of the glazed openings in the building were in need of repair or replacement. The main issue was found to be that the pile weather stripping was loose, degraded and in some cases missing. The lack of weather stripping was made evident through the air leakage tests conducted in December 2013. In both operable windows (Window 2 and Window 3) tested, the required pressure drop to conduct the test (75 Pa) was not possible to maintain. The airflow for those windows had to be calculated at 30 Pa for a pro-rated pressure differential of 75 Pa. These calculations demonstrate air leakage rates that are much higher than the maximum allowable air leakage rates for operable windows under the National Fenestration Rating Council's (NFRC) rating system. NFRC allows 1.5 L/s/m^2 (A2 classification – minimum code requirement) while the existing windows' infiltration sits close to 15 L/s/$m^{2.}$ Test methodology, results and calculations can be found in Appendix A – Air Leakage Test Results.

1.2 ENERGY MODEL

To show the impact of the air leakage through the existing windows on the utility bills, it was necessary to create an energy model of the facility. Information on the buildings systems was obtain through visual inspection and from drawings provided to us. The results of the aforementioned test were used in the model and expressed as a "Crack Length Co-efficient" in the base building. The model shows that there is a peak savings in infiltration of over 100 kW (400 kbtu/hr) by meeting the maximum allowable air leakage for an A2 rating in the NFRC's system. High infiltration and lack of low-e, argon or warm-edge spacers will result in energy loss and occupant discomfort. The existing windows have been estimated to have a total U value of 4 W/m^2-C$^\circ$ (See Appendix B – Energy Model Baseline Assumptions for details on the base building model inputs).

2.0 EVALUATION OF WINDOW UPGRADES

Our evaluation of the existing windows draws to the conclusion that the condition of the operable windows in the John St. office building are poor and require remediation or replacement in order to reduce energy costs and to maintain the comfort of the occupants who work close to the perimeter of the building. Windows in the garage were not investigated due to the low window to wall ratio and low heating set points and existing fixed windows in the Hughson Tower and John St. site have also been excluded as the air leakage tests show they are performing as expected and do not require attention at this time.

2.1 REMEDIATION OPTIONS

We looked at two options for repairing the existing windows. The first option is to replace the weather stripping of the existing windows and restoring them to a state where they meet the maximum allowable infiltration rate of an A2 classified window. This measure will help to ensure that any drafts felt by occupants will be kept to a minimum, however, the lack of low-e coating on the existing windows can create a draft like feeling as the surface of the glass is cold and radiates towards the occupants who work along the perimeter. The second remediation measure is to apply a film to the interior of the windows that provides a modest low-e insulating effect.

Our energy model shows that when both of these measures are coupled together, the payback period is only 6 years with a modest annual cost savings of $8,000 (weatherisation being the larger contributor). The window U value goes down slightly to 3.54 W/m^2-C˚.

2.2 REPLACEMENT OPTIONS

While remediation proves to have a reasonable payback, the existing operable windows are ~20 years old and are close to reaching their life expectancy. Unfortunately the simple payback on investing in replacement windows is long, however, there are some benefits that are not quantifiable that should be considered when reviewing the results of the replacement options. Window replacement can allow for more natural light to enter work spaces by selecting a low or no tint option which can improve the occupant productivity and reduce down time related to seasonal depression and illness. The issues surrounding the perceived comfort of occupants are addressed as low-e coating technology has come a long way since the early 1990's and offer more thermal protection from extreme ambient temperature swings and temperature differences between inside and out. Replacing windows may also preserve the life of room furnishings as they can block some of the UV rays that can fade furniture and carpets.

We looked at several different options for window replacements, including fiberglass frames vs. aluminum, operable vs. fixed windows and a mix of operable and fixed glazing units for each framing system.

Appendix C – Window Improvement Options contains the simulation results and various options explored. The capital costs for the window replacements were obtained through local suppliers and include labour, material and demolition of existing windows. Simple pay back has been shown as it compares with the base building. The second payback calculation assumes that window replacement has already been established and therefore it is reasonable to show the payback from a new baseline that includes the planned window upgrade and all measures below are compared back to that. We assumed that the replacement windows would be identical to the existing windows (mainly single and side by side double hung windows). This column demonstrates that flexibility in design can save money and utility costs in that fixed windows are less expensive and yield better efficiencies than operable windows as it demonstrates that capital and energy savings that can be achieved by allowing 50% of the windows to be fixed as well as if 100% of the windows are fixed. While operable windows give the occupants more local control to maintain their own comfort, they can prove to be detrimental to the heating and cooling costs of the building due to occupant behaviour (leaving windows open at night) and degradation over time. Operable windows also have slightly higher U values than their fixed counterparts due to the additional framing that surrounds the movable sections. Double hung windows have the highest of frame to glass ratios

and therefore suggest using an awning type operator in lieu of the double hung. The advantages of the awning operator is that it is more durable and will maintain air tightness for longer as there is less surface area subject to friction from movement and the seals are compressed, they are safer to occupants and generally easier to operate, while being slightly more efficient than other operable systems. See Figure 2-1 for proposed operable strategy.

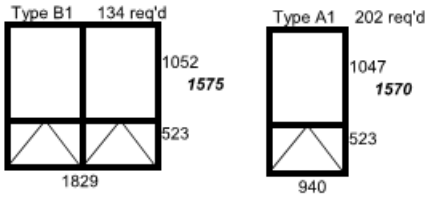


Figure 2-1 Proposed Awning Operable Window

Because the windows are mostly punched windows, this building is an ideal candidate to use fiberglass frames. The incremental cost is between $2-6/SF[1] above the same window with aluminum frames. Fiberglass frames are less conductive and therefore yield a much lower overall U value than an aluminum window with the same glazing components. With the exception of upgrading to a fiberglass system that contains 100% operable windows, all of the fiberglass measures have 0 payback as compared to the assumed new baseline (measure 4a – double hung, aluminum windows with low-e (Solarban 60), argon filled gaps and warm-edge spacers) and have lower paybacks even when compared back to the original base building with existing windows still in place. The energy cost savings outweighs the small incremental cost for the upgrade.

[1] Costs range depending on interior and exterior finishes chosen (premium for metallic look, etc.)

3.0 CONCLUSION

Our investigation into condition of the existing windows at the Horizon Utilities Ltd. headquarters has proven that there is a need for the operable windows to be attended to. While remediation shows a reasonable return on investment, the payback period may exceed the time in which the windows must be replaced. Replacement options are shown to have very long payback periods however (which is consistent with our experience when replacing existing double glazed windows), allowing for fixed windows to replace some or all of the operable windows the payback is drastically reduced and the benefits to the occupants will be realized immediately.

As the window may be replaced regardless, we have also calculated paybacks that are based on the incremental energy cost savings and installation cost over a selected baseline window. As the baseline window is an operable window, equivalent sized inoperable windows are typically less expensive, and have a lower U-value, thus greater savings. In such cases we have indicated the payback as immediate in relation to the baseline window.

APPENDIX A. AIR LEAKAGE TEST RESULTS

Intertek

TEST REPORT

REPORT NUMBER: 101436639TOR-002
ISSUE DATE: December 13, 2013

EVALUATION CENTER

Intertek Testing Services Ltd.
6225 Kenway Drive
Mississauga, Ontario L5T 2L3

RENDERED TO

MMM Group Ltd.
582 Lancaster Street
Kitchener, Ontario N2K 1M3

PRODUCT EVALUATED
3 Windows

EVALUATION PROPERTY
Air Leakage

LOCATION
Horizon Utilities Building – Hamilton, Ontario

Report of air leakage testing for MMM Group Ltd. on three windows in various locations at the Horizon Utilities Building in Hamilton, Ontario conducted in accordance with test methods outlined in ASTM 783-02 (R2010)

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2 Introduction

Intertek has conducted air leakage testing on three windows at the Horizon Utilities Building in Hamilton, Ontario. Testing was conducted in accordance with the test methods outlined in ASTM E783-02 (Reapproved 2010), "*Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors*". The windows were tested at a pressure differential of 75 Pa.

Testing was conducted on December 3, 2013.

3 Test Specimen and Assembly Description

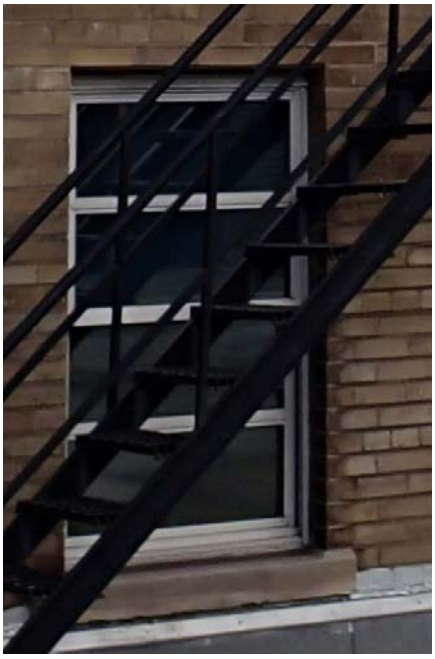
The Horizon Utilities Building is located at 55 John Street N., Hamilton, Ontario

Window 1 - Composite window consisting of 6 fixed vision lites

LOCATION	- First Floor, West Side, South-facing, adjacent to men's washroom.
TYPE	- Composite aluminum windows consisting of 6 vision lites.
OVERALL SIZE	- 1562 mm wide by 2616 mm high.
CONDITION	- Decent condition.
FRAMING	- Extruded aluminum frame.
GLAZING	- Laid-in, dual pane, glazed from the interior.
PERIMETER CAULKING	- There were no cracks in perimeter caulking .



Window 2 - Combination window consisting of 2 double hung windows		
LOCATION	- Second floor, east side, south facing, end of hallway adjacent server room.	
TYPE	- Combination window consisting of two mulled double hung windows.	
OVERALL SIZE	- 1829 mm wide by 1575 mm high.	
CONDITION	- Decrepit condition. Pile weatherstrip was loose, missing or degraded. Window sashes still operated.	
FRAMING	Extruded aluminum frame. Individual double hung windows were joined together.	
GLAZING	- Laid-in, glazed from the interior.	
PERIMETER CAULKING	- Decent condition. There were no cracks in perimeter caulking.	

Window 3 - Double hung window		
LOCATION	- Second floor, east side, south facing, server room.	
TYPE	- Double hung window.	
OVERALL SIZE	- 940 mm wide by 1575 mm high.	
CONDITION	- Decrepit condition. Pile weatherstrip was loose, missing or degraded. - Window sashes still operated.	
FRAMING	Extruded aluminum frame. Individual double hung windows were joined together.	
GLAZING	- Laid-in, glazed from the interior.	
PERIMETER CAULKING	- Decent condition. There were no cracks in perimeter caulking .	

4 Testing and Evaluation Methods

The Air Leakage test was conducted in accordance with the test methods of ASTM E783-02 (Reapproved 2010), "*Standard Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors*".

Prior to measuring air leakage, each operable sash was opened and closed five times.

4.1 CONSTRUCTION OF THE INTERIOR TEST CHAMBER

A clear polyethylene sheet was sealed to the interior wall creating a chamber. Roller blinds were installed on the interior side of the double hung windows (Windows 2 and 3). For the purpose of the air leakage test, the roller blinds were not removed and were incorporated into the interior test chamber.

4.2 EXTRANEOUS LEAKAGE

The exterior of the window is sealed with a clear plastic sheet to preclude the possibility of air passage through the window. Air is then evacuated from the interior test chamber and the volume of airflow is monitored. This allows for the determination of extraneous leakage of the chamber at the required test pressure differential.

Due to lack of accessibility, the extraneous leakage of Window 1 was not determined. The air leakage value reported for Window 1 included extraneous leakage. The chamber was sealed against the frame to minimize extraneous leakage as well as the window was in good condition. Hence, the extraneous leakage was deemed to be negligible.

4.3 AIR LEAKAGE TEST

The exterior plastic is then removed and the air within the interior chamber is again evacuated and new flow rate is measured at the desired pressure differential. The differences in the flow rates required to maintain the test pressure differential is attributed to *leakage* through the window. This allows for the derivation of the air leakage rate. The air leakage was measured at a pressure differential setpoint of 75 Pa and evaluated.

4.3.1 Deviation from the Standard Test Method

Once the exterior bag was removed for Window 2, a pressure differential of 75 Pa could not be achieved. A lower pressure was obtained. The air flow for that window had to be calculated at 30 Pa for a pro-rated pressure differential of 75 Pa. Refer to Appendix B for the calculation to obtain a pro-rated air flow at 75 Pa pressure differential.

5 Testing and Evaluation Results

5.1 AIR LEAKAGE RESULTS

Window 1 - Composite window consisting of 6 vision lites – first floor, west side, south facing

Test Pressure Differential	Window Area	Crack Length	Gross Air Leakage Measured	Gross Air Leakage Rate (per area)	Gross Air Leakage Rate (per crack length)
75 Pa Infiltration	4.09 m²	18.19 m	1.20 L/s	0.29 L/s·m²	0.07 L/s·m
75 Pa Exfiltration			1.14 L/s	0.28 L/s·m²	0.06 L/s·m²

Window 2 - Combination window consisting of 2 double hung windows – second floor, east side, south facing

Test Pressure Differential	Window Area	Crack Length	Air Leakage Measured[1]	Air Leakage Rate (per area)	Air Leakage Rate (per crack length)
75 Pa Infiltration	2.88 m²	11.10 m	42.8 L/s	14.9 L/s·m²	3.86 L/s·m
75 Pa Exfiltration			38.5 L/s	13.4 L/s·m²	3.47 L/s·m²

Window 3 - Double hung window – second floor, east side, south facing

Test Pressure Differential	Window Area	Crack Length	Air Leakage Measured	Air Leakage Rate (per area)	Air Leakage Rate (per crack length)
75 Pa Infiltration	1.48 m²	5.55 m	22.9 L/s	15.5 L/s·m²	4.13 L/s·m
75 Pa Exfiltration			18.4 L/s	12.4 L/s·m²	3.32 L/s·m²

A complete set of data sheets is included in Appendix A.

[1] Air Leakage corrected to 75 Pa . Refer to Appendix C

6 Conclusion

Intertek conducted air leakage testing on three windows at the Horizon Utilities Building in Hamilton, Ontario in accordance with the test methods outlined in ASTM E783-02 (Reapproved 2010), "*Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors*" at a pressure differential of 75 Pa. Results are report only and recorded herein.

INTERTEK

Tested and
Reported by: _____
Claudio Sacilotto,P.Eng
Senior Project Engineer, Building Products

Reviewed by: _____
Robert Giona
Manager, Building Products

7 Appendix A: Datasheets

Datasheets

(3 pages)

ASTM E783 Test Data

Client: MMMGroup
Project # G101436639
Date: 03-Dec-13
Standard: ASTM E783-02 (R2010)
Location: First Floor West Side adjacent men's washroom (Composite window consisting of 6 fixed lites)

Reviewed: V. Jones
Technicians: C. Sacilotto

Equipment:

	ID #	Cal Due
Schlegel Apparatus	280-01-0008	-
Fluke Airflow meter	20170392	Mar. 4/14
Magnehelic Manometer:	280-01-0904	Feb. 7/14
Meriam Laminar Flow Element	280-01-0171	Oct. 11/14
Thermometer/Barometer:	273-01-1165	Mar. 5/14

LFE Flow Coefficients	
b =	13.62489
c =	-0.04553512

Test: INFILTRATION

AT FLOW METER

Plate Mask Condition	Chamber Pressure Pa	Delta P (in H2O)	Inlet Temp (F)	Absolute Pressure (mbar)	Temp Correction Factor	Pressure Correction Factor	Viscosity Correction Factor	Gross Leakage (SCFM)	Gross Leakage corrected to 75 Pa (SCFM)	Gross Leakage (Sm^3/hr)	Gross Leakage (SL/s)
masked	75	0.000	61.3	996	1.0167	0.9830	1.0129	0.00	0.00	0.00	0.00
unmasked	75	0.185	61.3	996	1.0167	0.9830	1.0129	2.55	2.55	4.33	1.20
								NET	2.55	4.33	1.20

	width	height	Area	
imperial (in)	61.50	103.00	43.99	ft^2
metric (m)	1.562	2.616	4.09	m^2

Crack Length

Member	Qty	width	Crack Length	
horizontal	12	28.25	59.67	ft
vertical	4	94.250	18.19	m

	cfm	m^3/hr	L/s
Unit Leakage	2.550	4.333	1.204
	cfm/ft^2	$(m^3/hr)/m^2$	$L/s*m^2$
Leakage rate/area	0.058	1.060	0.294

	cfm	m^3/hr	L/s
Unit Leakage	2.550	4.333	1.204
	cfm/ft	$(m^3/hr)/m$	L/s*m
Leakage rate/area	0.043	0.238	0.066

Test: EXFILTRATION

AT FLOW METER

Plate Mask Condition	Chamber Pressure Pa	Delta P (in H2O)	Inlet Temp (F)	Absolute Pressure (mbar)	Temp Correction Factor	Pressure Correction Factor	Viscosity Correction Factor	Gross Leakage (SCFM)	Gross Leakage corrected to 75 Pa (SCFM)	Gross Leakage (Sm^3/hr)	Gross Leakage (SL/s)
masked	75	0.000	61.4	996	1.0165	0.9830	1.0127	0.00	0.00	0.00	0.00
unmasked	75	0.175	61.4	996	1.0165	0.9830	1.0127	2.41	2.41	4.10	1.14
								NET	2.41	4.10	1.14

	width	height	Area	
imperial (in)	61.50	103.00	43.99	ft^2
metric (m)	1.562	2.616	4.09	m^2

Crack Length

Member	Qty	width	Crack Length	
horizontal	12	28.25	59.67	ft
vertical	4	94.250	18.19	m

	cfm	m^3/hr	L/s
Unit Leakage	2.412	4.097	1.138
	cfm/ft^2	$(m^3/hr)/m^2$	$L/s*m^2$
Leakage rate/area	0.055	1.003	0.278

	cfm	m^3/hr	L/s
Unit Leakage	2.412	4.097	1.138
	cfm/ft	$(m^3/hr)/m$	L/s*m
Leakage rate/area	0.040	0.225	0.063

ASTM E783 Test Data

Client: MMMGroup
Project # G101436639
Date: 03-Dec-13
Standard: ASTM E783-02 (R2010)
Location: Hallway adjacent to Server Room (Combination set of two Double Hung Aluminum Windows)

Reviewed: V. Jones
Technicians: C. Sacilotto

Equipment:

	ID #	Cal Due
Schlegel Apparatus	280-01-0008	-
Fluke Airflow meter	20170392	Mar. 4/14
Magnehelic Manometer:	280-01-0904	Feb. 7/14
Meriam Laminar Flow Element	280-01-0171	Oct. 11/14
Thermometer/Barometer:	273-01-1165	Mar. 5/14

LFE Flow Coefficients	
b =	13.62489
c =	-0.045535120

Test: INFILTRATION — AT FLOW METER

Plate Mask Condition	Chamber Pressure Pa	Delta P (in H2O)	Inlet Temp (F)	Absolute Pressure (mbar)	Temp Correction Factor	Pressure Correction Factor	Viscosity Correction Factor	Gross Leakage (SCFM)	Gross Leakage corrected to 75 Pa (SCFM)	Gross Leakage (Sm³/hr)	Gross Leakage (SL/s)
masked	75	2.980	69.0	995	1.0019	0.9820	1.0015	39.61	39.61	67.29	18.69
unmasked	30	5.349	63.9	996	1.0117	0.9830	1.0090	71.82	130.29	221.36	61.49
							NET		90.68	154.07	42.80

	width	height	Area	
imperial (in)	72.00	62.00	31.00	ft²
metric (m)	1.829	1.575	2.88	m²

Crack Length

Member	Qty	width	Crack Length	
horizontal	6	33.50	36.42	ft
vertical	8	29.500	11.10	m

	cfm	m³/hr	L/s
Unit Leakage	90.683	154.071	42.798
	cfm/ft²	(m³/hr)/m²	L/s*m²
Leakage rate/area	2.925	53.497	14.860

	cfm	m³/hr	L/s
Unit Leakage	90.683	154.071	42.798
	cfm/ft	(m³/hr)/m	L/s*m
Leakage rate/area	2.490	13.881	3.856

Test: EXFILTRATION — AT FLOW METER

Plate Mask Condition	Chamber Pressure Pa	Delta P (in H2O)	Inlet Temp (F)	Absolute Pressure (mbar)	Temp Correction Factor	Pressure Correction Factor	Viscosity Correction Factor	Gross Leakage (SCFM)	Gross Leakage corrected to 75 Pa (SCFM)	Gross Leakage (Sm³/hr)	Gross Leakage (SL/s)
masked	50	3.253	75.0	995	0.9906	0.9820	0.9928	42.34	55.11	93.63	26.01
unmasked	10	2.853	77.8	996	0.9855	0.9830	0.9888	36.88	136.64	232.15	64.49
							NET		81.53	138.52	38.48

	width	height	Area	
imperial (in)	72.00	62.00	31.00	ft²
metric (m)	1.829	1.575	2.88	m²

Crack Length

Member	Qty	width	Crack Length	
horizontal	6	33.50	36.42	ft
vertical	8	29.500	11.10	m

	cfm	m³/hr	L/s
Unit Leakage	81.530	138.520	38.478
	cfm/ft²	(m³/hr)/m²	L/s*m²
Leakage rate/area	2.630	48.097	13.360

	cfm	m³/hr	L/s
Unit Leakage	81.530	138.520	38.478
	cfm/ft	(m³/hr)/m	L/s*m
Leakage rate/area	2.239	12.480	3.467

Intertek

ASTM E783 Test Data

Client: MMMGroup
Project # G101436639
Date: 03-Dec-13
Standard: ASTM E783-02 (R2010)
Location: Server Room (Double Hung Aluminum Window)
Equipment:

	ID #	Cal Due
Schlegel Apparatus	280-01-0008	-
Fluke Airflow meter	20170392	Mar. 4/14
Magnehelic Manometer:	280-01-0904	Feb. 7/14
Meriam Laminar Flow Element	280-01-0171	Oct. 11/14
Thermometer/Barometer:	273-01-1165	Mar. 5/14

Reviewed: V. Jones
Technicians: C. Sacilotto

LFE Flow Coefficients	
b =	13.62489
c =	-0.04553512

Test: INFILTRATION — AT FLOW METER

Plate Mask Condition	Chamber Pressure Pa	Delta P (in H2O)	Inlet Temp (F)	Absolute Pressure (mbar)	Temp Correction Factor	Pressure Correction Factor	Viscosity Correction Factor	Gross Leakage (SCFM)	Gross Leakage corrected to 75 Pa (SCFM)	Gross Leakage (Sm^3/hr)	Gross Leakage (SL/s)
masked	75	0.441	64.0	996	1.0115	0.9830	1.0088	6.02	6.02	10.22	2.84
unmasked	75	3.971	58.2	996	1.0228	0.9830	1.0176	54.62	54.62	92.80	25.78
								NET	48.60	82.58	22.94

	width	height	Area	
imperial (in)	37.00	62.00	15.93	ft^2
metric (m)	0.940	1.575	1.48	m^2

Crack Length				
Member	Qty	width	Crack Length	
horizontal	3	33.50	18.21	ft
vertical	4	29.500	5.55	m

	cfm	m^3/hr	L/s
Unit Leakage	48.602	82.576	22.938
	cfm/ft^2	$(m^3/hr)/m^2$	$L/s*m^2$
Leakage rate/area	3.051	55.794	15.498

	cfm	m^3/hr	L/s
Unit Leakage	48.602	82.576	22.938
	cfm/ft	$(m^3/hr)/m$	L/s*m
Leakage rate/area	2.669	14.879	4.133

Test: EXFILTRATION — AT FLOW METER

Plate Mask Condition	Chamber Pressure Pa	Delta P (in H2O)	Inlet Temp (F)	Absolute Pressure (mbar)	Temp Correction Factor	Pressure Correction Factor	Viscosity Correction Factor	Gross Leakage (SCFM)	Gross Leakage corrected to 75 Pa (SCFM)	Gross Leakage (Sm^3/hr)	Gross Leakage (SL/s)
masked	75	0.891	68.0	996	1.0038	0.9830	1.0029	11.98	11.98	20.35	5.65
unmasked	75	3.989	80.0	996	0.9815	0.9830	0.9857	51.00	51.00	86.64	24.07
								NET	39.02	66.29	18.41

	width	height	Area	
imperial (in)	37.00	62.00	15.93	ft^2
metric (m)	0.940	1.575	1.48	m^2

Crack Length				
Member	Qty	width	Crack Length	
horizontal	3	33.50	18.21	ft
vertical	4	29.500	5.55	m

	cfm	m^3/hr	L/s
Unit Leakage	39.018	66.292	18.415
	cfm/ft^2	$(m^3/hr)/m^2$	$L/s*m^2$
Leakage rate/area	2.449	44.792	12.442

	cfm	m^3/hr	L/s
Unit Leakage	39.018	66.292	18.415
	cfm/ft	$(m^3/hr)/m$	L/s*m
Leakage rate/area	2.143	11.945	3.318

8 Appendix B: Calculation of Air Flow at a Different Pressure Differential

$$Q_{75}/Q_y = [\Delta p_{75}/ \Delta p_y]^n \quad (8.1)$$

Where,

Q_{75} Air Flow at 75 Pa (in L/s)

Q_y Calculated air flow at y Pa pressure differential Pa (in L/s)

Δp_{75} Pressure differential of 75 Pa

Δp_y Pressure differential of y Pa

n flow coefficient. A value of n=0.65 represents many cases of window leakage (8.2)

from equation (7.1) above

$Q_{75} = [\Delta p_{75}/ \Delta p_y]^n \times Q_y$

$Q_{75} = [75/ \Delta p_y]^{0.65} \times Q_y$

For example

Determine air flow at 75 Pa, if air flow was measured at 30 Pa

Air Flow at 30 Pa was measured to be 71.82 L/s

$Q_{75} = [75/ \Delta p_{30}]^{0.65} \times Q_{30}$

$= [75/ 30]^{0.65} \times 71.82$

$= [75/ 30]^{0.65} \times Q_{30}$

$= 1.814 \times 71.82$

$= 130.3$ L/s

8.1 Hutcheon, N.B., Handegord, G.O.P, NRC-CNRC, Building Science for a Cold Climate, pp. 264, (NRCC 1985)

and

Shaw, C.Y. A method for predicting air infiltration rates for a tall building surrounded by lower structures of uniform height./ *ASHRAE Transactions*, 1979, *85*, (Part 1), pp. 72-84. (NRCC 18029)

8.2 Hutcheon, N.B., Handegord, G.O.P, NRC-CNRC, Building Science for a Cold Climate, pp. 264, (NRCC 1985)

9 Appendix C: Photographs



Photo 1. Exterior view of Window 1 (circled in red)



Photo 2. Interior view of Window 1



Photo 3. Exterior view of Window 2 (circled in red) and Window 3 (circled in dashed green)



Photo 4. Interior view of Window 3



Photo 5. Exterior view of Window 2 and Window 3 bagged on the exterior (bagged in order to calculate extraneous leakage)



Photo 6. Interior view of Window 3



Photo 7. Interior view of Window 3 being tested for air leakage

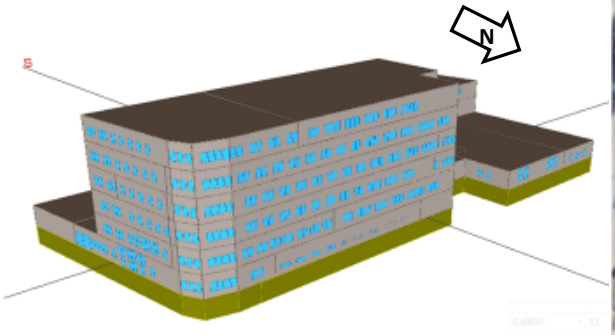
10 Revision Page

Revision No.	Date	Changes	Author	Reviewer
0	December 13, 2013	First issue	Claudio Sacilotto	Robert Giona

END OF DOCUMENT

APPENDIX B. ENERGY MODEL BASELINE ASSUMPTIONS

Model Inputs - Architectural Systems





Window to Wall Ratio

Orientation	Total
North	21%
North-East	22%
East	13%
South-East	13%
South	21%
South-West	25%
West	8%
Overall	**19%**

Building Plan

Building Section	Space Use Category	Area (ft²)	% of Total	Flr-to-Flr (ft)	Flr-to-Clg (ft)
Office	Office, Lobby	114,400	80%	12.5	9.0
Conference & Meeting Rooms	Lobby, Conference/Meeting	5,700	4%	12.5	9.0
Control Centre	Office (24/7)	5,700	4%	12.5	9.0
Parking	Active Storage, Bulky	5,700	4%	14.5	14.5
Maintenance Garage	Active Storage, Bulky	4,300	3%	30.0	30.0
Storage	Active Storage, Fine	4,300	3%	12.5	9.0
Lobby	Lobby, Conference/Meeting	2,900	2%	16.5	16.5
Total		**143,000**			

Building Envelope

Exposed walls, floors, roofs, and opaque doors:

Construction	Description (structure, insulation, air barrier)	R-Nom. (IP)	R-Value (IP)	Area (ft²)	% of Total Env.
Walls	4" Brick wall (w/clading); air spc; 12" brick/block, plaster	5	5.00	40000	45%
Roof	3" rigid insulation	15	15.00	40000	45%
	Total opaque, exposed surfaces:		**10.00**	**80,000**	**90%**

Windows and glass doors:

Window	Description (coating, fill, framing)	T-vis (%)	SHGC (%)	U-Value (IP)	Area (ft²)	% of Total Env.
Type 1 & 2 (existing windows from 1990's)	CoG: 2-gl, 13mm air, tint film	81%	76%	0.57		
	Total: Alum, dbl hung, alum. Spacer	35%	36%	0.76	7,600	9%
Garage windows (original single pane)	CoG: single pane glass (~1/2" thick)	N/A	90%	0.88		
	Total: Metal framed, awning operator	70%	33%	0.96	300	0%
All other windows (non operable)	CoG: 2-gl, 13mm air, tint film	47%	47%	0.48		
	Total: Alum. fx, 3mm tb, alum. Spacer	43%	43%	0.65	1,000	1%
	Total glazed surfaces:	**37%**	**37%**	**0.75**	**8,874**	**10%**

Notes:
"R-Nominal" is for insulating layers only.
"R-Vlaue" includes the effect of thermal bridging.

	U-value (Btu/hr-ft²-°F)	Area (ft²)	Heat Trans. (kBtu/hr-°F)
Net Envelope:	**9.1**	**88,900**	**807**

Assumptions - Mechanical Systems

Delivery Systems

System	Serving	Description (type, strategy, controls)	Sizing (htg)		Sizing (clg)
AHU-1	4th & 5th Floor	Constant volume hot deck/cold deck system; perimeter radiant htg HW loop supplies heat and preheat coils; CW loop supplies clg coil Steam humidification RH min 30% max 34% Cycle fans to maintain unoccupied setbacks; OA damper position min. 10%; 100% outdoor air economizer dual temperature control; SAT reset = zone reset Supply fan; 2 spd air-foil TSP = 3.5"; FanEff = 50%; MotorEff = 90% Return fan:; 2 spd air-foil TSP = 2.0", FanEff = 30% MotorEff = 90%	13,000 cfm 2.7 W/cfm 536 MBH **Sizing (pre-ht)**	Fan Pw Cap Cap	22,000 cfm 1.6 W/cfm 684 MBH 423 MBH
AHU-2	Bsmt, 1st & 2nd Floor (East)	Constant volume hot deck/cold deck system; perimeter radiant htg HW loop supplies heat and preheat coils; CW loop supplies clg coil Steam humidification RH min 30% max 34% Cycle fans to maintain unoccupied setbacks; OA damper position min. 10%; 100% outdoor air economizer dual temperature control; SAT reset = zone reset Supply fan; 2 spd air-foil TSP = 3.5"; FanEff = 50%; MotorEff = 90% Return fan:; 2 spd air-foil TSP = 2.0", FanEff = 30% MotorEff = 90%	8,000 cfm 2.8 W/cfm 259 MBH **Sizing (pre-ht)**	Fan Pw Cap Cap	13,000 cfm 1.7 W/cfm 420 MBH 352 MBH
AHU-3	2nd (West) & 3rd Floors	Constant volume hot deck/cold deck system; perimeter radiant htg HW loop supplies heat and preheat coils; CW loop supplies clg coil Steam humidification RH min 30% max 34% Cycle fans to maintain unoccupied setbacks; OA damper position min. 10%; 100% outdoor air economizer dual temperature control; SAT reset = zone reset Supply fan; 2 spd air-foil TSP = 3.5"; FanEff = 50%; MotorEff = 90% Return fan:; 2 spd air-foil TSP = 2.0", FanEff = 30% MotorEff = 90%	8,000 cfm 2.8 W/cfm 259 MBH **Sizing (pre-ht)**	Fan Pw Cap Cap	13,000 cfm 1.7 W/cfm 684 MBH 352 MBH
AHU-4	Hughson Tower	Constant volume system; perimeter radiant htg HW loop supplies htg coils; CW loop supplies clg coil Steam humidification RH min 30% max 34% Cycle fans to maintain unoccupied setbacks; OA damper position min. 10%; 100% outdoor air economizer dual temperature control Supply fan; 2 spd air-foil TSP = 3.0"; FanEff = 40%; MotorEff = 85% Return fan:; 2 spd air-foil TSP = 1.0", FanEff = 25% MotorEff = 85%	4,800 cfm 1.5 W/cfm 182 MBH	Fan Pw Cap	4,800 cfm 1.5 W/cfm 150 MBH
AHU-6	1st Floor (back office)	Constant volume hot deck/cold deck system; perimeter radiant htg HW loop supplies heat and preheat coils; CW loop supplies clg coil Steam humidification RH min 30% max 34% Cycle fans to maintain unoccupied setbacks; OA damper position min. 10%; 100% outdoor air economizer dual temperature control; SAT reset = zone reset Supply fan; 2 spd air-foil TSP = 3.5"; FanEff = 50%; MotorEff = 90% Return fan:; 2 spd air-foil TSP = 2.0", FanEff = 30% MotorEff = 90%	???? cfm 20 HP Sup ??? MBH **Sizing (pre-ht)**	Fan Pw Cap Cap	???? cfm 10 HP Ret ??? MBH ??? MBH
RTU-1 thru 6	6th Floor	DX single zone sytems (4 & 5 serve occupied space - remaining serve shell space), perimeter radiant htg Gas fired burner - 80% thermal efficiency DX coil - EER 9.0 Supply fan - 2.0" w.g.; combined eff - 50%	9 EER 80% %Eff-p	Fan Cool Heat	???? cfm n/a ton
Garage & Maintenance	Parking Garage	Exhaust Fan interlocked with OA damper to provide ventilation to parking area; controlled with multiple CO sensors located within space. Unit heaters to provide gas heating to 46F. - Run 1 - 2 hours per day. - Fan eff. = 1.0 W/cfm		Fan Cool Heat	???? cfm n/a ton 700 MBH

Distribution Loops

System	Serving	Description (type, strategy, controls)	Efficiency		Sizing
Hot Water Loop	Heating Coils and Radiators	Two (2) constant volume pumps. Head: 70 ft. Impeller Efficiency: 85% Motor Efficiency: 68% Temperature Setpoint: 170°F (ΔT = 30°F)	37 W/gpm	Flow	200 gpm
Chilled Water Loop	Cooling Coils	Two (2) constant volume pumps. Head: 70 ft. Impeller Efficiency: 85% Motor Efficiency: 72% Temperature Setpoint: 45°F (ΔT = 10°F)	17 W/gpm	Flow	420 gpm
Condensor Water Loop	Cooling Tower & Chillers	Two (2) constant volume pumps. Head: 75 ft. Impeller Efficiency: 85% Motor Efficiency: 71%	20 W/gpm	Flow	540 gpm

Plant Equipment

System	Serving	Description (type, strategy, controls)	Efficiency		Sizing
Boilers	HW Loop	Four atmospheric boilers each size to 850 MBH Setpoints (supply/return): 170°F / 140°F	85 %EFF-p	Heat	850 MBH
Chillers	CHW Loop	Two rotary chiller each size to 85.3 tons Setpoints (supply/return): 45°F / 55°F	5.2 COP-p	Cool	85 ton
Cooling Tower	Condensor Loop	One closed-loop cooling tower c/w constant volume fans.	28 W/gpm	Flow	540 gpm

Assumptions - Electrical Systems

Interior Lighting

Serving	Description (fixture, strategy, controls)	Area (ft²)	Eff. (W/ft²)	
Offices, Meeting & Lobby	Fixture: 3 - T8 lamp fixtures Automatic Controls: locally dimmable, peak shaving control, daylight harvesting and occupancy sensors LPD based on ASHRAE 2001 Office Bldg type.	128,700	1.30 1.04	Installed Controlled
Garage, Maintenance, Storage and M&E	Fixture: ??? Automatic Controls: None	14,300	0.80 0.80	Installed Controlled

Total Interior Lighting, Installed: 1.3 W/ft²

Total Interior Lighting, Controlled: 1.0 W/ft²

Plug Loads

Serving	Description	Peak (kW)	Density (W/ft²)
Entire Building	Default MNECB plug loads	n/a	0.5
Entire Building	Elevators = 1,049 kWh/yaer	n/a	0.002
Entire Building	PA / IT / Security	5 kW	0.09
Exterior	Snow and ice melt; melting or idling 2,100 hours/year	24 kW	0.1

Assumptions - Site Conditions

Utility Rate Information

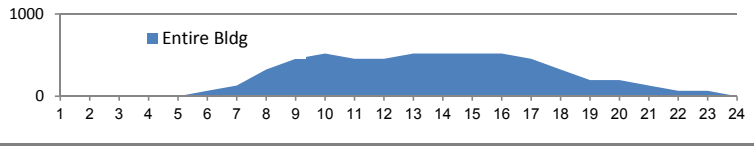
Utility Type	Provider	Rate Schedule	Consumption		Demand	
Electricity	Horizon	Yearly average (2013)	$0.11	per kWh	n/a	per kW
Natural gas	Union Gas	Yearly average (2013)	$0.22	per m³		

Heating and Cooling Setpoints

Area	Heating (°F)		Cooling (°F)		Humidity (%RH)		Notes
	Occ.	Unocc.	Occ.	Unocc.	Min.	Max.	
Office, lobby & meeting	72	70	75	77	30%	34%	
Parking	50	50	50	50	0%	100%	
Mech. Rooms	65	65	-	-	0%	100%	

Occupancy Schedules

Area	Typical Daily Maximum %	Peak Occupancy
Entire Bldg	80%	650
Total Peak Occupancy:		**650**



APPENDIX C. WINDOW IMPROVEMENT OPTIONS

Window Study

Horizon Utilities Head Office

Hamilton, Ontario

Window Improvement Options

	Upgrade	Energy Cost ($)			Energy Intensity (ekWh/m²)			GHG Emissions (tonnes, CO2e)			Increm. Capital Cost	Simple Payback	Simple Payback*	Capital Cost Assumptions
		Total	Δ	%	Total	Δ	%	Total	Δ	%	$	years	years	
0	Base Building	$272,162	-	-	343	-	-	3,245	-	-	-	-		
	Remediation Options													
1	Replace weather stripping	$265,447	$ (6,715)	+2.5%	327	-16	+4.7%	3,103	-142	###	$52,500	8		$7/SF labour and materials
2	Add low-e film to int. surf.	$271,235	$ (927)	+0.3%	341	-2	+0.6%	3,228	-17	###	$37,500	40		$5/SF labour and materials
3	Apply both remediation measures	$264,371	$ (7,791)	+2.9%	325	-18	+5.3%	3,083	-162	###	$45,000	6		$6/SF labour and materials**
	Replacement Options													
4a	Base replacement	$261,788	$ (10,374)	+3.8%	317	-26	+7.5%	3017	-228	###	$525,000	83	0	$115/SF labour and materials
4b	4a + fiberglass frames	$259,777	$ (12,385)	+4.6%	310	-33	+9.6%	2,955	-291	###	$540,000	71	7	$117/SF labour and materials
4c	4b + 50% fixed	$259,572	$ (12,590)	+4.6%	309	-34	+9.8%	2949	-297	###	$450,000	61	0	$100/SF labour and materials
5a	Use fixed units for all Type 2 replacements	$261,032	$ (11,130)	+4.1%	315	-28	+8.3%	2996	-250	###	$420,000	67	0	$95/SF labour and material
5b	5a + triple glazed IGU	$260,389	$ (11,773)	+4.3%	312	-31	+8.9%	2,976	-270	###	$525,000	76	27	$120/SF labour and materials
6a	4a + no operable windows	$259,973	$ (12,189)	+4.5%	311	-32	+9.4%	2,960	-285	###	$412,500	59	0	$96/SF labour and materials
6b	6a + fiberglass frames	$256,856	$ (15,306)	+5.6%	307	-36	####	2924	-321	###	$427,500	48	0	$98/SF labour and material

**Simple payback over lowest cost replacement option 6a.*

***Discount available if the same GC does both remedial options at the same time*

Notes:

4a Base replacement option = high performance alum. dbl hung window, with Low-e (Solarban60), argon filled gaps, warm-edge spacers (at $2-$4 SF for awning operators 1/3 from bottom)

5a Type 2 windows consist of 2 double hung units - appear on their own and within bands of windows on North exposure (6'x5')

-Values shown with 0 payback has no incremental cost from base replacement option 4a (i.e. less capital cost; greater cost savings).

Appendix N – Horizon Utilities Corporation – 55 John St. North, Hamilton – Roof Inspection Review – Fall 2013

Garland Canada Inc.

Roof Asset Management Program

Horizon Utilities Corporation - 55 John St. North, Hamilton - Roof Inspection Review - Fall 2013

Prepared By
Bryce Cheeseman

Prepared For
Reva McCann

November 19, 2013

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Client Data

Client: Horizon Utilities Corporation

Client Data

Name	Horizon Utilities Corporation		
Address 1	55 John Street North	**Address 2**	-
City	Hamilton	**Province**	ON
Postal	L8R 3M8	**Country**	Canada

Contact Info

Contact Person	Reva McCann	**Title**	Commodity Management Specialist
Mobile Phone:	-	**Office Phone:**	(905)521-4916
Email:	reva.mccann@horizonutilities.com		

Facility Summary

Client: Horizon Utilities Corporation

Facility: 55 John Street North - Hamilton



Facility Data

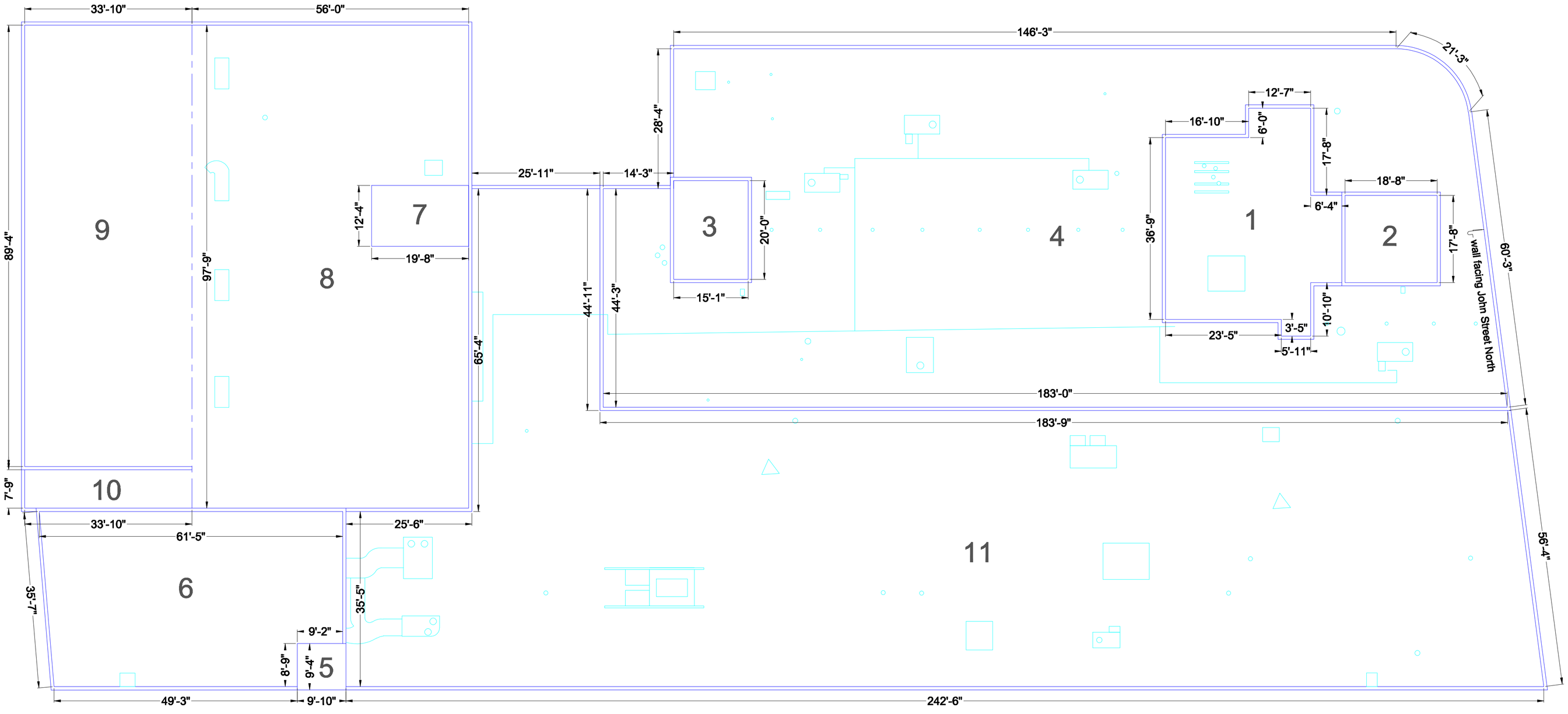
Address 1	55 John Street North
Address 2	-
City	Hamilton
Province	ON
Postal	L8R 3M8
Type of Facility	Commercial
Square Footage	37,366
Contact Person	Reva McCann

Notes

55 John St, Hamilton, is the Head Office for Horizon Utilities.
It is a 37,000 sq ft facilitly, made up of 11 roof sections.
There are 3 main building areas, the tower, the parking garage and the Hughson Substation.

Roof Sections

Name	Date Installed	Square Footage	Roof Access
Roof Area 11	1999	14,248	Penthouse
Roof Areas 1,2,3,4	1999	12,146	Penthouse
Roof Areas 5,6,7,8,9,10	1999	10,971	Penthouse



ROOF AREA (SQ. FT.)

Section 1	=	1287 sq.ft.
Section 2	=	329 sq.ft.
Section 3	=	302 sq.ft.
Section 4	=	10384 sq.ft.
Section 5	=	92 sq.ft.
Section 6	=	2044 sq.ft.
Section 7	=	242 sq.ft.
Section 8	=	5232 sq.ft.
Section 9	=	3023 sq.ft.
Section 10	=	263 sq.ft.
Section 11	=	13985 sq.ft.
Total	=	37183 sq.ft.

LEGEND

- AREAS WITH STEEL CATWALK
- AREAS WITH BARE AND/OR BLOWN FELTS
- AREAS WITH VEGETATION GROWTH
- AREAS WITH DEBRIS

ROOF PROJECTIONS

- ANTENNA
- BREATHER
- CAPPED STACK
- CHANGE IN ELEV.
- CHIMNEY
- CONDUIT LINE
- CONTROL JOINT
- DRAIN
- EXHAUST FAN ON CURB
- EXPANSION JOINT
- EXPLOSION HATCH
- FLAGPOLE
- FENCE
- GOOSENECK VENT
- GOOSENECK VENT ON OVERSIZED CURB
- HATCH
- HVAC UNIT
- HVAC UNIT ON CURB
- HVAC UNIT ON SLEEPERS
- LADDER
- LIGHT POST
- PIPE SUPPORT
- PITCH POCKET
- PLUMBING OR SOIL STACK
- RA ROOF ANCHOR
- SATELLITE DISH
- SCUPPER
- SECURITY CAMERA
- SKYLIGHT
- SLOPE
- SQUARE VENT
- SQUARE VENT ON ON OVERSIZED CURB
- TALL CONE OR "B" VENT
- TALL CONE OR "B" VENT ON CURB
- UNUSED OPENING
- WALKWAY PADS

NOTE: THE ROOFING CONTRACTOR SHALL BE RESPONSIBLE FOR SITE VERIFICATION OF ALL ROOF MEASUREMENTS

Garland Canada Inc.
209 Carrier Drive
Toronto, ON M9W 5Y8
Phone: 416-747-7995

TITLE: ROOF PLAN

CLIENT:

PROJECT: Sections 1 to 11
55 John St. North, Hamilton
ON L8R 3M8, Canada

IRC #

W.O. #

SCALE: 1" : 13'-0"

DATE: 15 NOVEMBER 2013

DRN. BY:

CHK. BY:

NORTH

DWG. #

Construction Details

Client: Horizon Utilities Corporation

Facility: 55 John Street North - Hamilton

Roof Section: Roof Areas 1,2,3,4

Roof Info

Year Installed	1999	**Square Footage**	12,146
Slope Dimension	.5/12	**Roof Height**	80
Roof Access	Penthouse	**System Type**	Modified Bitumen
		Contractor	Spinton Roofing Frank Francella 1800368-8441 (Office) (905)971-3493 (Mobile) Frank@spintonroofing.com

Roof Assembly

Roof #	Layer Type	Description	Attachement	R-Value	Insulation Thickness
1	Deck	Metal Deck	Mechanically attached	-	-
1	Vapor Retarder	Asphalt/Felt	Spot Mopped	-	-
1	Insulation	Polyisocyanurate	Mechanically attached	12	2
1	Protection Mat	No-Woven Fabric	Hot asphalt	-	-
1	Membrane	Mod Bit - 2 ply	Torch applied	-	-

Details

Perimeter Detail	Parapet Wall
Flashing Material	Modified Membrane
Drain System	Internal Roof Drains
Parapet Wall	Pre-Cast Concrete
Coping Cap	Stone

Notes

This Roof Section includes the roof tower and the 3 penthouse roofs associated with the tower.



Inspection Report

Client: Horizon Utilities Corporation

Facility: 55 John Street North - Hamilton

Report Date: 09/12/2013

Roof Section: Roof Areas 1,2,3,4

Inspection Information

Inspection Date	09/12/2013	**Core Data**	Yes
Inspection Type	Core Analysis	**Leakage**	Yes
Deck Conditions	Excellent		

Flashing Conditions

Perimeter	Good	**Wall**	Good
Projections	Good	**Counterflashing**	N/A

Miscellaneous Details

Reglets	Good	**Debris**	No
Control Expansion Joints	N/A	**Ponding Water**	Minor
Parapet Wall	Good	**Coping Joints**	Excellent

Perimeter

Rating	Good
Condition	The parapet wall is in good condition. The coping stone is holding up very well. The membrane running up the parapet wall is in good condition.

Field

Rating	Good
Condition	The field membrane is in good condition. The roof system is 14 years old and is holding up fairly well. The 2 ply modified roof membrane holds some water from ponding. The roof has slope from tapered insulation, however, there are areas where water ponds. Ponding is where water will sit on a flat roof for more than 48 hours after rainfall.The roof system is asphalt based and asphalt will disolve in water over time. The water will deteriorate the membrane over time. There are a few small blisters on the roof area. Blisters are caused when air and/or air vapour is trapped within the system. The air will expand and contract with temperature change and deteriorate the strength of the roof system.

Penetrations

Rating	Fair
Condition	The flashing membrane is deteriorating at some of the projections. The flashing membrane has come apart at some of the flashing seams of the mechanical units. There have been some leaks at the flashing membrane.

Drainage

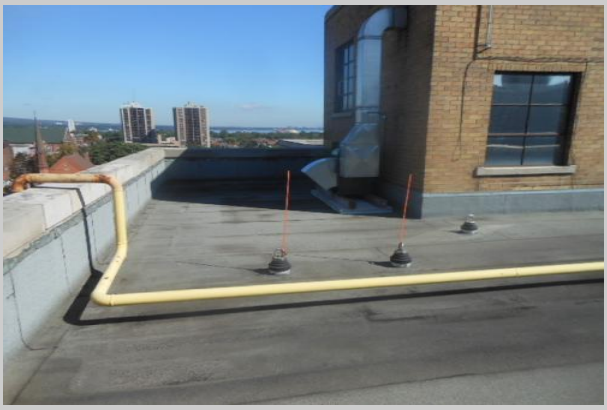
Rating	Fair
Condition	The insulation has been installed to create slope to the drains. However, the roof holds water after heavy rain and snow. The ponding water is starting to deteriorate the roof system.

Other

Rating	Poor
Condition	The walls on this upper roof section (The Tower) are in poor condition. The walls are taking on water through heavy and driving rain, and have no way to drain out, other than into the building. The mourtar of the brick wall is deteriorating and the walls and mourtar is cracking. The windows are also in very poor condition. The windows are very old and many of these windows are leaking. Many of them are not needed and provide no significant light to the facility.

Overall

Rating	Good
Condition	The roof system is 14 years old and we are starting to see signs of deterioration. The membrane is holding up, but because of ponding water, high winds and other elements, the roof membrane is starting to degranulate and lose its strength and UV resistance.



View by the penthouse where the membrane is darker from ponding water.



View of section 4 looking towards the east.



View of core cut reveals 2" polyisocyanurate, 1/8" separation sheet and 2 plies of modified membrane



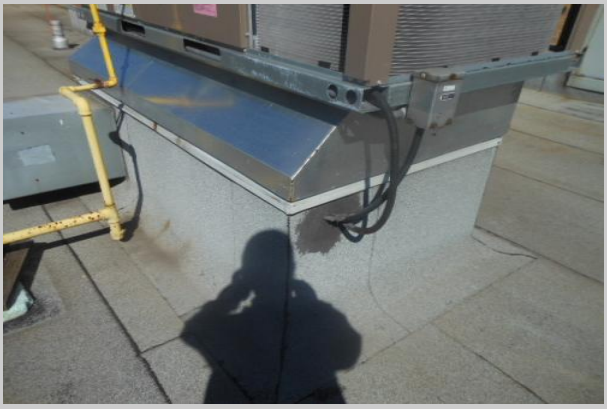
View of brick wall which has been repaired temporarily in the past.



More brick work attempted repairs.



View of the southside of section 4 facing west.



The electrical should normally be run into a separate tall cone, but may have been done based on the concrete deck. This mastic should be aluminized and will always be a maintenance item.



These walls are in very poor shape and should be protected better with new cladding, stucco or a coating.



View of the east side of section 4 where an exaggerated cricket/saddle was installed to help with the drainage.



More signs of mortar repairs in the brickwork.



View of the northside of section 4 where a small area was already replaced recently (note lighter grey patch along the perimeter)



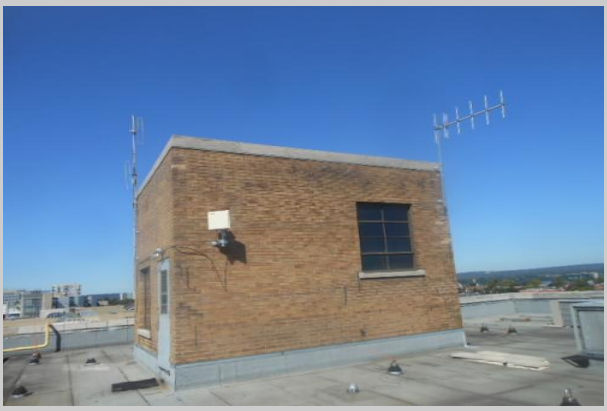
View of the northside of section 4



The redundant sleepers should be removed. This is the view from the west side of section 4 facing the east.



Signs of ponding water to the left of the HVAC unit, towards the middle of the roof section.



View of penthouse brick work that needs to be better protected as leaks are coming through these walls.



signs of previous attempts to repair the deteriorated mourtar in the brick work.



Closer view of current cracks in the brick founnd in a variety of areas below roof sections 1, 2 and 3.



View of badly deteriorated membrane located on the north side of section 3

Solution Options

Client: Horizon Utilities Corporation

Facility: 55 John Street North - Hamilton

Roof Section: Roof Areas 1,2,3,4

Repair Options

Solution Option:	Repair	**Action Year:**	2014
Section Square Footage:	12,146	**Expected Life Years:**	1
Estimated Cost:	$7,500.00		
Scope of Work:	The following repairs should be completed in 2014, unless the roof can be restored within the next 2 years and wall cladding can be installed, covering all of the existing deteriorated brick walls. Repoint all of the deteriorated brick walls, where the mortar is deteriorated. Repair any roof leaks, with rubberized mastic and reinforced with fiberglass mesh. Seal any open seams in the modified membrane.		

Restore Options

Solution Option:	Restore	**Action Year:**	2014
Section Square Footage:	12,146	**Expected Life Years:**	20
Estimated Cost:	$145,000.00		
Scope of Work:	The solution option includes restoring the existing modified membrane of all the roofs, including the penthouse roofs. The roof restoration involves the following: 1) Cut out all wet insulation as determined through the thermographic roof scan. 2) Replace all wet insulation and membrane. 3) Sweep the entire roof membrane, removing all minerals, dirt or debris. 3) Repair all roof anomolies, ridges, blisters and ridges. 4) Install new flashing modified membrane (high performance), adhered with fibered mastic. Butter all seams with rubberized mastic, reinforced with fiberglass mesh. 5) Coat the entire roof membrane with cold applied rubberized resaturant. 6) Cover the entire roof with white gravel. 7) Install new perimeter and curb sheet metal. The system comes with a 10 year warranty, and a life expectancy of 15-20 years.		

Replace Options

Solution Option:	Replace	**Action Year:**	2020

Section Square Footage:	12,146	**Expected Life Years:**	30
Estimated Cost:	$350,000.00		
Scope of Work:	3-Ply System: High Strength Mod-Bit Cap Sheet w/ Type IV Glasfelts Inter plies Please note the above cost is a budget number not a firm price. A firm price would be determined by a competitive bid process. This replacement includes the following and is performed by a contractor and incorporates the best performance qualities of both the single ply rubber roof system and the multi layers inorganic built-up roof system. The modified system uses intermittent layers of type III asphalt and fiberglass roofing felts along with a super thick and strong rubber modified/fiberglass reinforced bitumen cap sheet. The multiple layers are covered by a heavy top pour of type III asphalt and are surfaced with protective roofing gravel. This modified membrane dramatically improves the performance and life expectancy of the roof system. SCOPE OF WORK Replace Existing Roof Membrane • Tear off and properly dispose of existing roof membrane and metal coping flashings. Field of Roof (3-Ply Mod-Bit Membrane) • Install Kraft Paper vapour barrier, in a hot spot mopping of asphalt. • Install 2.5” ISO insulation (R20), hot mopped on top of the vapour barrier. • Install tapered insulation, and then install 1/2" high density, asphalt coated, fibre insulation board (R1.5), staging the seams with the ISO to reduce the effects of thermo bridging. • Taper the insulation around the perimeter of all internal drains, creating a sumped drain which will assist in the removal of water from the roof surface. • Install 2-plys of Type IV Glasfelts using Type III asphalt at a rate of 25 lbs / sq. • Install 1-ply of High Strength (Tensile Strength >500 lbf/in, Tear Strength >500 lbf) using Type III asphalt at a rate of 30 lbs / sq. • Flood coat with Type III asphalt at a rate of 60 lbs / sq and embed 3/8" pea gravel (at a rate of 500-600 lbs / sq.) to create a durable UV reflective surface. NOTE: Installing a 3-ply Mod-Bit roof membrane will offer multiple layers of protection against a water penetration with the added protection of the top Mod-Bit cap-sheet which offers excellent durability against UV aging, thermal shock with a cold weather flexibility surpassing the ASTM 6163 test standards @ -30oC. NOTE: Garland Canada does not recommend the use of Type 15 organic felts (Tensile Strength = 25 lbf/in, Tear Strength = no rating) as the base plies for a built up roof (BUR) system, as they offer no flexibility and are manufactured from organic materials that rot and deteriorate over time, leading to reduced roof life		

Solution Options

Client: Horizon Utilities Corporation

Facility: 55 John Street North - Hamilton

Roof Section: Roof Areas 1,2,3,4

Repair Options

Solution Option:	Repair	**Action Year:**	2014
Section Square Footage:	12,146	**Expected Life Years:**	30
Estimated Cost:	$100,000.00		
Scope of Work:	Install metal wall cladding, covering all of the walls of the penthouses. The scope of work involves the following: 1) Cover all of the walls with a self adhering waterproof membrane. 2) Install Z-Bars, framing the entire wall system 3) Insulate the walls, using the Z-Bars to support the insulation. 4) Cover all of the walls with high grade metal wall panels, with no exposed fasteners. 5) Cap all walls and ends of the walls. The wall cladding system comes with a 30 year waterproof warranty.		

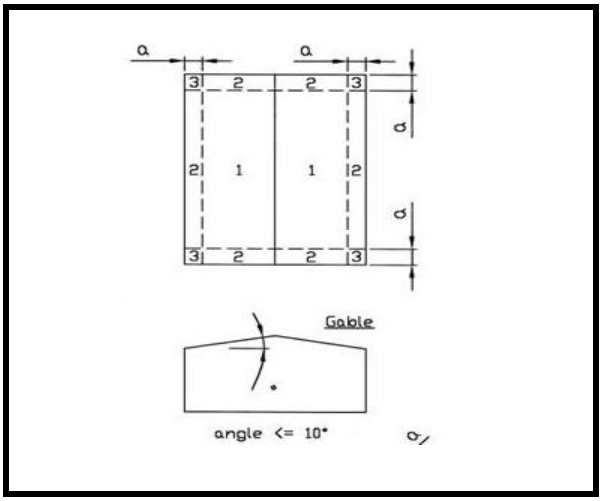
The Garland Company, Inc.
Low Slope Roofing Wind Uplift Calculations
3800 East 91st Street
Cleveland, Ohio 44105-2197
Phone: (800) 321-9336 Fax (216) 883-2046

Project **Horizon Utilities**
Roof **Section 1**
Sales Rep. **Bryce Cheesman** Location **Hamilton, ON**

Zone 1 psf (mid roof)	Zone 2 psf (eaves, ridge, hip)	Zone 3 psf (corners)
40.1	**62.9**	**85.8**

Edge Zone Width "a" **12** ft. **8** in.

Fastener Safety Factor	**3.00**
Importance	**III**
Importance Factor	**1.15**
Wind Speed (mph)	**90**
Ultimate Pullout Value	**456**
Exposure Category	**C**
Design Roof Height	**95.00**
Minimum Building Width	**126.00**
Roof Pitch (X, Y) **0.25** :	**12**
Snow Load (psf)	



System Type: **Modified Bitumen** System Type: **Modified Bitumen Cold**
Surfacing: **Coated Finish** Attachment Method: **Mech/ Fasten Insul/Board**

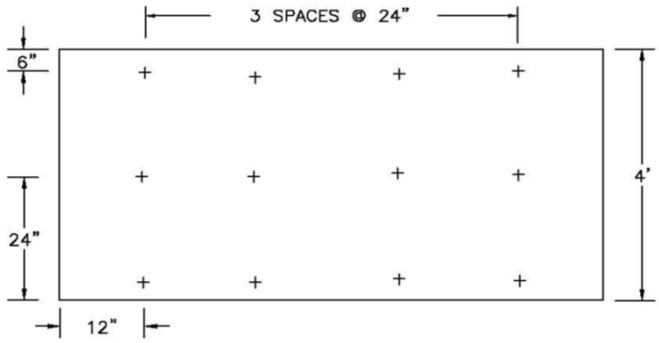
Zone 1 (mid roof)	Zone 2 (eaves, ridge, hip)	Zone 3 (corners)
_12__ fasteners per 4' x 8' board	_18__ fasteners per 4' x 8' board	_24__ fasteners per 4' x 8' board

NOTES: Attachment pattern is for attaching poly iso to metal deck. A min. .25" densdeck or securock was assumed to be adhered to the poly iso. Insulation adhesive was assumed to be Insul-Lok HR applied in 3/4" continuous beads spaced 12 in. o.c. per the attached diagram.

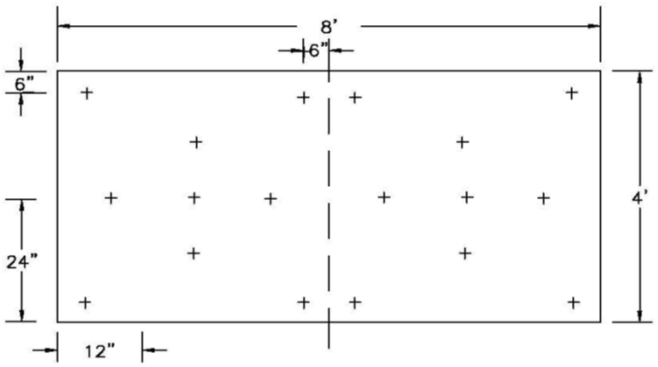
*Unless specifically stated otherwise, these calculations are based on
ASCE 7-05 (American Society for Civil Engineers); if a specific building code is required, please specify.
*It is recommended to include the "Negative Uplift Pressures" in the specifications as well as the Safety Factor, Importance Factor, Building Category, Wind Speed, Ultimate Pullout Value, and Exposure.
*The Wind Speed is determined based upon geographical location.
*The Exposure and Importance Factors are needed to determine the uplift pressures.

If you have any questions, please call 800-321-9336 or respond to engineering@garlandind.com

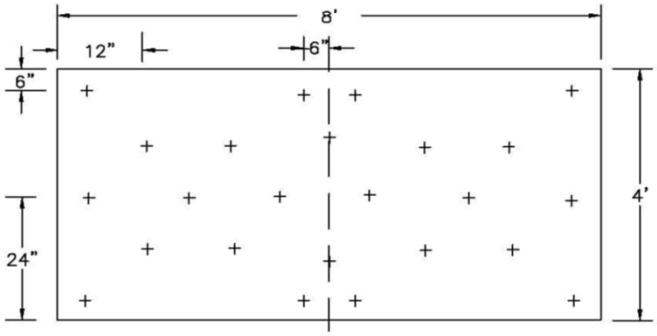
ZONE 1 INSULATION BOARD FASTENER PATTERN: 12 FASTENERS PER BOARD



ZONE 2 INSULATION BOARD FASTENER PATTERN: 18 FASTENERS PER BOARD



ZONE 3 INSULATION BOARD FASTENER PATTERN: 24 FASTENERS PER BOARD



THE GARLAND COMPANY, INC.
3800 EAST 91st STREET
CLEVELAND, OHIO 44105-2197
—PHONE 1-800-321-9336—
FAX 1-216-641-0633

DETAIL:

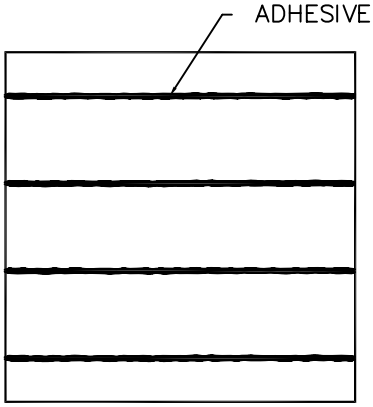
4 X 8 BOARD PATTERN

SECTION:

INSULATION BOARD FASTENER PATTERN

REV: 1 9/05

TYPICAL ZONE 1 INSULATION BOARD ADHESIVE PATTERN: 12" OC BEADS PER BOARD



4 ADHESIVE RIBBONS
EQUALLY SPACED AT
12" (15.2cm) O.C. (TYP.)

The Garland Company, Inc.
3800 East 91st Street
Cleveland, Ohio 44105-2197
Phone: (800) 321-9336 Fax (216) 883-2046

PROJECT	**Horizon Utilities**
ROOF SECTION	**Section 1**
DATE	**11/5/2013**
BASIC VELOCITY PRESSURE	**25.38** psf
DESIGN CODE	**ASCE 7-05**

System & Attachment Data

SYSTEM TYPE	Modified Bitumen
SYSTEM SCOPE	Modified Bitumen Cold
SURFACING	Coated Finish
ATTACHMENT METHOD	Mech/ Fasten Insul/Board
SUBSTRATE MATERIAL	Steel
SUBSTRATE THICKNESS	22 gauge
FASTENER TYPE	Steel: OMG Standard
FASTENER SAFETY FACTOR	3
ULTIMATE FASTENER PULLOUT	456 lbs/screw
ALLOWABLE FASTENER PULLOUT	152 lbs/clip

Building & Site Data

BASIC WIND SPEED	90	mph
EXPOSURE CATEGORY	C	
TOPOGRAPHY FACTOR	1.00	
BUILDING TYPE	Enclosed	
ROOF PITCH (X, Y)	0.25	12
RUN TO RIDGE	63	
EAVE HEIGHT	95	
DESIGN ROOF HEIGHT	95.00	ft
IMPORTANCE CLASS / FACTOR	III	1.15
MIN. BLDG WIDTH	126	ft
WIND-BORNE DEBRIS REGION	No	
PARAPET	No	
ROOF ANGLE	1.19	deg
PROTECTED OPENINGS	Yes	
ROOF TYPE	Gable	

	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5		
ROOF PRESSURE (psf)	40.1	62.9	85.8	27.6	50.2		
OVERHANG PRESSURE (psf)	43.14	43.14	71.06				
EDGE ZONE WIDTH "a" =	12.60	ft					

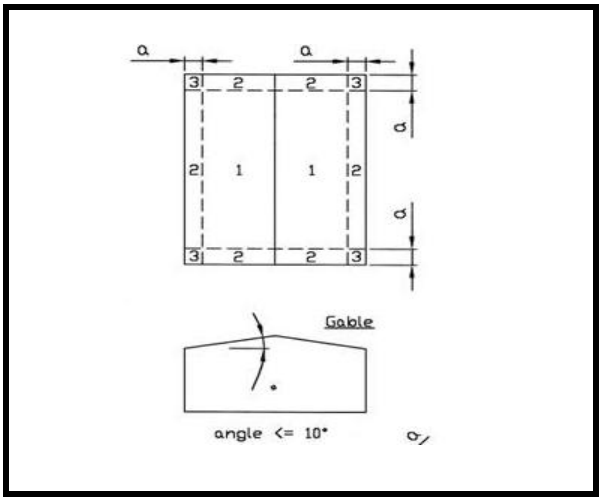
The Garland Company, Inc.
Low Slope Roofing Wind Uplift Calculations
3800 East 91st Street
Cleveland, Ohio 44105-2197
Phone: (800) 321-9336 Fax (216) 883-2046

Project **Horizon Utilities**
Roof **Section 4**
Sales Rep. **Bryce Cheesman** Location **Hamilton, ON**

Zone 1 psf (mid roof)	Zone 2 psf (eaves, ridge, hip)	Zone 3 psf (corners)
38.7	**60.7**	**82.7**

Edge Zone Width "a" **12** ft. **8** in.

Fastener Safety Factor	**3.00**
Importance	**III**
Importance Factor	**1.15**
Wind Speed (mph)	**90**
Ultimate Pullout Value	**456**
Exposure Category	**C**
Design Roof Height	**80.00**
Minimum Building Width	**126.00**
Roof Pitch (X, Y) **0.25** :	**12**
Snow Load (psf)	



System Type: **Modified Bitumen** System Type: **Modified Bitumen Cold**
Surfacing: **Coated Finish** Attachment Method: **Mech/ Fasten Insul/Board**

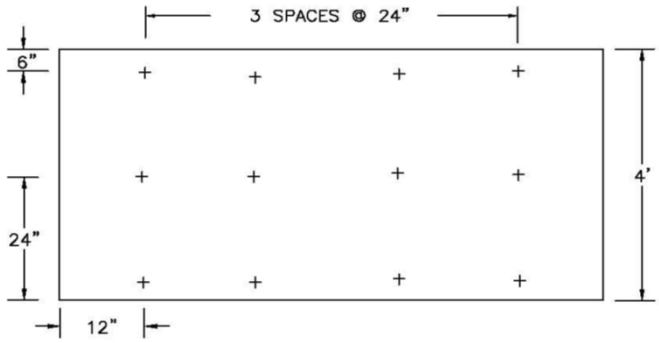
Zone 1 (mid roof)	Zone 2 (eaves, ridge, hip)	Zone 3 (corners)
_12__ fasteners per 4' x 8' board	_18__ fasteners per 4' x 8' board	_24__ fasteners per 4' x 8' board

NOTES: Attachment pattern is for attaching poly iso to metal deck. A min. .25" densdeck or securock was assumed to be adhered to the poly iso. Insulation adhesive was assumed to be Insul-Lok HR applied in 3/4" continuous beads spaced 12 in. o.c. per the attached diagram.

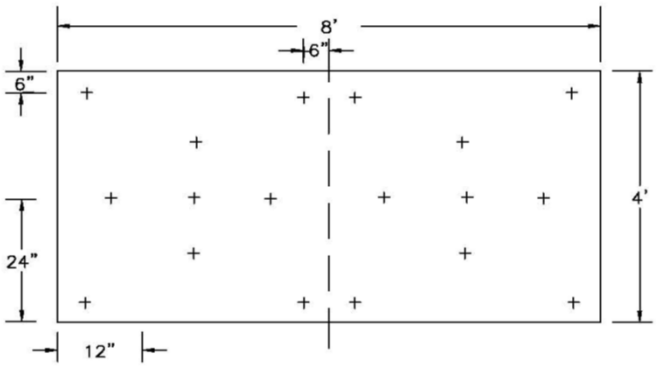
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*It is recommended to include the "Negative Uplift Pressures" in the specifications as well as the Safety Factor, Importance Factor, Building Category, Wind Speed, Ultimate Pullout Value, and Exposure.
*The Wind Speed is determined based upon geographical location.
*The Exposure and Importance Factors are needed to determine the uplift pressures.

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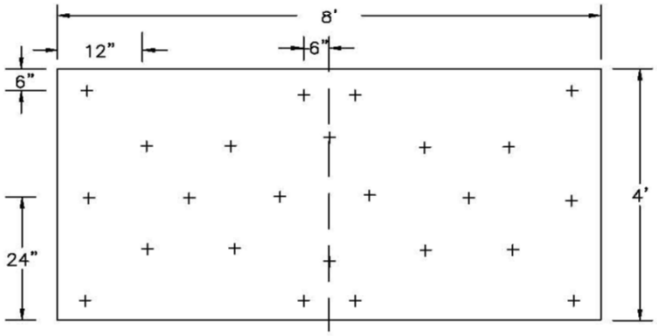
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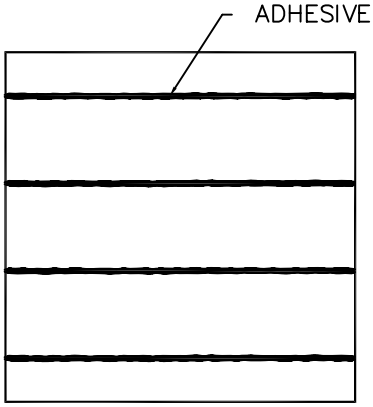
4 X 8 BOARD PATTERN

SECTION:

INSULATION BOARD FASTENER PATTERN

REV: 1 9/05

TYPICAL ZONE 1 INSULATION BOARD ADHESIVE PATTERN: 12" OC BEADS PER BOARD



4 ADHESIVE RIBBONS
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12" (15.2cm) O.C. (TYP.)

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Cleveland, Ohio 44105-2197
Phone: (800) 321-9336 Fax (216) 883-2046

since 1895

PROJECT	**Horizon Utilities**
ROOF SECTION	**Section 4**
DATE	**11/5/2013**
BASIC VELOCITY PRESSURE	**24.48** psf
DESIGN CODE	**ASCE 7-05**

System & Attachment Data

SYSTEM TYPE	Modified Bitumen
SYSTEM SCOPE	Modified Bitumen Cold
SURFACING	Coated Finish
ATTACHMENT METHOD	Mech/ Fasten Insul/Board
SUBSTRATE MATERIAL	Steel
SUBSTRATE THICKNESS	22 gauge
FASTENER TYPE	Steel: OMG Standard
FASTENER SAFETY FACTOR	3
ULTIMATE FASTENER PULLOUT	456 lbs/screw
ALLOWABLE FASTENER PULLOUT	152 lbs/clip

Building & Site Data

BASIC WIND SPEED	90	mph
EXPOSURE CATEGORY	C	
TOPOGRAPHY FACTOR	1.00	
BUILDING TYPE	Enclosed	
ROOF PITCH (X, Y)	0.25	12
RUN TO RIDGE	63	
EAVE HEIGHT	80	
DESIGN ROOF HEIGHT	80.00	ft
IMPORTANCE CLASS / FACTOR	III	1.15
MIN. BLDG WIDTH	126	ft
WIND-BORNE DEBRIS REGION	No	
PARAPET	No	
ROOF ANGLE	1.19	deg
PROTECTED OPENINGS	Yes	
ROOF TYPE	Gable	

	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5		
ROOF PRESSURE (psf)	38.7	60.7	82.7	26.7	48.5		
OVERHANG PRESSURE (psf)	41.61	41.61	68.53				
EDGE ZONE WIDTH "a" =	12.60	ft					

Construction Details

Client: Horizon Utilities Corporation

Facility: 55 John Street North - Hamilton

Roof Section: Roof Areas 5,6,7,8,9,10

Roof Info

Year Installed	1999	**Square Footage**	10,971
Slope Dimension	1/12	**Roof Height**	40
Roof Access	Penthouse	**System Type**	Modified Bitumen
		Contractor	Spinton Roofing Frank Francella 1800368-8441 (Office) (905)971-3493 (Mobile) Frank@spintonroofing.com

Roof Assembly

Roof #	Layer Type	Description	Attachement	R-Value	Insulation Thickness
1	Deck	Metal Deck	Mechanically attached	-	-
1	Vapor Retarder	2 ply hot	Hot asphalt	-	-
1	Insulation	Polyisocyanurate	Hot asphalt	12	2"
1	Membrane	Mod Bit - 2 ply mineral surfaced	Torch applied	-	-

Details

Perimeter Detail	Parapet Wall, Wall Flashing, Drip Edge
Flashing Material	Modified Membrane
Drain System	Internal Roof Drains, Gutter System
Parapet Wall	Poured In Place Concrete
Coping Cap	Metal

Notes

Roof Areas 5, 6, 7, 8, 9 and 10 make up the original Hughson Substation.
The building is extremely old and has been designated as Historic Building.



Inspection Report

Client: Horizon Utilities Corporation

Facility: 55 John Street North - Hamilton

Report Date: 09/12/2013

Roof Section: Roof Areas 5,6,7,8,9,10

Inspection Information

Inspection Date	09/12/2013	**Core Data**	Yes
Inspection Type	Core Analysis	**Leakage**	No
Deck Conditions	Excellent		

Flashing Conditions

Perimeter	Good	**Wall**	Good
Projections	Good	**Counterflashing**	Good

Miscellaneous Details

Reglets	Good	**Debris**	No
Control Expansion Joints	N/A	**Ponding Water**	None
Parapet Wall	Good	**Coping Joints**	Good

Perimeter

Rating	Good
Condition	The perimeter flashing detail is in good condition. The parapet walls are in excellent condition. The seams of the flashing membrane are well sealed.

Field

Rating	Good
Condition	The field membrane is in good condition. There is excellent natural slope, built into the concrete deck. The roof membrane is holding up very well, because of the excellent slope.

Penetrations

Rating	Good
Condition	There are pitch pockets that were installed too low and have had some minor roof leaks. most of the penetrations are in good condition.

Drainage

Rating	Good
Condition	There is excellent slope to the exterior gutters. None of the roofs hold water. The roof membrane is holding up very well.

Overall

Rating	Good
Condition	The roof membrane is 14 years old, but because of the excellent slope, the membrane is holding up well.



View of section 5, 6 and 8



View of section 9, 8 and 7 (starting from the top and moving down, left to right)



View of section 8 and the poorly installed railing that do not have proper pitch pans (seen on the right). Note the deteriorated membrane in the middle of the roof.



View of section 8



View of section 8





The membrane is in poor shape as seen here on section 8 where it ties into section 9 on the north side.



Recently installed new modifed membrane where it was leaking at the base of the post.





View of section 9



View of ponding water on the left which will only be rectified when tapered insulation is installed.



Moss growth seen here where water is getting in behind the membrane/metal flashing above



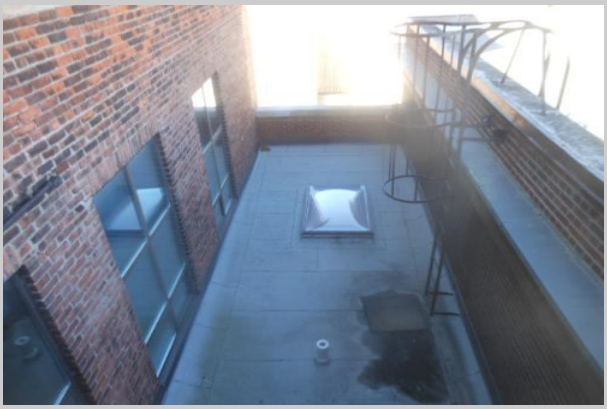
Membrane has delaminated as seen here by the corner of section 9



Minerals have badly deteriorated here from excessive water held here.



This conduit was not properly installed in a proper pitch pan.



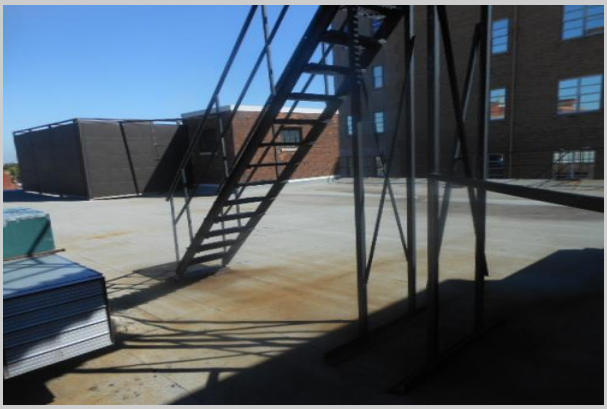
View of section 10, ponding water is excessive on the right



The lower roof #10,
This roof has already been replaced because of sloppy workmanship and poor quality material.
The insulation was soaked.
The roof was replaced in approximately 2007



All the debris should be removed from the drain strainer over section 10



View of section 8



There are some mortar issues along the wall at the lower brick work of section 9



Moss growth from water that is getting from in behind the metal counter flashing.



View of deteriorated membrane as seen on the right dark spots



View of parapet wall located on the west side of section 6



View of section 6 which is sloped 2:12



View of canopies that need to be repaired along the souhtwest corner that wraps around the corner of section 6.



View of deteriorated membrane that has started to crack along the perimeter of the overhang.



Solution Options

Client: Horizon Utilities Corporation

Facility: 55 John Street North - Hamilton

Roof Section: Roof Areas 5,6,7,8,9,10

Repair Options

Solution Option:	Repair	**Action Year:**	2014
Section Square Footage:	10,971	**Expected Life Years:**	2
Estimated Cost:	$5,000.00		
Scope of Work:	The following repairs should be completed as required, and only if the roof system can not be restored in the next few years. The roof has issues, and should be repaired as necessary. The mortar in the brick work should be repointed.		

Restore Options

Solution Option:	Restore	**Action Year:**	2016
Section Square Footage:	10,971	**Expected Life Years:**	20
Estimated Cost:	$100,000.00		
Scope of Work:	Restore the entire roof section with the same technique used to restore the garage roof and the tower roofs. Restoration involves the following: Remove all of the wet and moist insulation, and replace (matching existing) and replace the modified membrane. Sweep the entire existing roof membrane, removing all loose minerals, dirt and debris. Repair the existing roof membrane, repairing all ridges, blisters, and any annomolies. Install new flashing membrane, which is High Strength Modified Membrane, adhered with Fibered Mastic. Butter all flashing seams with rubberized mastic, reinforced with fiberglass mesh. Coat the entire field of the roof system with cold applied rubberized roof resaturant. Cover the existing resaturant with white gravel. Aluminize all exposed flashing membrane. Secure the membrane with termination bars. Also, the roof's safety rails need to be repaired or replaced to meet code. The restoration comes with a 10 year warranty and a life expectancy of 15-20 years.		

Replace Options

Solution Option:	Replace	**Action Year:**	2021
Section Square Footage:	10,971	**Expected Life Years:**	30
Estimated Cost:	$225,000.00		
Scope of Work:	3-Ply System: High Strength Mod-Bit Cap Sheet w/ Type IV Glasfelts Inter plies Please note the above cost is a budget number not a firm price. A firm price would be		

determined by a competitive bid process.

This replacement includes the following and is performed by a contractor and incorporates the best performance qualities of both the single ply rubber roof system and the multi layers inorganic built-up roof system. The modified system uses intermittent layers of type III asphalt and fiberglass roofing felts along with a super thick and strong rubber modified/fiberglass reinforced bitumen cap sheet. The multiple layers are covered by a heavy top pour of type III asphalt and are surfaced with protective roofing gravel. This modified membrane dramatically improves the performance and life expectancy of the roof system.

SCOPE OF WORK

Replace Existing Roof Membrane
• Tear off and properly dispose of existing roof membrane and metal coping flashings.
Field of Roof (3-Ply Mod-Bit Membrane)
• Install Kraft Paper vapour barrier, in a hot spot mopping of asphalt.
• Install 2.5" ISO insulation (R20), hot mopped on top of the vapour barrier.
• Install 1/2" high density, asphalt coated, fibre insulation board (R1.5), staging the seams with the ISO to reduce the effects of thermo bridging.
• Taper the insulation around the perimeter of all internal drains, creating a sumped drain which will assist in the removal of water from the roof surface.
• Install 2-plys of Type IV Glasfelts using Type III asphalt at a rate of 25 lbs / sq.
• Install 1-ply of Modified Membrane(Tensile Strength >500 lbf/in, Tear Strength >500 lbf) using Type III asphalt at a rate of 30 lbs / sq.
• Flood coat with Type III asphalt at a rate of 60 lbs / sq and embed 3/8" pea gravel (at a rate of 500-600 lbs / sq.) to create a durable UV reflective surface.

NOTE: Installing a 3-ply Mod-Bit roof membrane will offer multiple layers of protection against a water penetration with the added protection of the top Mod-Bit cap-sheet which offers excellent durability against UV aging, thermal shock with a cold weather flexibility surpassing the ASTM 6163 test standards @-30oC.

NOTE: Garland Canada does not recommend the use of Type 15 organic felts (Tensile Strength = 25 lbf/in, Tear Strength = no rating) as the base plies for a built up roof (BUR) system, as they offer no flexibility and are manufactured from organic materials that rot and deteriorate over time, leading to reduced roof life

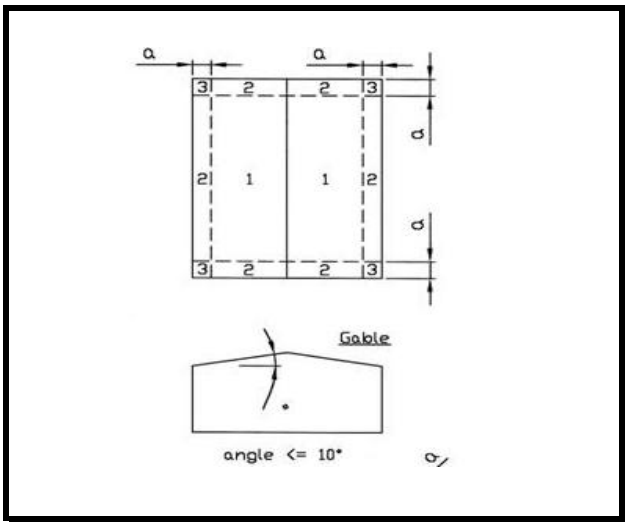
The Garland Company, Inc.
Low Slope Roofing Wind Uplift Calculations
3800 East 91st Street
Cleveland, Ohio 44105-2197
Phone: (800) 321-9336 Fax (216) 883-2046

Project **Horizon Utilities**
Roof **Section 6**
Sales Rep. **Bryce Cheesman** Location **Hamilton, ON**

Zone 1 psf (mid roof)	Zone 2 psf (eaves, ridge, hip)	Zone 3 psf (corners)
24.9	**43.3**	**64.0**

Edge Zone Width "a" **12** ft. **8** in.

Fastener Safety Factor	**N/A**
Importance	**III**
Importance Factor	**1.15**
Wind Speed (mph)	**90**
Ultimate Pullout Value	**N/A**
Exposure Category	**C**
Design Roof Height	**60.00**
Minimum Building Width	**126.00**
Roof Pitch (X, Y)	**2** : **12**
Snow Load (psf)	



System Type: **Modified Bitumen** System Type: **Modified Bitumen Cold**

Surfacing: **Coated Finish** Attachment Method: **Insulation Adhesive**

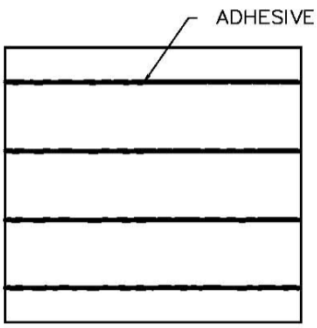
Zone 1 (mid roof)	Zone 2 (eaves, ridge, hip)	Zone 3 (corners)
Beads spaced _12"__ o.c. per 4' x 4' board	Beads spaced _12"__ o.c. per 4' x 4' board	Beads spaced _12"__ o.c. per 4' x 4' board

NOTES: Attachment pattern is for adhering poly iso to concrete and min. .25" densdeck or securock to poly iso. Insulation adhesive was assumed to be Insul-Lok HR applied in 3/4" continuous beads spaced per the attached diagram.

*Unless specifically stated otherwise, these calculations are based on ASCE 7-05 (American Society for Civil Engineers); if a specific building code is required, please specify.
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*The Wind Speed is determined based upon geographical location.
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TYPICAL ZONE 1 INSULATION BOARD ADHESIVE PATTERN: 12" OC BEADS PER BOARD



4 ADHESIVE RIBBONS
EQUALLY SPACED AT
12" (15.2cm) O.C. (TYP.)

THE GARLAND COMPANY, INC.
GARLAND CANADA, INC.
THE GARLAND COMPANY UK, LTD
since 1895

DETAIL:
4 X 4 BOARD PATTERN

SECTION:
INSULATION BOARD ADHESIVE PATTERN

REV: 3 28/07

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The Garland Company, Inc.
3800 East 91st Street
Cleveland, Ohio 44105-2197
Phone: (800) 321-9336 Fax (216) 883-2046

PROJECT	**Horizon Utilities**
ROOF SECTION	**Section 6**
DATE	**11/5/2013**
BASIC VELOCITY PRESSURE	**23.04** psf
DESIGN CODE	**ASCE 7-05**

System & Attachment Data

SYSTEM TYPE	Modified Bitumen	
SYSTEM SCOPE	Modified Bitumen Cold	
SURFACING	Coated Finish	
ATTACHMENT METHOD	Insulation Adhesive	
SUBSTRATE MATERIAL	Concrete	
SUBSTRATE THICKNESS	6 in	
FASTENER TYPE	N/A	
FASTENER SAFETY FACTOR	N/A	
ULTIMATE FASTENER PULLOUT	N/A	lbs/screw
ALLOWABLE FASTENER PULLOUT	N/A	lbs/clip

Building & Site Data

BASIC WIND SPEED	90	mph
EXPOSURE CATEGORY	C	
TOPOGRAPHY FACTOR	1.00	
BUILDING TYPE	Enclosed	
ROOF PITCH (X, Y)	2	12
RUN TO RIDGE	30	
EAVE HEIGHT	60	
DESIGN ROOF HEIGHT	60.00	ft
IMPORTANCE CLASS / FACTOR	III	1.15
MIN. BLDG WIDTH	126	ft
WIND-BORNE DEBRIS REGION	No	
PARAPET	No	
ROOF ANGLE	9.46	deg
PROTECTED OPENINGS	Yes	
ROOF TYPE	Gable	

	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5		
ROOF PRESSURE (psf)	24.9	43.3	64.0	27.0	33.2		
OVERHANG PRESSURE (psf)	20.73	50.68	85.24				
EDGE ZONE WIDTH "a" =	12.60	ft					

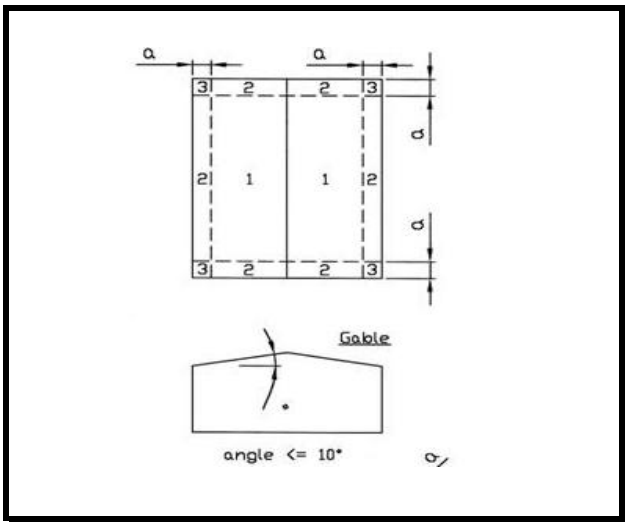
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Phone: (800) 321-9336 Fax (216) 883-2046

Project **Horizon Utilities**
Roof **Section 9**
Sales Rep. **Bryce Cheesman** Location **Hamilton, ON**

Zone 1 psf (mid roof)	Zone 2 psf (eaves, ridge, hip)	Zone 3 psf (corners)
25.0	**41.9**	**63.0**

Edge Zone Width "a" **12** ft. **8** in.

Fastener Safety Factor	**N/A**
Importance	**III**
Importance Factor	**1.15**
Wind Speed (mph)	**90**
Ultimate Pullout Value	**N/A**
Exposure Category	**C**
Design Roof Height	**40.00**
Minimum Building Width	**126.00**
Roof Pitch (X, Y) **0.25** :	**12**
Snow Load (psf)	



System Type: **Modified Bitumen** System Type: **Modified Bitumen Cold**

Surfacing: **Coated Finish** Attachment Method: **Insulation Adhesive**

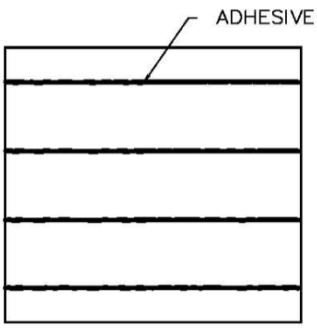
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Beads spaced _12"__ o.c. per 4' x 4' board	Beads spaced _12"__ o.c. per 4' x 4' board	Beads spaced _12"__ o.c. per 4' x 4' board

NOTES: Attachment pattern is for adhering poly iso to concrete and min. .25" densdeck or securock to poly iso. Insulation adhesive was assumed to be Insul-Lok HR applied in 3/4" continuous beads spaced per the attached diagram.

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4 ADHESIVE RIBBONS
EQUALLY SPACED AT
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GARLAND CANADA, INC.
THE GARLAND COMPANY UK, LTD
since 1895

DETAIL:
4 X 4 BOARD PATTERN

SECTION:
INSULATION BOARD ADHESIVE PATTERN

REV: 3 28/07

3800 East 91st Street, Cleveland, Ohio 44105-2197 Phone: (800) 321-9336

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The Garland Company, Inc.
3800 East 91st Street
Cleveland, Ohio 44105-2197
Phone: (800) 321-9336 Fax (216) 883-2046

PROJECT	**Horizon Utilities**
ROOF SECTION	**Section 9**
DATE	**11/5/2013**
BASIC VELOCITY PRESSURE	**21.15** psf
DESIGN CODE	**ASCE 7-05**

System & Attachment Data

SYSTEM TYPE	Modified Bitumen	
SYSTEM SCOPE	Modified Bitumen Cold	
SURFACING	Coated Finish	
ATTACHMENT METHOD	Insulation Adhesive	
SUBSTRATE MATERIAL	Concrete	
SUBSTRATE THICKNESS	6 in	
FASTENER TYPE	N/A	
FASTENER SAFETY FACTOR	N/A	
ULTIMATE FASTENER PULLOUT	N/A	lbs/screw
ALLOWABLE FASTENER PULLOUT	N/A	lbs/clip

Building & Site Data

BASIC WIND SPEED	90	mph
EXPOSURE CATEGORY	C	
TOPOGRAPHY FACTOR	1.00	
BUILDING TYPE	Enclosed	
ROOF PITCH (X, Y)	0.25	12
RUN TO RIDGE	30	
EAVE HEIGHT	40	
DESIGN ROOF HEIGHT	40.00	ft
IMPORTANCE CLASS / FACTOR	III	1.15
MIN. BLDG WIDTH	126	ft
WIND-BORNE DEBRIS REGION	No	
PARAPET	No	
ROOF ANGLE	1.19	deg
PROTECTED OPENINGS	Yes	
ROOF TYPE	Gable	

	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5		
ROOF PRESSURE (psf)	25.0	41.9	63.0	24.7	30.5		
OVERHANG PRESSURE (psf)	35.96	35.96	59.23				
EDGE ZONE WIDTH "a" =	12.60	ft					

Construction Details

Client: Horizon Utilities Corporation

Facility: 55 John Street North - Hamilton

Roof Section: Roof Area 11

Roof Info

Year Installed	1999	**Square Footage**	14,248
Slope Dimension	.5/12	**Roof Height**	20
Roof Access	Penthouse	**System Type**	Modified Bitumen
		Contractor	Spinton Roofing Frank Francella 1800368-8441 (Office) (905)971-3493 (Mobile) Frank@spintonroofing.com

Roof Assembly

Roof #	Layer Type	Description	Attachement	R-Value	Insulation Thickness
1	Deck	Metal Deck	Mechanically attached	-	-
1	Vapor Retarder	1 ply organic felt	Spot Mopped	-	-
1	Insulation	Polyisocyanurate	Fully Adhered	12	2"
1	Membrane	Mod Bit - 2 ply mineral surfaced	Torch applied	-	-

Details

Perimeter Detail	Parapet Wall
Flashing Material	Modified Membrane
Drain System	Internal Roof Drains
Parapet Wall	Pre-Cast Concrete
Coping Cap	Stone

Notes

Roof Area 11 is the lower roof or the parking garage



Inspection Report

Client: Horizon Utilities Corporation

Facility: 55 John Street North - Hamilton

Report Date: 09/12/2013

Roof Section: Roof Area 11

Inspection Information

Inspection Date	09/12/2013	**Core Data**	Yes
Inspection Type	Core Analysis	**Leakage**	No
Deck Conditions	Good		

Flashing Conditions

Perimeter	Good	**Wall**	Good
Projections	Good	**Counterflashing**	N/A

Miscellaneous Details

Reglets	N/A	**Debris**	No
Control Expansion Joints	N/A	**Ponding Water**	Minor
Parapet Wall	Good	**Coping Joints**	Good

Perimeter

Rating	Good
Condition	The flashing membrane is in good condition. Flashing seams are holding up well.

Field

Rating	Good
Condition	The field membrane is holding up well. The roof is 14 years old and has experienced some minor leaks, mainly caused at projections. There was also a wall that fell on the roof system at the south east corner and crushed the deck.

Penetrations

Rating	Fair
Condition	There are many penetrations on the roof, with mechanical units, boilers and other plumbing stacks etc. The penetrations have all been sealed many times with rubberized mastic and have been aluminized.

Drainage

Rating	Good
Condition	There is a slight slope to the internal drains. There is slope, however the roof still holds water in areas. This ponding water is deteriorating the roof membrane.The granules of the membrane are delaminating from the membrane. The ponding water is starting to deteriorate the roof membrane.

Overall

Rating	Good
Condition	The roof membrane is in good condition. The 2 ply modified membrane is starting to show some signs of aging, but it is holding up nicely. The roof is 14 years old and the roof is losing granules (which protect the membrane from UV)



Overview of roof. Note that the middle of the roof shows signs of excessve ponding water. ***Ponding***: ponding water occurs as rain or snow melt water collects in large pools on the surface of a roof system. These pools begin to form because of two reasons: (1) roof drains are blocked or clogged with debris, (2) roof drains are built along side building support columns which maintain a consistent height while the rest of the roof system is built on a deck which tends to move and deflect under the downward pressure of weight. In both cases, roof depressions that collect and hold water will tend to grow in size as the added weight of the ponding water will continue to deflect the roof deck even further.

Ponding water has many negative effects on a roof system. The added weight can crush insulation to the point where it becomes a useless thermal barrier - this will cost you big money since your HVAC system will have to work longer and harder to maintain a comfortable interior temperature. In the winter ponding water will expand as it freezes. This expansion will weaken small imperfections in the roof system. Small cracks and tears will widen until they rupture to allow water into the building. Ponding water also accelerates the aging of a roof. The natural waterproofing oils in the asphalt will separate from the membrane if the system remains submerged under water for periods longer than 48 hours. And finally, a negatively deflected deck becomes a structural concern. The deck's tolerances will only accept a limited amount of weight and deflection before it becomes a candidate for a roof collapse



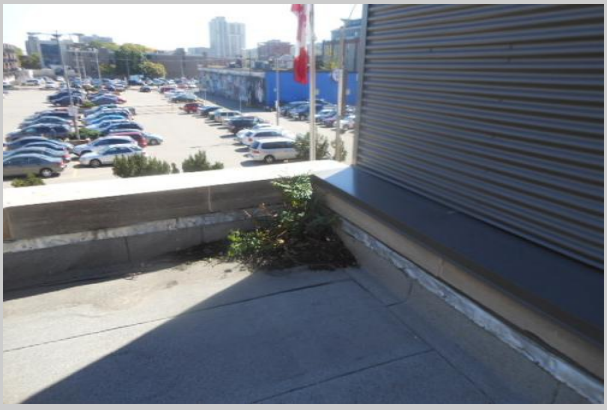
Busy part of roof where there are signs of significant ponding water.



Example of ponding water around one of the larger HVAC units in the middle of the roof.



View of perimeter flashing along the base of the windows



Mosses are small, soft plants that are typically 1–10 cm (0.4-4 in) tall, though some species are much larger. They commonly grow close together in clumps or mats in damp or shady locations. They do not have flowers or seeds, and their simple leaves cover the thin wiry stems. At certain times mosses produce spore capsules which may appear as beak-like capsules borne aloft on thin stalks.

These roots from plant growth can damage the underlying membrane



Signs of extreme ponding water. ***Ponding***: ponding water occurs as rain or snow melt water collects in large pools on the surface of a roof system. These pools begin to form because of two reasons: (1) roof drains are blocked or clogged with debris, (2) roof drains are built along side building support columns which maintain a consistent height while the rest of the roof system is built on a deck which tends to move and deflect under the downward pressure of weight. In both cases, roof depressions that collect and hold water will tend to grow in size as the added weight of the ponding water will continue to deflect the roof deck even further.



View of small area which was recently replaced.
A wall from the firehall fell and collapsed the deck.



This cone will need to be replaced as the corrosion here has badly deteriorated the base.







View of roof shows that the perimeter by the windows was tapered to the middle, however, the drains are not receiving the water well here.



View of small part of section



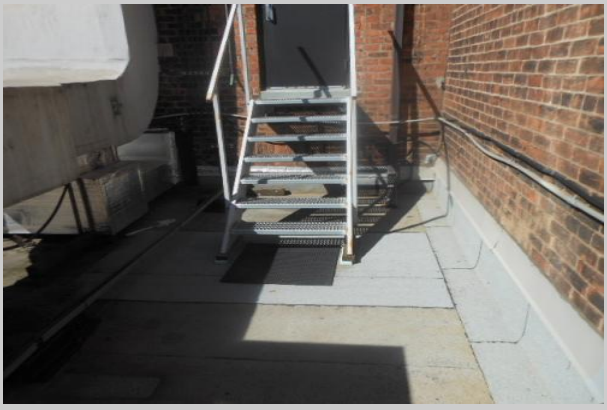
Another view of small part of section that leads to the stairs to section 8







View of railing at the edge of section 6





View of ponding water between the large units on section 11



This detail around the HVAC unit that ties into the wall needs to be repaired.



Area that needs to be repaired.



View of perimeter detail around all the busy HVAC units

Solution Options

Client: Horizon Utilities Corporation

Facility: 55 John Street North - Hamilton

Roof Section: Roof Area 11

Inspection Options

Solution Option:	Inspection	**Action Year:**	2014
Section Square Footage:	14,248	**Expected Life Years:**	1
Estimated Cost:	$2,900.00		
Scope of Work:	The roof should be thermal scanned to verify the amount of wet insulation. This cost can be a cost effective method with other flat roofs on the property to determine options. Doing more than one roof at one time will reduce the individual costs. Due to the history and of the roof it is extremely important to determine whether or not the roof system is holding wet insulation in any areas. The infra red scan will give us a snap shot of which areas are wet and allow us to develop a long term roof asset management plan (depending on results of the scan). The following is included as part of the Garland Infra Red Scan Service: The logical starting point for your roof maintenance program is to perform an accurate Infrared Thermal Scan. The Scan is a diagnostic tool and acts very much like an X-ray to determine the condition of the roof and insulation that are not visible to the naked eye. It will detect areas of wet insulation and invisible roof leaks. Utilizing the most up to date equipment, and performing the scan at the optimal time will ensure the most accurate readings. The use of a thermal scan assists in setting priorities. Funds are spent on correction of wet insulation thereby correcting leaks and minimizing long-term costs. 1. A complete scan of the designated roofs with any problem areas marked directly on the roof surface. 2. A scale drawing of the roof with all sections of wet insulation marked to scale. 3. Built up membrane analysis determining the roof felt condition, number of plies of roofing felt, adhesion between plies, pliability of the core(s) taken and adhesion of the gravel on the surface. 4. Analysis of the flashing at all areas including all perimeters and projections. Additionally, all metal counter flashing, expansion/control joints, reglet joints, copings, plumbing vents, pitch pockets, skylights, drains, and air intake and exhaust units. Notation of areas of exposed roofing felt, ridging of the roof membrane, blisters, ponding and other weaknesses. 5. Core cuts determining the type, thickness, R-value and condition of the insulation. Type of deck and air/vapour retarder noted. 6. Thermograms and photos of all problem areas. 7. Recommendations for any required work to bring the roofs up to a watertight condition immediately and recommendations for the future as related to restoration and/or replacement. Once the scan is completed you will have the scientific information you require to make proper maintenance decisions regarding your roof system. Let me know if you have any further questions in regards to this procedure.		

Repair Options

Solution Option:	Repair	**Action Year:**	2014
Section Square Footage:	14,248	**Expected Life Years:**	2
Estimated Cost:	$7,500.00		
Scope of Work:	The following roof repairs should be done in 2014, in order to keep the building watertight, until the capital funds can be allocated to the roof section: 1) Repoint all of the brick walls, repairing all of the deteriorated mortar, 2) Recaulk all of the windows. 3)Repair any roof leaks and open seams in the modified flashing membrane. All of these repairs will only be neccessary if the funds are not available to cover the brick walls with metal cladding and to restore the existing roof membrane.		

Restore Options

Solution Option:	Restore	**Action Year:**	2015
Section Square Footage:	14,248	**Expected Life Years:**	15
Estimated Cost:	$110,000.00		
Scope of Work:	Restoring the existing modified membrane involves the following scope of work; 1) Conduct a thermographic roof scan, to determine the presence of moisture in the existing roof system. 2) Cut out and replace any wet insulation and membrane. The membrane will match the existing, and will be installed with torch application. 3) Sweep the existing roof membrane. Clean the roof of all loose ganuals, dirt or debris. 4) Repair any roof membrane issues, including blisters, ridges etc. Repair the existing membrane with cold adhesive and reinforced with modified membrane. 5) Install a new modified membrane flashing membrane, with cold applied fibered mastic. The membrane needs to be secured at the top of the wall with termination bars. 6) Butter all seams with rubberized mastic, reinforced with fiberglass mesh. 7) cover the existing modified membrane with a cold applied rubberized resaturant. 8) Cover the entire roof with white gravel. 9) Install new perimeter metal. Aluminize all exposed flashing membrane with fibered aluminizer. The above solution comes with a 10 year warranty and should extend the life of the roof by 15-20 years.		

Replace Options

Solution Option:	Replace	**Action Year:**	2020
Section Square Footage:	14,248	**Expected Life Years:**	30
Estimated Cost:	$250,000.00		
Scope of Work:	3-Ply System: High Performance Mod-Bit Cap Sheet w/ Type IV Glasfelts Inter plies Please note the above cost is a budget number not a firm price. A firm price would be determined by a competitive bid process. This replacement includes the following and is performed by a contractor and incorporates the best performance qualities of both the single ply rubber roof system and the multi layers inorganic built-up roof system. The modified system uses intermittent layers of type III asphalt and fiberglass roofing felts along with a super thick and strong rubber modified/fiberglass reinforced bitumen cap sheet. The multiple layers are covered by a heavy top pour of type III asphalt and are surfaced with protective roofing gravel. This modified membrane dramatically		

improves the performance and life expectancy of the roof system.

SCOPE OF WORK

Replace Existing Roof Membrane
• Tear off and properly dispose of existing roof membrane and metal coping flashings.
Field of Roof (3-Ply Mod-Bit Membrane)
• Install Kraft Paper vapour barrier, in a hot spot mopping of asphalt.
• Install 2.5” ISO insulation (R20), hot mopped on top of the vapour barrier.
• Install tapered fiberboard, and then install 1/2" high density, asphalt coated, fibre insulation board (R1.5), staging the seams with the ISO to reduce the effects of thermo bridging.
• Taper the insulation around the perimeter of all internal drains, creating a sumped drain which will assist in the removal of water from the roof surface.
• Install 2-plys of Type IV Glasfelts using Type III asphalt at a rate of 25 lbs / sq.
• Install 1-ply of Modified Membrane (Tensile Strength >500 lbf/in, Tear Strength >500 lbf) using Type III asphalt at a rate of 30 lbs / sq.
• Flood coat with Type III asphalt at a rate of 60 lbs / sq and embed white gravel (at a rate of 500-600 lbs / sq.) to create a durable UV reflective surface.

NOTE: Installing a 3-ply Mod-Bit roof membrane will offer multiple layers of protection against a water penetration with the added protection of the top Mod-Bit cap-sheet which offers excellent durability against UV aging, thermal shock with a cold weather flexibility surpassing the ASTM 6163 test standards @ -30oC.

NOTE: Garland Canada does not recommend the use of Type 15 organic felts (Tensile Strength = 25 lbf/in, Tear Strength = no rating) as the base plies for a built up roof (BUR) system, as they offer no flexibility and are manufactured from organic materials that rot and deteriorate over time, leading to reduced roof life.

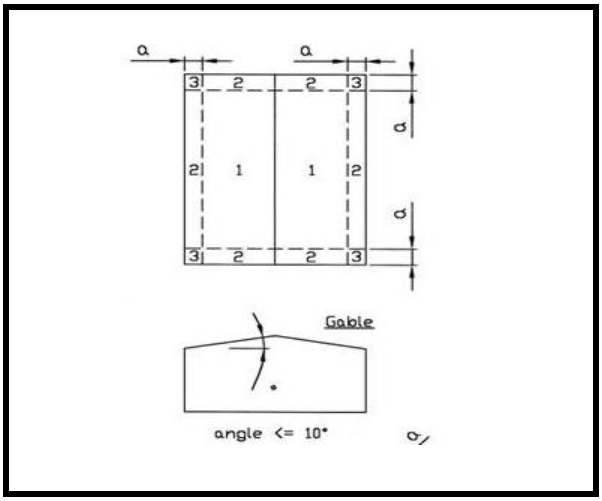
The Garland Company, Inc.
Low Slope Roofing Wind Uplift Calculations
3800 East 91st Street
Cleveland, Ohio 44105-2197
Phone: (800) 321-9336 Fax (216) 883-2046

Project **Horizon Utilities**
Roof **Section 11**
Sales Rep. **Bryce Cheesman** Location **Hamilton, ON**

Zone 1 psf (mid roof)	Zone 2 psf (eaves, ridge, hip)	Zone 3 psf (corners)
16.8	**28.1**	**42.3**

Edge Zone Width "a" **7** ft. **8** in.

Fastener Safety Factor	**3.00**
Importance	**III**
Importance Factor	**1.15**
Wind Speed (mph)	**90**
Ultimate Pullout Value	**456**
Exposure Category	**B**
Design Roof Height	**19.00**
Minimum Building Width	**126.00**
Roof Pitch (X, Y) **0.25** :	**12**
Snow Load (psf)	



System Type: **Modified Bitumen** System Type: **Modified Bitumen Cold**
Surfacing: **Coated Finish** Attachment Method: **Mech/ Fasten Insul/Board**

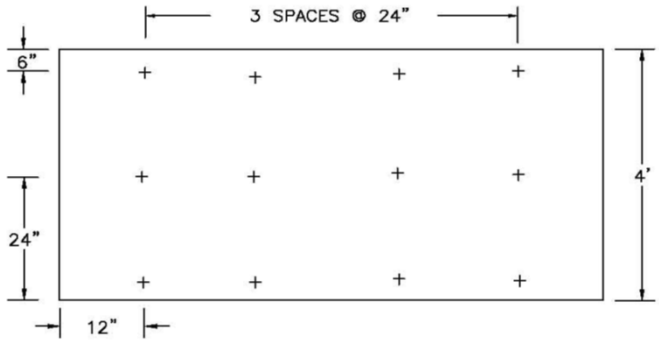
Zone 1 (mid roof)	Zone 2 (eaves, ridge, hip)	Zone 3 (corners)
_12__ fasteners per 4' x 8' board	_18__ fasteners per 4' x 8' board	_24__ fasteners per 4' x 8' board

NOTES: Attachment pattern is for attaching poly iso to metal deck. A min. .25" densdeck or securock was assumed to be adhered to the poly iso. Insulation adhesive was assumed to be Insul-Lok HR applied in 3/4" continuous beads spaced 12 in. o.c. per the attached diagram.

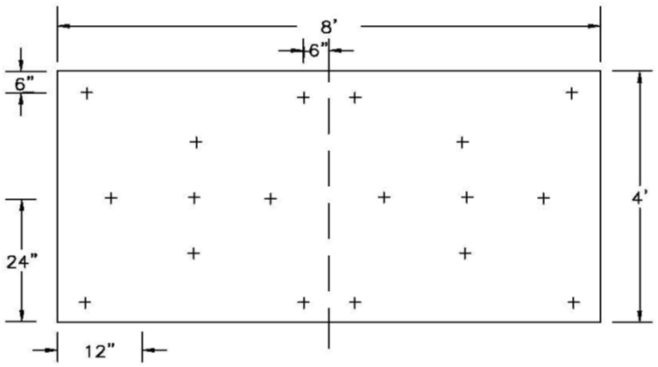
*Unless specifically stated otherwise, these calculations are based on
ASCE 7-05 (American Society for Civil Engineers); if a specific building code is required, please specify.
*It is recommended to include the "Negative Uplift Pressures" in the specifications as well as the Safety Factor, Importance Factor, Building Category, Wind Speed, Ultimate Pullout Value, and Exposure.
*The Wind Speed is determined based upon geographical location.
*The Exposure and Importance Factors are needed to determine the uplift pressures.

If you have any questions, please call 800-321-9336 or respond to engineering@garlandind.com

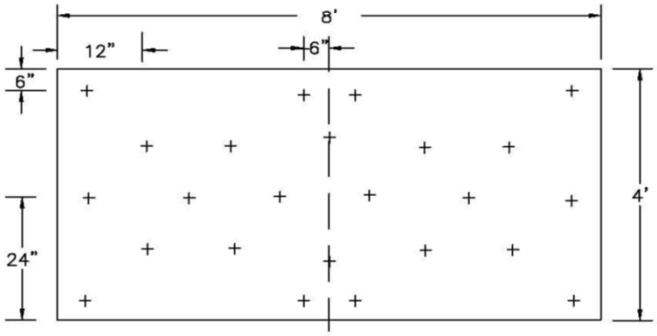
ZONE 1 INSULATION BOARD FASTENER PATTERN: 12 FASTENERS PER BOARD



ZONE 2 INSULATION BOARD FASTENER PATTERN: 18 FASTENERS PER BOARD



ZONE 3 INSULATION BOARD FASTENER PATTERN: 24 FASTENERS PER BOARD



THE GARLAND COMPANY, INC.
3800 EAST 91st STREET
CLEVELAND, OHIO 44105-2197
—PHONE 1-800-321-9336—
FAX 1-216-641-0633

DETAIL:

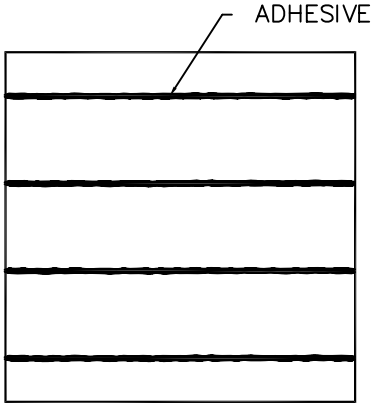
4 X 8 BOARD PATTERN

SECTION:

INSULATION BOARD FASTENER PATTERN

REV: 1 9/05

TYPICAL ZONE 1 INSULATION BOARD ADHESIVE PATTERN: 12" OC BEADS PER BOARD



4 ADHESIVE RIBBONS
EQUALLY SPACED AT
12" (15.2cm) O.C. (TYP.)

The Garland Company, Inc.
3800 East 91st Street
Cleveland, Ohio 44105-2197
Phone: (800) 321-9336 Fax (216) 883-2046

PROJECT	**Horizon Utilities**
ROOF SECTION	**Section 11**
DATE	**11/5/2013**
BASIC VELOCITY PRESSURE	**14.20** psf
DESIGN CODE	**ASCE 7-05**

System & Attachment Data

SYSTEM TYPE	Modified Bitumen
SYSTEM SCOPE	Modified Bitumen Cold
SURFACING	Coated Finish
ATTACHMENT METHOD	Mech/ Fasten Insul/Board
SUBSTRATE MATERIAL	Steel
SUBSTRATE THICKNESS	22 gauge
FASTENER TYPE	Steel: OMG Standard
FASTENER SAFETY FACTOR	3
ULTIMATE FASTENER PULLOUT	456 lbs/screw
ALLOWABLE FASTENER PULLOUT	152 lbs/clip

Building & Site Data

BASIC WIND SPEED	90	mph
EXPOSURE CATEGORY	B	
TOPOGRAPHY FACTOR	1.00	
BUILDING TYPE	Enclosed	
ROOF PITCH (X, Y)	0.25	12
RUN TO RIDGE	63	
EAVE HEIGHT	19	
DESIGN ROOF HEIGHT	19.00	ft
IMPORTANCE CLASS / FACTOR	III	1.15
MIN. BLDG WIDTH	126	ft
WIND-BORNE DEBRIS REGION	No	
PARAPET	No	
ROOF ANGLE	1.19	deg
PROTECTED OPENINGS	Yes	
ROOF TYPE	Gable	

	ZONE 1	ZONE 2	ZONE 3	ZONE 4	ZONE 5		
ROOF PRESSURE (psf)	16.8	28.1	42.3	16.6	20.4		
OVERHANG PRESSURE (psf)	24.14	24.14	39.76				
EDGE ZONE WIDTH "a" =	7.60	ft					

Executive Summary

Client: Horizon Utilities Corporation

Facility *	Section *	System Type	Age(years)	Square Footage	Leakage	Rating	Recommendation	Action Year
55 John Street North - Hamilton	Roof Area 11	Modified Bitumen	14 Year(s)	14,248	NO	Good	Restore	2015
55 John Street North - Hamilton	Roof Areas 1,2,3,4	Modified Bitumen	14 Year(s)	12,146	YES	Good	Restore	2014
55 John Street North - Hamilton	Roof Areas 5,6,7,8,9,10	Modified Bitumen	14 Year(s)	10,971	NO	Good	Restore	2016
Facility Total:				**37,365**				
Client Total:				**37,365**				

Cost Estimate

Client: Horizon Utilities Corporation

Facility *	Section *	System Type	Square Footage	Recommendation	Action Year	Cost Estimate
55 John Street North - Hamilton	Roof Area 11	Modified Bitumen	14,248	Restore	2015	$110,000.00
55 John Street North - Hamilton	Roof Areas 1,2,3,4	Modified Bitumen	12,146	Restore	2014	$145,000.00
55 John Street North - Hamilton	Roof Areas 1,2,3,4	Modified Bitumen	12,146	Repair	2014	$100,000.00
55 John Street North - Hamilton	Roof Areas 5,6,7,8,9,10	Modified Bitumen	10,971	Restore	2016	$100,000.00
Facility Total:						**$455,000.00**
Client Total:						**$455,000.00**

Priority Summary

Client: Horizon Utilities Corporation

Facility *	Section *	System Type	Age(years)	Leakage	Rating
Good					
55 John Street North - Hamilton	Roof Area 11	Modified Bitumen	14 Year(s)	NO	Good
55 John Street North - Hamilton	Roof Areas 1,2,3,4	Modified Bitumen	14 Year(s)	YES	Good
55 John Street North - Hamilton	Roof Areas 5,6,7,8,9,10	Modified Bitumen	14 Year(s)	NO	Good

Yearly Budget Summary

Client: Horizon Utilities Corporation

Facility *	Section *	Recommendation	Cost	Expected Life
Year: 2014				
55 John Street North - Hamilton	Roof Areas 1,2,3,4	Restore	$145,000.00	20 Year(s)
55 John Street North - Hamilton	Roof Areas 1,2,3,4	Repair	$100,000.00	30 Year(s)
Total for 2014:			**$245,000.00**	
Year: 2015				
55 John Street North - Hamilton	Roof Area 11	Restore	$110,000.00	15 Year(s)
Total for 2015:			**$110,000.00**	
Year: 2016				
55 John Street North - Hamilton	Roof Areas 5,6,7,8,9,10	Restore	$100,000.00	20 Year(s)
Total for 2016:			**$100,000.00**	

EGBERTS ENGINEERING LIMITED
CONSULTING ENGINEERS

November 15, 2013

Garland Canada
1290 Martingrove Road
Toronto, Ontario M9W 4X3

Att: Bryce Cheeseman

Re: Review of Roof deck at Horizon Utilities
55 John Street North, Hamilton
Toronto, Ontario, Our File 2013-158

Dear Client:

We were requested to review the roof deck at the above site to assess the capacity to support a revised roofing assembly. The existing modified bitumen roof is to be replaced by a 3 ply felt, hot asphalt and gravel ballast assembly.

It is our opinion that the proposed change in roofing materials is a safe proposal, with the added dead load returning to the original roof assembly and where measurements have allowed structural review, well within the load capacity of the roof structure measured on site.

SITE REVIEW

The site was reviewed with Shane McGowan, Garland Canada on October 10, 2013. The site is an assembly of numerous attached buildings and additions from an original building likely from around 1920; an original 3 story office tower possibly in the 1940's or 1950's which was changed to a 6 story building in 1960; plus a 1 level garage on the south side possibly in the range of 1970. No dates were provided and limited records have been located. While requests for existing building plans from the owner were not fruitful, a request to the Hamilton Building Department located a partial set of building permit plans showing various architectural, mechanical and electrical permit plans and some of the plans for the 3 story addition to the office tower.
Structural plans defining framing and design loads were generally not located at the City Building Department.

The site review was limited to the roof of the garage and portions of the original utility buildings at the rear of the site. The garage roof is conventional galvanized steel deck, supported by a steel beam and purlin assembly. The original utility building is a concrete slab, supported on rolled steel beams (ie American "I" shapes).

The roof of the tower could not be accessed due a vermiculite plaster ceiling, likely with diamond wire lath attached to the steel roof joists.

GARAGE ROOF

The roof area (see attached plan SK-1) is approximately 75 ft x 180 ft and is framed with deep steel beams (24 and 33" deep) spanning 40 ft and 55 ft, with 12" deep steel beam purlins between spanning just over 20 ft and spaced at 7 ft c/c. Standard galvanized steel roof deck (estimated as 1.5" deep x 18 ga) is placed over the top of the steel framing. There is no ceiling and limited mechanical distribution except for roof mounted equipment in specific locations.
Steel members were measured on site and evaluated using a steel grade customarily used in Canada from about 1965 to 1995 (ie 44 ksi or 300 MPa), based on the appearance and likely age of the structure.
Snow accumulation on this low roof adjacent to the 6 story office tower was considered in evaluating the steel framing and considerable live load capacity was found – in the range of 100 to 130 psf, allowing for 15 to 20 psf roofing and deck self-weight. This loading capacity well exceeds the required snow loads for this roof, and hence minor changes in the roofing dead load are acceptable and safe.
The steel roof deck was measured and is estimated as 18 ga (0.048") however measurement was difficult to obtain in the limited exposed edges that were available. The deck is adequate for the loads assuming this measurement is correct. A thinner deck guage would be deficient for the snow loads and would require reinforcing. The deck should be exposed and measured during roofing to verify capacity.

OFFICE TOWER ROOF

We were not able to readily access the roof structure due to a vermiculite plaster ceiling. This would have required considerable demolition, possible environmental issues and cleanup, before being able to access and measure the framing components.
We did obtain partial plans for the tower from the City Building Department, showing a three story addition to an existing three story building, and a roof framing plan was included. The plans specify a general roof load of 40 psf, without any added snow accumulation around the penthouse, and a dead load including a 2" concrete slab of 40 psf. The plans also show roofing details specifying "20 year felt and gravel roof". The roof framing may be described as: felt and gravel roofing, 2" concrete slab and steel deck, W10x15 steel purlins and W14 x30 or larger main steel beams; 7/8" vermiculite plaster ceiling, dropped acoustic ceiling with electrical and mechanical services generally located between the two ceilings.

We feel the dead load allowance used understated the actual conditions, and that 50 psf should have been used for the apparent roof construction, but the snow loading used in the original design (ie Live load in those days) is almost double the current required snow load of 22 psf. This provides some reserve capacity which may be used for added dead load.

Typical purlin beams (W10x15) and main roof beams within the main roof area (ie W14 x30 and W14 x 34), plus roof perimeter beams (W16x36) were design checked using likely A36 grade steel and all found to be more than adequate for the current and original design loads, allowing for a full felt and gravel roofing assembly and corrected over-all dead load of 50 psf. The purlin beams (which may be thought of as joists) were also checked for snow accumulation loads consistent with current Code requirements and a corrected dead load. They were found to still be adequate for the proposed roof revision.

ORIGINAL HYDRO BUILDING

The area reviewed is south of the elevator shaft and the room below is a part storage room. This original roof was constructed as an 8" concrete slab over steel beams. Three steel beams were measured and design-checked. A low grade A36 steel was assumed to have been used for this construction although grades slightly lower at 33,000 psi yield may have been used. The available live (ie snow) load, allowing for an 8" concrete roof slab and a conventional felt and gravel roof, varies from 75 to 145 psf. The required current basic snow loading is 22 psf, increasing to about 40 psf, due to snow accumulation against the elevator walls and mechanical screens. There is sufficient capacity in this area to allow an increase in roofing dead load.

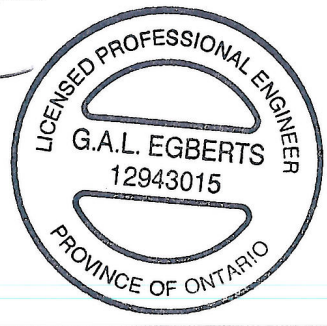
CONCLUSION

There is sufficient capacity in the three roof areas reviewed to allow an increase in the roofing dead load assembly. Documents indicate that the original roofing assembly on the office tower was similar to the proposed roofing replacement.

However the roof deck over the garage, immediately adjacent to the tower perimeter could be deficient to support snow accumulation against the tower walls. It is recommended that the deck edges be exposed clearly and guage be confirmed while roofing is installed. Should reinforcing be deemed required this can be implemented from below, independent of roofing operations.

Yours very truly,

G.A.L.Egberts, M.Eng. P.Eng.
EGBERTS ENGINEERING LIMITED

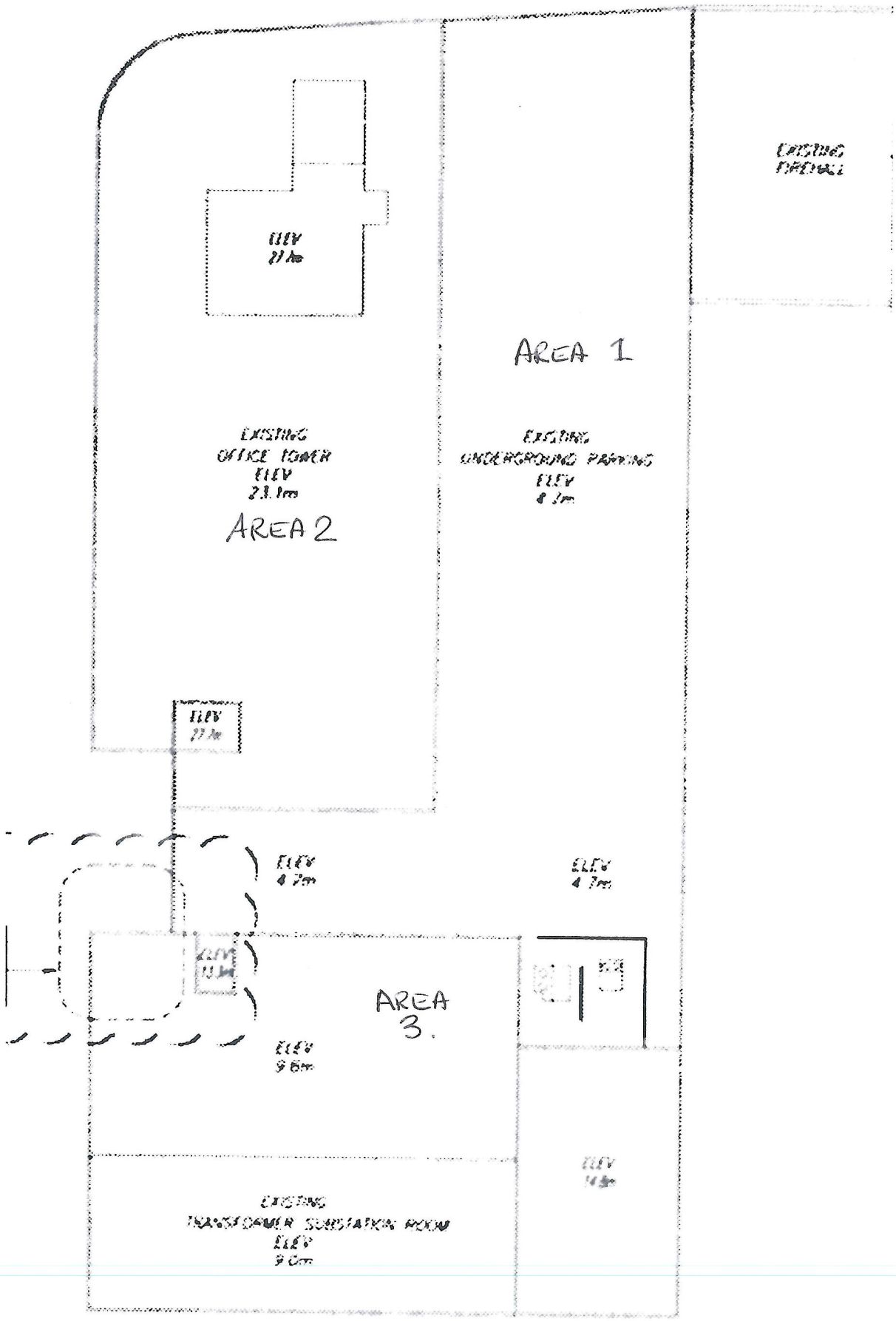


ATTACHMENTS

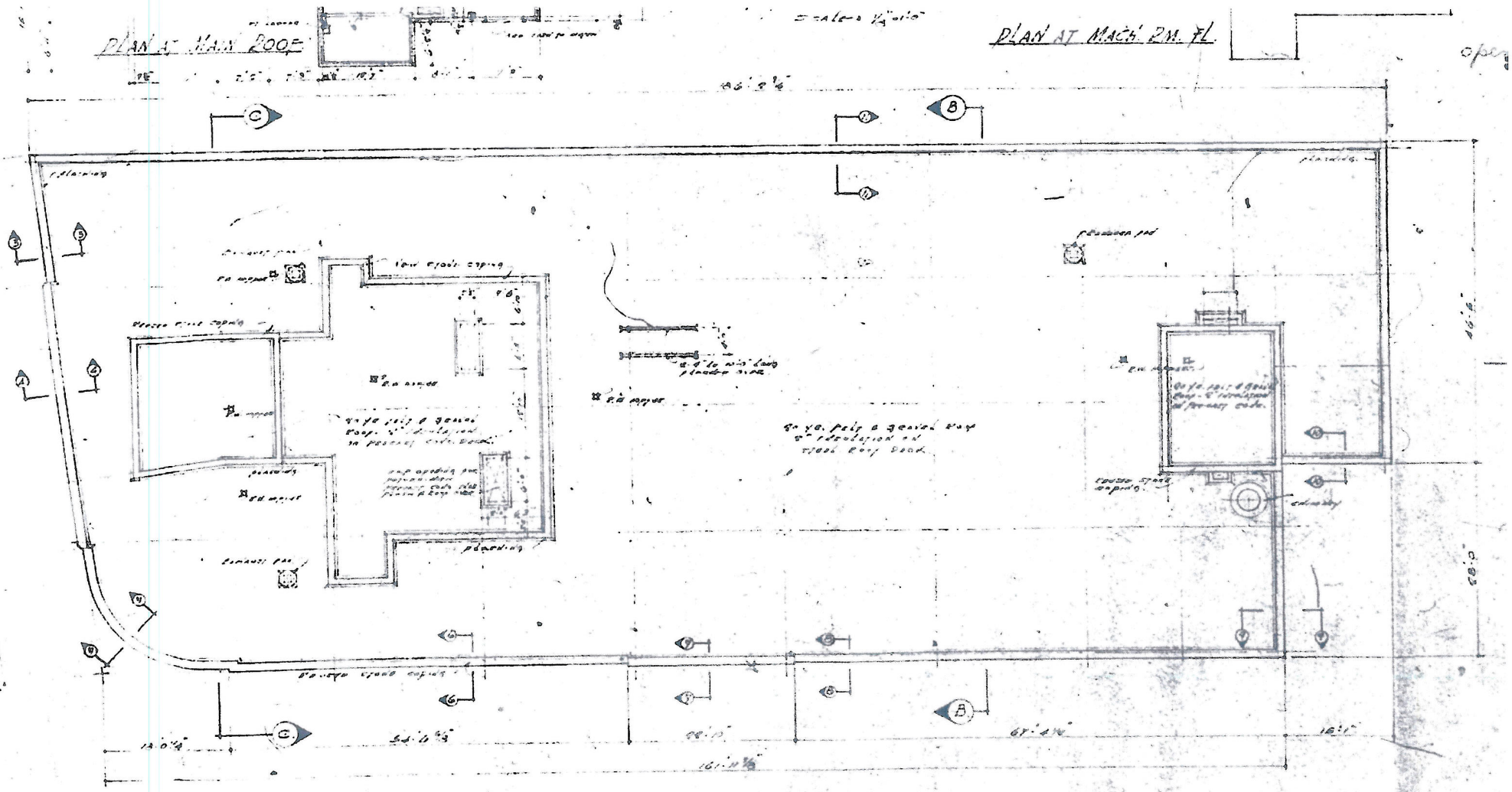
1. Roof key plan – Area 1: Garage roof; Area 2 : Office Tower roof; Area 3 Original Hydro Building

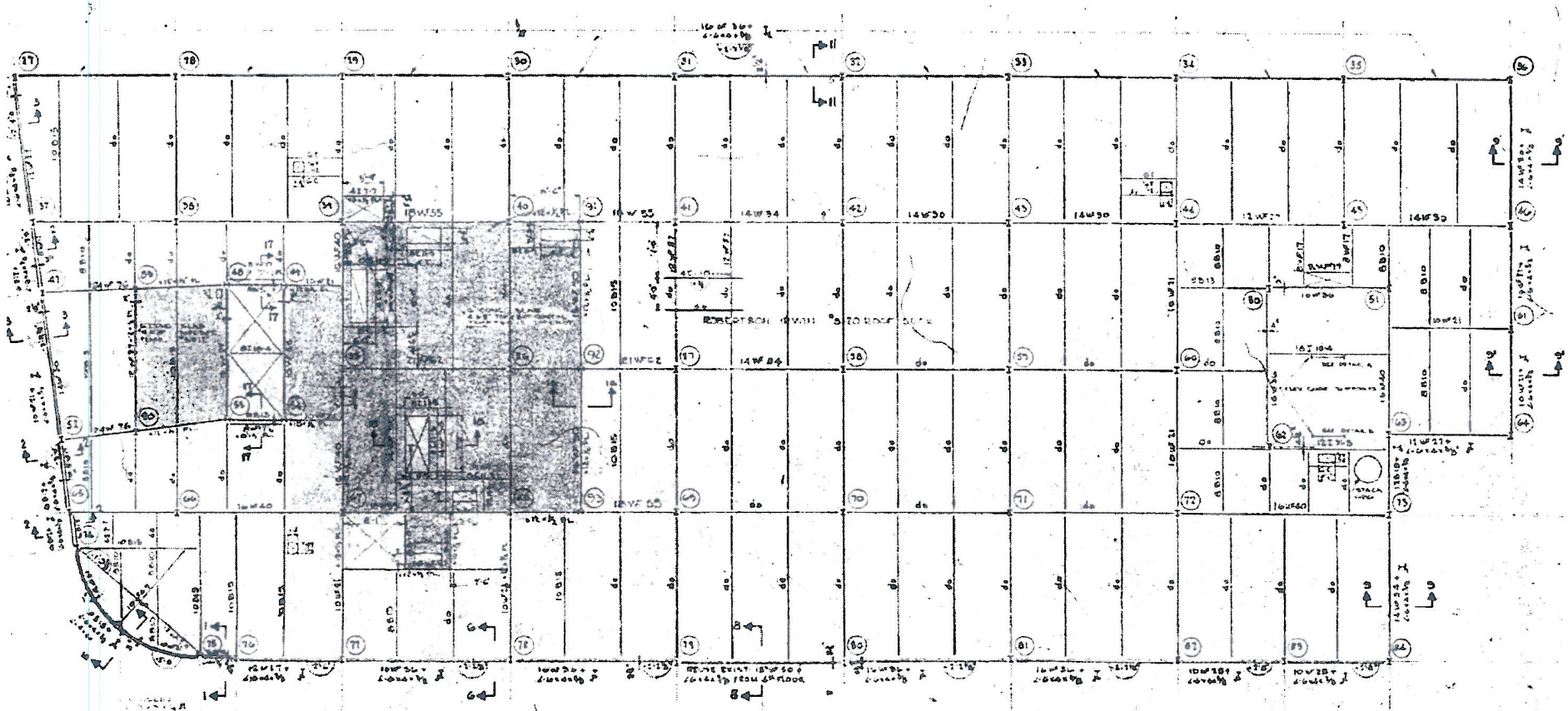
2. Roof plan of the Office Tower

3. Framing plan for the Office Tower



ROOF KEY PLAN


PLAN AT MAIN ROOF
PLAN AT MACH. RM. FL.
ROOF PLAN
1960 TOWER



ROOF FRAMING PLAN

BUILT-UP ROOF RESTORATION – SECTION 07562

PART 1 GENERAL

1.1 SECTION INCLUDES

Restoration system over the properly prepared gravel surfaced built-up and mineral surface roof system.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals.
B. Detail Drawings
    1. Coping Cap – Cold Applied
    2. Expansion Joint – Cold Applied
    3. Gravel Finish – Cold Applied
    4. Internal Drain - Cold Applied

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
    1 ASTM D451- Test Method for Sieve Analysis of Granular Mineral Surfacing for Asphalt Roofing Products.
    2 ASTM D1079- Terminology Relating to Roofing, Waterproofing and Bituminous Materials.
    3 ASTM D1227- Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
    4 ASTM D1863- Specification for Mineral Aggregate Used as a Protective Coating for Roofing.
    5 ASTM D2822- Specification for Asphalt Roof Cement.
    6 ASTM D2824- Specification for Aluminum-Pigmented Asphalt Roof Coating.
    7 ASTM D4601- Specification for Asphalt Coated Glass Fiber Base Sheet Used in Roofing.
    8 ASTM D5147- Test Method for Sampling and Testing Modified Bituminous Sheet Materials.
    9 ASTM D6162- Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.
    10 ASTM D6163- Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.
    11 ASTM E108- Test Methods for Fire Test of Roof Coverings.
    12 ASTM D41 Standard Specification for Asphalt Primer Used in Roofing, Dampproofing and Waterproofing.

B. Factory Mutual Research (FM):
    1. Roof Assembly Classifications.

C. National Roofing Contractors Association (NRCA) Canadian Roofing Contractors Association (CRCA):
    1. Roofing and Waterproofing Manual.

D. Underwriters Laboratories, Inc. (UL):

1. Fire Hazard Classifications.

E. Warnock Hersey (WH):
1. Fire Hazard Classifications.

1.4 SYSTEM DESCRIPTION

It is the intent of this specification to install a long-term, quality restoration system that meets or exceeds all current NRCA (CRCA) guidelines as stated in the most recent edition of the NRCA(CRCA) Roofing and Waterproofing Manual. Please discuss any concerns with the Owner and Roofing System Manufacturer.

1.5 SUBMITTALS FOR REVIEW

A. Product Data: Provide manufacturer's technical product data for each type of roofing product specified. Include data substantiating that materials comply with specified requirements.

1. Samples: Submit [two (2)] samples of the following:

i). 1 lb. sample of roofing aggregate for review to meet minimum SRI.

ii). 1 quart quart of each bituminous material

iii). 12" x 12" sample of each roll membrane

2. Specimen Warranty: Provide an unexecuted copy of the warranty specified for this Project, identifying the terms and conditions required of the Manufacturer and the Owner.

B. Manufacturer's Installation Instructions: Submit installation instructions and recommendations indicating special precautions required for installing the membrane.

C. Manufacturer's Certificate: Submit a certified copy of the roofing manufacturer's ISO 9001 compliance certificate and has approved third party testing facility in accordance with ASTM E108, Class [A or B or C] for external fire and meets local or nationally recognized building codes.

D. Test Reports: Submit test reports, prepared by an independent testing agency, for all modified bituminous sheet roofing, indicating compliance with ASTM D5147.

E. Written certification from the roofing system manufacturer certifying the applicator is currently authorized for the installation of the specified roof system.

F. Any material submitted as equal to the specified material must be accompanied by a report signed and sealed by a professional engineer licensed in the state in which the installation is to take place. This report shall show that the submitted equal meets the Design and Performance criteria in this specification. Substitution requests submitted without licensed engineer approval will be rejected for non-conformance.

G. Qualification data for firms and individuals identified in Quality Assurance Article below.

H. Submit under provisions of Section 01300.

1.6 CONTRACT CLOSEOUT SUBMITTALS

A. General: Comply with Requirements of Division 01 Section - Closeout Submittals.

B. Special Project Warranty: Provide specified warranty for the Project, executed by the authorized agent of the Manufacturer.

C. Roofing Maintenance Instructions. Provide a manual of manufacturer's recommendations for maintenance of installed roofing systems.

D. Insurance Certification: Assist Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on roofing and associated work.

E. Demonstration and Training Schedule: Provide a schedule of proposed dates and times for instruction of Owner's personnel in the maintenance requirements for completed roofing work. Refer to Part 3 for additional requirements.

1.7 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section to have ISO 9001 certification.

B. Installer: Company specializing in roof restoration, with not less than 10 years experience and authorized by roofing system manufacturer as qualified to install manufacturer's roofing materials

C. Installer's Field Supervision: Maintain a full-time Supervisor/Foreman on job site during all phases of roofing work and at any time roofing work is in progress. Maintain proper supervision of workmen. Maintain a copy of the specification**s** in the possession of the Supervisor/Foremen and on the roof at all times.

D. Immediately correct roof leakage during construction. If the Contractor does not respond within twenty four (24) hours, the Owner has the right to hire a qualified contractor and backcharge the original contractor.

E. Insurance Certification: Assist Owner in preparation and submittal of roof system installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on the roofing and associated work.

1.8 PRE-INSTALLATION CONFERENCE

A. Pre-Roofing Conference: Convene a pre-roofing conference approximately two (2) weeks before scheduled commencement of restoration system application and associated work**.**

B. Require attendance of installer of each component of associated work, installers of deck or substrate construction to receive roofing work, installers of rooftop units and other work in and around roofing which must precede or follow roofing work (including mechanical work if any), Architect, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of the Work, including (where applicable) Owner's insurers, testing agencies and governing authorities.

C. Objectives of conference to include:

1. Review foreseeable methods and procedures related to roofing work.

2. Tour representative areas of roofing substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work performed by others.

3. Review roofing system requirements

4. Review required submittals both completed and yet to be completed.

5. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.

6. Record discussion of conference including decisions and agreements (or disagreements) reached and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.

7. Review notification procedures for weather or non-working days.

8. The Owner's Representative will designate one of the conference participants to record the proceedings and promptly distribute them to the participants for record.

9. The intent of the conference is to resolve issues affecting the installation and performance of roofing work. Do not proceed with roofing work until such issues are resolved to the satisfaction of the Owner and Consultant of Record. This shall not be construed as interference with the progress of Work on the part of the Owner or Consultant of Record.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site with seals and labels intact, in manufacturer's original containers, dry and undamaged.

B. Store and handle roofing sheets in a dry, well-ventilated, weather-tight place to ensure no possibility of significant moisture exposure. Store rolls of felt and other sheet materials on pallets or other raised surface. Stand all roll materials on end. Cover roll goods with a canvas tarpaulin or other breathable material (not polyethylene).

C. Do not leave unused materials on the roof overnight or when roofing work is not in progress unless protected from weather and other moisture sources.

D. It is the responsibility of the contractor to secure all material and equipment on the job site. If any material or equipment is stored on the roof, the contractor must make sure that the integrity of the deck is not compromised at any time. Damage to the deck caused by the contractor will be the sole responsibility of the contractor and will be repaired or replaced at his expense.

1.10 MANUFACTURER'S INSPECTIONS

When the project is in progress, the roofing system manufacturer will provide the following:

A. Keep the Owner's representative informed as to the progress and quality of the work

B. Provide job site inspections a minimum of four days a week and/or on a daily basis when work is being performed.

C. Report to the Owner's representative in writing any failure of refusal of the Contractor to correct unacceptable practices called to the Contractor's attention.

D. Confirm after completion that manufacturer has observed no applications procedures in conflict with the specifications other than those that may have been previously reported and corrected.

1.11 PROJECT CONDITIONS

A. Weather Condition Limitations: Do not apply roofing membrane during inclement weather or when a 40% chance of precipitation is expected.

B. Materials shall be stored at room temperature until immediately prior to application when the ambient temperature is 40F, 5C or below. Discontinue the application if the material cannot be stored at a temperature, which permits even distribution during application.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

D. Proceed with roofing work only when existing and forecasted weather conditions will permit unit of work to be installed in accordance with manufacturer's recommendations and warranty requirements.

E. When applying materials with spray equipment, take precautions to prevent over spray from damaging or defacing surrounding walls, building surfaces, vehicles or other property.

F. Avoid inhaling spray mist; take precautions to ensure adequate ventilation.

G. Protect completed roof sections from foot traffic until fully cured.

H. Take precautions to ensure that materials do not freeze.

I. Minimum temperature for application is 40F, 5C and rising.

J. Do not apply materials if rain is imminent.

K. All slopes greater than 2:12 require back-nailing to prevent slippage of the ply sheets. Use ring or spiral-shank one (1) inch cap nails, or screws and plates at a rate of one (1) fastener per ply (including the membrane) at each insulation stop. Place insulation stops at 16 ft o.c. for slopes less than 3:12 and four (4) ft o.c. for slopes greater than 3:12. On non-insulated systems, nail each ply directly into the deck at the rate specified above. When slope exceeds 2:12, install all plies parallel to the slope (strapping) to facilitate backnailing. Install four (4) additional fasteners at the upper edge of the membrane when strapping the plies.

1.12 SEQUENCING AND SCHEDULING

A. Sequence installation of restoration system with related units of work specified in other sections to ensure that roof assemblies including roof accessories, flashing, trim and joint sealers are protected against damage from effects of weather, corrosion and adjacent construction activity.

B. Fully complete all roofing field assembly work each day. Phased construction will not be accepted.

1.13 WARRANTY

A. Upon completion of installation, and acceptance by the Owner and Owner's representative, the manufacturer will supply to the Owner a ten (10) year warranty.

B. Installer will submit a minimum of a two (2) year warranty to the membrane manufacturer with a copy directly to Owner.

C. Membrane manufacturer will provide an annual inspection for the life of the warranty.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. When a performance standard is specified it shall be indicative of a standard required.

B. Roof restoration system, including modified flashing plies must meet the provisions identified within Sections 01300.

C. Any item or materials submitted must comply in all respects as to the quality and performance specified. The Owner's representative/Owner shall be the sole judge as to whether or not an item submitted as a substitute is truly equal. The Contractor shall assume all monetary or other risk involved, should the Owner's representative/Owner find the proposed system unacceptable.

D. Substitutions: Products proposed as equal to the products specified in this Section shall be submitted in accordance with Bidding Requirements and Division 01 provisions.

1. Proposals shall be accompanied by a copy of the manufacturer's standard specification section. That specification section shall be signed and sealed by a professional engineer licensed in the state in which the installation is to take place. Substitution requests containing specifications without licensed engineer certification shall be rejected for non-conformance.
2. Include a list of three (3) projects of similar type and extent, located within a one hundred mile radius from the location of the project. In addition, the three projects must be at least five (5) years old and be available for inspection by the Owner or Owner's Representative.
3. Equivalency of performance criteria, warranty terms, submittal procedures, and contractual terms will constitute the basis of acceptance.
4. The Owner's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

2.2 DESCRIPTION

1. **Restoration** – Built Up Roof work including but not limited to:

   A. A rubberized, heavy bodied fibered reinforced, fire-rated restoration treatment designed to restore the weathering surface of modified membrane systems.

   B. Modified Flashing Plies:

      1. Modified Cap Flashing Ply: Modified Membrane: 145 mil SBS and SIS (Styrene-Butadiene-Styrene and Styrene-Isoprene-Styrene) rubber modified membrane incorporating post consumer recycled rubber and reinforced with a fiberglass and polyester composite scrim

2. **Spot Replacement** - Built up and mineral surface spot replacement roofing work including but not limited to:

   A. Minimum (2) plies - Approved SBS torch applied base and SBS (Styrene-Butadiene-Styrene) modified cap sheet. The base sheet shall meet and/or exceed ASTM D 6163, Type II with a minimum tensile of 210 lbf./in and tear strength of 250 lbf., with a nominal thickness of 110 mil. The modified cap sheet shall be SBS (Styrene-Butadiene-Styrene) rubber modified roofing membrane reinforced with a fiberglass and polyester composite scrim. This membrane is designed for torch applications and has a burn-off backer that indicates when the material is hot enough to be installed. The cap sheet shall meet or exceed ASTM D 6162, Type III with a minimum tear strength of 310 lbf/in. and tear strength of 510 lbf, with a nominal thickness of 180 mils. It must also have a low temperature flexibility of -40 degrees Celsius.
   bonded to the prepared substrate (same thickness as existing insulation, combination of ISO and ½" protection board with approved insulation adhesive. Add one layer of modified bitumen cap sheet, as above.

   B. VOC compliant adhesive requirements between insulation boards are as follows:

- Tensile Strength ASTM D 412-92	250 psi
- Density ASTM D 1875-90	8.5 lb/gal.
- Viscosity ASTM D 2556-93a	22000 – 60000 cP
- Peel Strength ASTM D903	17 lb./in.
- Flexibility ASTM D 816-82	Pass @ -56.7 Celsius
- VOC status	0 g/l

C. Installation requirements: The old membrane/system shall be removed down to the deck and disposed at an authorized dumpsite. Concrete deck shall be prepared by filling any honeycombing and imperfections in deck surface with latex filler. The vapour barrier shall be created by installing a torch applied fiberglass ply using a suitable heat source adhere one ply to the entire surface. Shingle in direction of slope of roof to shed water on each roof area. For a metal deck, the deck shall be verified for any corrosion and treated as required. Note the owner and consultant must be notified immediately if the deck is to be treated or replaced.

1. Install one layer of SBS Torch Base Sheet to a properly prepared substrate. Shingle in proper direction to shed water on each area of roofing.

2. To a suitable substrate, lay out the roll in the course to be followed and unroll six (6) feet (1.8m).

3. Using a roofing torch, heat the surface of the coiled portion until the burn-off backer melts away. At this point, the material is hot enough to lay into the substrate. Progressively unroll the sheet while heating and press down with your foot to insure a proper bond.

4. After the major portion of the roll is bonded, re-roll the first six (6) feet (1.8m) and bond it in a similar fashion.

5. Repeat this operation with subsequent rolls with side laps of four (4) inches (101mm) and end laps of eight inches.

6. Give each lap a finishing touch by passing the torch along the joint and spreading the melted bitumen evenly with a rounded trowel to insure a smooth, tight seal.

7. Extend underlayment two (2) inches (50mm) beyond top edges of cants at wall and projection bases.

8a) Install modified capsheet. Over the SBS Torch Base Sheet underlayment(s), lay out the roll in the course to be followed and unroll six (6) feet. Seams for the top layer of modified membrane will be staggered over the SBS Torch Base Sheet seams.

b) Using a roofing torch, heat the surface of the coiled portion until the burn-off backer melts away. At this point, the material is hot enough to lay into the

substrate. Progressively unroll the sheet while heating and press down with your foot to insure a proper bond.

D. A minimum two-hour fire watch is required for each day that torch-applied membranes are installed.

E. Keep an ABC rated fire extinguisher in a central location where all workers know where it is and how to operate in properly

2.3 BITUMINOUS MATERIALS

A. Asphalt Primer: V.O.C. compliant, ASTM D41.

B. Asphalt Roofing Mastic: V.O.C. compliant, ASTM D2822, Type II.

C. Flashing Adhesive: V.O.C. complaint, ASTM D 4586, Type II, Class I, having the following:

- Viscosity @77_F	7 sec.
- Density @77_F	8.3 lb/gal.
- Non-Volatile (ASTM D4479)	Typical 70%
- Flash Point (ASTM D93)	39.4 C min.
- VOC Status	200 g/l max.

D. Resaturant: Heavy-bodied, rubberized, fiber reinforced, fire rated, low solvent, Class A approved, having the following characteristics:

- Viscosity @77_F	20-25 sec.
- Density @77_F	9.1 lb/gal.
- Non-Volatile (ASTM D4479)	Typical 75%
- Asphalt Content (ASTM D4479)	Typical 63 I%
- Uniformity (ASTM D4479)	Pass
- VOC Status	285 g/l max.

2.4 SHEET MATERIALS

A. Modified Base Flashing Ply: (for replacement only)

40 mil SBS modified membrane with dual fiberglass scrim reinforcement with the following minimum performance requirements according to ASTM D-5147.

Tensile Strength (ASTM D5147)		
2 in/min. @73.4 ± 3.6°F	MD 215 lbf/in	CMD 215 lbf/in
Tear Strength (ASTM D-5147)		
2 in/min. @ 73.4 ± 3.6°F	MD 275 lbf	CMD 275 lbf

Elongation at Maximum Tensile (ASTM D-5147)

2 in/min. @ 73.4 ± 3.6°F MD 4.5% CMD 4.5%

Low Temperature Flexibility (ASTM D5147): Passes -30°F (-34°C)

B. Modified Cap Flashing Ply:

Modified Membrane Properties (Finished Membranes); ASTM D6162, Type III Grade G

1. Tensile Strength (ASTM D5147)

   a. 2 in/min. @ 73.4 ± 3.6°F MD 1,000 lbf/in CMD 1,100 lbf/in

   b. 50 mm/min. @ 23 ± 3°C MD 175 kN/m CMD 192.5 kN/m

2. Tear Strength (ASTM D5147)

   a. 2 in/min. @ 73.4 ± 3.6°F MD 1,700 lbf CMD 1,800 lbf

   b. 50 mm/min. @ 23 ± 3°C MD 7,561.6 N CMD 8,006.4 N

3. Elongation at Maximum Tensile (ASTM D5147)

   a. 2 in/min. @ 73.4 ± 3.6°F MD 16.0% CMD 16.0%

   b. 50 mm/min. @ 23 ± 3°C MD 16.0% CMD 16.0%

4. Low Temperature Flexibility (ASTM D5147): Passes -40°F (-40°C)

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive associated work and conditions under which roofing will be installed. Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to installer. A Thermographic scan with full drawing is to be done and paid for by the contractor, which is to include all core cuts. Three hard copies of a complete TS report are to be submitted to the owner, submit one PDF copy of the report to the owner.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Cooperate with manufacturer, inspection and test agencies engaged or required to perform services in connection with installing the roof system.

B. Insurance/Code Compliance: Where required by code, install and test the roofing system to comply with governing regulation and specified insurance requirements.

C. Protect other work from spillage of roofing materials and prevent materials from entering or clogging drains and conductors. Replace or restore other work damaged by installation of the roofing system to match existing.

D. Coating shall be applied per manufacturers application instructions for the type of coating used.

E. Apply roofing materials as specified herein unless recommended otherwise by manufacture's instructions. Keep roofing materials dry during application. Do not permit phased construction.

3.3 CLEANING AND SURFACE PREPARATION

A. All defects such as deteriorated roof decks, saturated insulation board, etc. must be repaired or replaced per roof system manufacturer specifications prior to application of the restoration materials.

B. Remove all loose roofing gravel, dirt and foreign debris from the roof surface.

C. Do not damage roof membrane in cleaning process.

D. All surface defects (splits, blisters, tears) must be repaired:

E. Blister Repair

1. Clean and prime the area.
2. All blisters must be cut and opened down to the solidly adhered plies of the existing roof system. Use a roofer's knife to open the blister with an "X" or "H" cut. Fold the flaps and remove any existing moisture. Permit the area to dry before applying repair materials.
3. Apply a liberal coating of bituminous material into the blister. Firmly press the flaps into the bituminous material and trim the edges to ensure proper fit.
4. Apply a coating of bituminous material over the repaired area extending a minimum of eight (8) inches beyond the cuts. Install a torch applied modified cap sheet, same as indicated for the spot replacement ensuring there is good bleed out along the seams of the torched down membrane.

F. Edge Detail Repair

1. Remove all loose dirt and debris along the edge detail and prime with an asphalt primer.
2. Secure all loose metal to the wood nailer.
4. Install a bond breaker at moving joints.
4. Apply a liberal coat of mastic over the prepared area and embed fabric into the mastic.
5. Apply a liberal coat of mastic over the fabric. Sufficiently cover the fabric to

obliterate the weave from sight.
6. Apply surfacing to the repair.

G. Pitch Pocket Repair/Drains
1. Fill the pitch pocket with an elastomeric roof cement. Taper the mastic at the edge of the pitch pocket to ensure water run-off.
2. Clean and prime the area with an asphalt primer.
3. Apply a liberal coating of mastic around the pitch pocket extending a minimum of twelve (12) inches onto the horizontal roofing surface.
4. Cut four (4) strips of fabric. Each strip should be twelve (12) inches wide and be of sufficient length so as to extend a minimum of twelve (12) inches beyond the pitch pan.
5. Embed a strip into the mastic along each side of the pitch pocket. Brush or roll the fabric into place to ensure proper embedment.
6. Top dress the area with mastic.
7. Install rain bonnet, draw band and caulk.
8. All drains to be installed are to be as detail drawings.

3.4 MODIFIED FLASHING INSTALLATION

A. Prepare all walls, penetrations and expansion joints to be flashed and where shown on the drawings, with asphalt primer at the rate of one hundred (100) square feet per gallon. Allow primer to dry tack free.

B. With trowel grade mastic, the modified membrane will be used as the flashing and nailed off 12” O.C. at all vertical surfaces. Around the perimeter edge the membrane will be run up the cant across the top and nail 6” O.C on the outer edge.

C. The entire sheet of flashing membrane must be solidly adhered to the substrate. All flashing shall be 36” wide at maximum with a 4” overlap at seems.

D. Seal all vertical laps of flashing membrane with a three-course application of one part elastomer and fiberglass mesh.

E. Seal junction of flashing membrane and roof with a three-course application of cold flashing adhesive and 6” mesh.

F. All metal flashings, (counter-flashings, met cap flashings, expansion joints caps and similar work) are to receive new 26 gauge prepainted metal (colour to match existing). Perimeter metal details will require a continuous starter strip secured 18” O.C. Metal is to have s-locks and is to be secured by use of screws in the s-locks. There are not to be any fasteners through the metal into the cant. Do not fasten metal through face of flashing.

G. When metal wall panels are present, the fasteners are to be loosened to allow the panel to be pulled away from the wall. The flashing membrane shall go up the wall a minimum of 12” and be fastened with an aluminum termination bar 6” O.C. A bead of one part elastomer is to be put along the top edge of the membrane and termination bar. All flashing membrane is to extend a minimum of 9” on to the roof surface.

3.5 COATING APPLICATION

A. Remove debris from roof surface and make necessary repairs as specified in 3.3.D.

B. Apply primer to roof surface as required per manufacturer's instructions.

C. Brush, spray or squeegee the restoration material onto the roof surface at a rate of not less than seven (7) gallons per one hundred (100) square feet.

D. Immediately embed white calcite aggregate conforming to ASTM D-1549 Solar Reflectance with a minimum solar reflectance index (SRI) of 83, at a nominal rate of five hundred (500) pounds per one hundred (100) square feet. Ensure that none of the black resaturant can be seen throughout the field.

3.6 FIELD QUALITY CONTROL

A. Perform field inspection as required.

B. Correct defects or irregularities discovered during field inspection.

C. Require attendance of roofing materials manufacturers' representatives at site during installation of the roofing system.

3.7 CLEANING

A. Remove bitumen adhesive drippings from all walls, windows, floors, ladders and finished surfaces.

B. In areas where finished surfaces are soiled by asphalt or any other sources of soiling caused by work of this section, consult manufacturer of surfaces for cleaning instructions and conform to their instructions.

C. Repair or replace defaced or disfigured finishes caused by work of this section.

3.8 FINAL INSPECTION

A. At completion of roofing installation and associated work, meet with Contractor, installer, installer of associated work, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of roofing system.

B. Walk roof surface areas of the building, inspect perimeter building edges as well as flashing of roof penetrations, walls, curbs and other equipment. List all items requiring correction or completion and furnish copy of list to each party in attendance.

C. The roofing system manufacturer reserves the right to request a thermographic scan of the roof during final inspection to determine if any damp or wet materials have been installed. The thermographic scan shall be provided by the Roofing Contractor.

D. If core cuts verify the presence of damp or wet materials, the Roofing Contractor shall be required to replace the damaged areas at his own expense.

E. Repair or replace deteriorated or defective work found at time above inspection as required to a produce an installation which is free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

F. Notify the Owner upon completion of corrections.

G. Following the final inspection, provide written notice of acceptance of the installation from the roofing system manufacturer.

3.9 BUILDING SPECIFIC

A. All gas lines are to be coated with 2 coats of epoxy fortified rust coating.

B. Blueboard insulation is to be placed under all wood blockings and aluminized (insulation only). All defective wood blocking is to be replaced with new quick blocks of similar sizing. Hold down anchors for piping are to be replaced where replacement blocking occurs.

C. Coat all rusted units and stacks with 2 coats of aluminized rust coating.

END OF SECTION

SUBMITTALS – SECTION 01300

PART 1 – GENERAL

1.1 Related Sections

.1 Section 07562: Roof Restoration

1.2. Material Performance

.1 Resaturant

The modified cold process restoration coating to be employed shall be ratable to Class A, rubberized, heavy bodied fibered reinforced, fire-rated restoration treatment designed to restore the weathering surface of gravel surfaced BUR and modified membrane systems.

The modified restoration material to be employed shall meet or exceed the following ASTM standards:

A. Non-Volatile (ASTM D 4479) – Typical 75%

B. Asphalt Content (ASTM D 4479) – Typical 63 l%

C. Flash Point (ASTM D 93) - >100 degrees F.

D. Uniformity (ASTM D 4479) – Pass

E. VOC Status – 285 g/l maximum

F. Viscosity @ 77 degrees _F - 20-25 seconds

G. Density @ 77 degrees _F - 9.1 lb/gal.

2. Modified Base Flashing Ply (spot replacement only)

40 mil SBS modified membrane with dual fiberglass scrim reinforcement having the following minimum performance requirements according to ASTM D-5147.

Tensile Strength (ASTM D5147) 2 in/min. @73.4 ± 3.6°F	MD 210 lbf/in	CMD 210 lbf/in
Tear Strength (ASTM D-5147) 2 in/min. @ 73.4 ± 3.6°F	MD 275 lbf	CMD 275 lbf
Elongation at Maximum Tensile (ASTM D-5147) 2 in/min. @ 73.4 ± 3.6°F	MD 4%	CMD 4%

Low Temperature Flexibility (ASTM D5147): Passes -30°F (-34°C)

3. Modified Cap Flashing Ply (flashing only)

Modified Membrane Properties (Finished Membranes); ASTM D6162, Type III Grade G

1. Tensile Strength (ASTM D5147)

a. 2 in/min. @ 73.4 ± 3.6°F MD 1,000 lbf/in CMD 1,100 lbf/in

b. 50 mm/min. @ 23 ± 3°C MD 175 kN/m CMD 192.5 kN/m

2. Tear Strength (ASTM D5147)

a. 2 in/min. @ 73.4 ± 3.6°F MD 1,700 lbf CMD 1,800 lbf

b. 50 mm/min. @ 23 ± 3°C MD 7,561.6 N CMD 8,006.4 N

3. Elongation at Maximum Tensile (ASTM D5147)

a. 2 in/min. @ 73.4 ± 3.6°F MD 16.0% CMD 16.0%

b. 50 mm/min. @ 23 ± 3°C MD 16.0% CMD 16.0%

4. Low Temperature Flexibility (ASTM D5147): Passes -40°F (-40°C)

4. Modified Cap Flashing Ply (field only for spot replacement)

Modified Membrane Properties (Finished Membranes): ASTM D6162, Type III Grade S

1. Tensile Strength (ASTM D5147)

a. 2 in/min. @ 73.4 ± 3.6°F MD 310 lbf/in CMD 310 lbf/in

b. 50 mm/min. @ 23 ± 3°C MD 54.2 kN/m CMD 54.2 kN/m

2. Tear Strength (ASTM D5147)

a. 2 in/min. @ 73.4 ± 3.6°F MD 510 lbf CMD 510 lbf

b. 50 mm/min. @ 23 ± 3°C MD 2269 N CMD 2269 N

3. Elongation at Maximum Tensile (ASTM D5147)

a. 2 in/min. @ 73.4 ± 3.6°F MD 6.0% CMD 6.0%

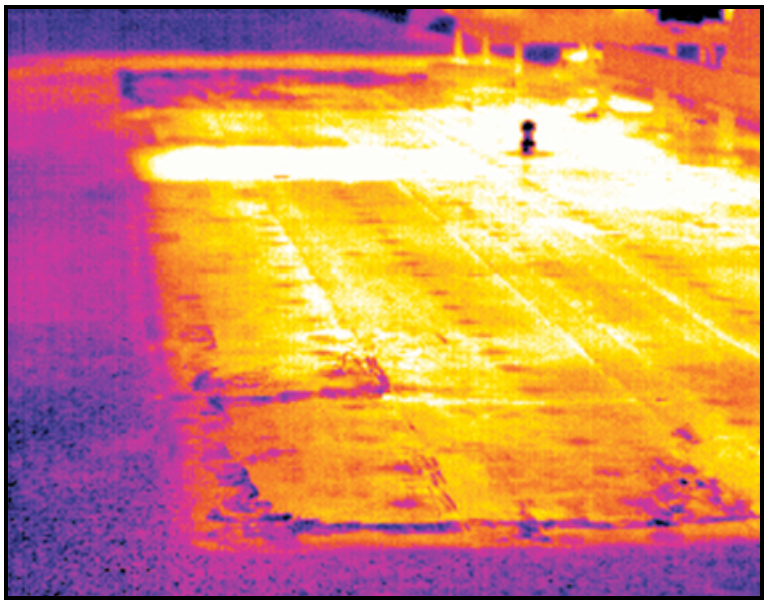
b. 50 mm/min. @ 23 ± 3°C MD 6.0% CMD 6.0%

4.Low Temperature Flexibility (ASTM D5147): Passes -40°F (-40°C)

END OF SECTION

No Funds for Replacement? Consider Restoration.

By Tom Stuewe



When moisture penetration is suspected, analytical testing of a core sample may be required. This infrared scan reveals wet insulation that visual inspection alone could not detect.

Restoration can be a viable interim solution for prolonging the service life of building roofs. This is particularly true for roofs that have already been recovered one or more times since restorations add minimal weight, compared to installing a new roof on top of an existing one. Typically, building codes require a total tear-off and reroofing after a maximum of two layers of roofing.

In addition, since the federal government expects you to depreciate your commercial roofs over a 39-year period, it makes sound economic sense to do everything possible to extend roof life to meet that standard if at all possible. Unlike reroofing, restorations are financed through maintenance rather than capital budgets, offering financial advantages at tax time.

Fortunately, the roofing industry offers a number of cost-effective, highly proven solutions for restoring older, but still sound, roofs. Today's high-tech restoration coatings can add 10 to 15 years of service life to an existing roof system. The average cost for restoration is $3-5 per square foot, compared to $7 to $12 per square foot for roof replacement, a figure that can rise substantially if continued neglect results in damage to the underlying deck.

Restoration options are available for virtually every type of roof system, including:

- Asphalt-based gravel-surfaced modified bitumen/built-up roofs
- Asphalt-based smooth or mineral surfaced modified bitumen/built-up roofs
- Coal-tar-based gravel-surfaced built-up roofs
- Single-ply roofs
- Metal roofs

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Benefits Beyond the Obvious

Compared to roof replacement, restoration offers a host of benefits that add up to savings, including:

- **Tax credits and energy rebates —** Depending on geographic location, tax credits and other valuable financial incentives may be available for implementing solutions that can be independently verified (e.g., through ENERGY STAR®[1] qualification, LEED®[2] point contribution, etc.) to improve energy efficiency.
- **Maintenance vs. capital expense —** As a maintenance expense, restoration allows you to immediately expense your costs, as opposed to reroofing, which, as a capital expense, must be depreciated over the anticipated 39-year working life of the roof.
- **Sustainability —** Restoration temporarily eliminates the need for disposal to a landfill, thereby reducing short-term expense and adverse environmental impact. More importantly, restoration provides the most fundamental sustainability benefit of all – extended service life.
- **Insurance savings —** Depending on the system chosen, a restoration may upgrade your roof to a Class A fire rating, promoting safety and reducing insurance costs.
- **Less disruption —** Roof restoration is typically faster, cleaner, and less labor intensive than roof replacement, making it less disruptive to the buildings, properties, and people.

In addition, some restoration solutions incorporate highly reflective coatings, which can increase solar reflectivity by 70 to 90 percent, dramatically reducing interior cooling costs for the added benefit of energy savings.

Is Your Roof Right for Restoration?



There is a good reason why roofing professionals frequently prefer to recommend tear-off and replacement to restoration: analyzing a roof's viability as a candidate for restoration requires a high level of technical skill and training. First and foremost, the roof has to be well maintained and free of leaks and wet insulation. A thorough roof inspection should be performed, no more than six months before the restoration, to determine:

- Whether the roof has adequate slope
- A comprehensive history documenting the pattern of any roof leaks
- The condition of the insulation and underlying deck, as identified through core analysis
- The precise location of any water penetration, as identified through the use of scientific instrumentation, such as an infrared scan

[1] ENERGY STAR® is a registered trademark of the U.S. government. The ENERGY STAR Program represents a voluntary partnership between businesses and organizations and the federal government to promote energy efficiency and environmental activities.
[2] LEED® Buildings performance refers to the Leadership in Energy and Environmental Design® (LEED) Green Building Rating System®, which is a voluntary, consensus-building national standard that was initiated by the U.S. Green Building Council (USGBC) for developing high-performance sustainable buildings. LEED®, Leadership in Energy and Environmental Design®, and Green Building Rating System® are registered trademarks of The U.S. Green Building Council.

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Written documentation of these findings should be accompanied by a formal recommendation of solutions, including a comparative ROI analysis and possibly an energy audit, evaluating the costs and benefits of restoration versus replacement.

Roof restorations are typically warranted for five to ten years (compared to 15 to 30 years for new roofs), although specific terms and conditions may vary. Be sure you understand what is covered, how to file a claim, and who may perform the warranty work.

Address Problems First

If restoration is a viable option for your roof, the first step is to resolve any existing roof problems. If your roof is fundamentally sound, most problems can be easily and cost-effectively addressed.



The majority of roof leaks occur at termination points and where penetrations occur. This includes areas such as flashings, edge details, perimeter details, scuppers, drains, and curbs. Prior to restoration, all termination and penetration points should be repaired or replaced, depending on their condition. It may also be advisable to add drainage crickets to areas prone to ponding, keeping in mind that roof surfaces vulnerable to ponding are not usually good candidates for restoration. In addition, masonry walls and other components must be repaired and/or treated with weatherproofing sealants. Protecting such areas with metal wall panels is frequently the best long-term solution.

Even roofs where moisture has partially penetrated the insulation may be candidates for restoration — if the damage is well confined. Such cases typically call for a dual strategy in which only the seriously damaged portions of the roof are replaced, after which the entire roof is restored.

Choosing the Right Technology

Today, a wide range of technologies are used for roof restorations. These include material solutions that are based on asphalt, coal-tar, urethane, polyurea, silicone, and acrylic technologies; solvent-based elastomeric technologies; emulsion technologies; and hybrid materials that combine one or more of these chemistries. At the higher end of the quality spectrum are coatings that provide exceptional waterproofing integrity while closely matching the original roof's appearance.

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When identifying an appropriate restoration technology, there are many factors to consider.



These include, but are not limited to:

- Roof type, e.g., BUR, modified bitumen, single ply, or metal
- Surfacing type, e.g., flood and gravel, smooth, or mineral
- Performance requirements, such as greater reflectivity, improved fire rating, etc.
- Other factors such as the number of years a facility will be in service, macro (geographical) and micro (site conditions, facility use) environmental concerns, number of rooftop units, access to the roof, sensitivity to odor, degree of slope, time available for the job, etc.

Your professional roofing partner can help you analyze these factors and recommend a technology that is appropriate to the specific conditions of your roof, ensuring that your roof restoration meets or exceeds all specified performance requirements.

Conclusion

Restoration can be an efficient, cost-effective way to make a good roof better, significantly extending the interval between more costly roof replacements. Just as appealing, restoration offers the added benefits of reducing energy use, tax and insurance expenditures, adverse environmental impact, and facility downtime. Evaluating a roof to determine its viability for restoration, and analyzing the comparable efficacies of vying restoration technologies, requires a high level of roofing knowledge and competence. But in a challenging economy, timely restorations can be an effective and worthwhile method of extending the watertight performance of your facilities.

Degreed in construction management from The Ohio State University, Tom Stuewe has worked in construction for over eight years. In his current role as product manager for The Garland Company, Inc., he provides technical support and assistance for the field team responsible for the proper application of coating and mastic products. Garland is a Cleveland-based manufacturer of high-performance solutions for the total building envelope.

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Restore instead of reroof

With the high costs of operating a facility, many building owners are looking for alternatives to roof replacement. With the soaring costs of insulation and other construction materials, restoring an existing roof system could be the best use of an owner's maintenance budget.

There are a variety of restoration products and systems that will exrend the life of low-sloped commercial roofs. These restoration systems use coatings that are efficiently applied using conventional tools and spray equipment, which makes the process easy for the contractor and affordable for the building owner.

Restoring an existing roof has the added benefits of conserving resources and minimizing landfill disposal. Finishing the roof with a reflective coating will reduce electric consumption of air conditioning equipment. All of these "green" benefits are extremely desirable for building owners.



"With the soaring costs of insulation and other construction materials, restoring an existing roof system could be the best use of an owner's maintenance budget."

KURT SOSINSK - CSI, CDT, PRODUCT MANAGER
Tremco Inc., Beechwood, OH

Not all roofs are restorable

If the existing roof is not in good condition, the owner will be wasting his money attempting to upgrade a roof that has little service life remaining. Additionally, the contractor and coating manufacturer would be blamed for the inevitable failure, since they are the ones who recommended the restoration. However, by following a process for evaluating the roof, you can minimize the risks of restoration.

First, determine the condition of the insulation. Wet insulation not only transmits heat out of the building, but it also leads to dererioration of the structural roof deck and provides an optimum climate for mold. Areas of wet insulation must be removed during any roof work per building codes.

Wet insulation can be easily detected with commonly available field analytical equipment, such as an infra-red camera. The results of this analysis should be documented to clearly identify wet insulation that must be removed. Take a roof core (and properly patch) during the moisture analysis to identify the insulation type and thickness, including the deck type. This info will be valuable if the building must be reroofed.

Perform a thorough visual inspection of the roof membrane. From this inspection, identify the type of membrane and the type of bitumen or polymer it consists of, such as asphalt, coal tar, SBS, APP, EPDM, CSPE, PVC, etc. You will need to know what materials the roof is made of in order to determine a compatible coating system and procedures for surface prep, repairs, and coating application.

Include flashings, walls, copings, curbs, and penetrations in your inspection. In many cases, the roof is in good shape but the details need work. A roof membrane is commonly and incorrectly blamed for problems with air handlers or other non-membrane flashings. The best practice is to rework problem areas and install new flashings during a restoration.

Determine if inferior conditions can be corrected during the restoration process. Small areas of wet insulation can be replaced, but beware of roofs with widespread blisters, splits, tears, or numerous punctures. These defects most likely indicate the roof should not be restored, but replaced instead. Present the results of your inspection, including photographs, to the building owner to justify your recommendations.

Specifying the new coating system is the final step. Consult with reputable roof coating manufacturers to ensure your recommendations are correct. Make sure the new coating system will retain the fire rating that the building requires. Your thorough evaluation and development of a solid scope of work will ensure a successful roof restoration system that will provide years of energy efficient and leak free service for the building owner. Odds are the building owner will be equally impressed with your approach and will seek you out when it comes time to do additional work.

The Roof Coatings Manufacturers Association [RMCA] is the national trade association that represents the manufacturers of cold-applied roof coatings, cements and waterproofing agents, as well as the suppliers of products, services and equipment to the industry. RCMA is committed to improving performance and quality of roofing. For additional information, contact RCMA at: 202-207-0919; or visit: www.roofcoatings.org. RSI

Appendix O – 2014-2019 Fleet Replacement Plan

Confidential Document
Internal Use Only

Horizon Utilities
2014–2019 Fleet Replacement Plan



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Introduction

Horizon Utilities maintains a fleet of 184 vehicles including 45 trailers with garages in St. Catharines and Hamilton to ensure safe, reliable and dependable vehicles for our employees to perform their daily activities. In 2012, Horizon Utilities extended the hours of operation 8am to 11pm Monday to Friday. These extended hours allow time for; the mechanics to perform emergency repairs and ensure next day availability of vehicles; and an increase in tool time for the construction and maintenance personnel, as a result of mechanics fueling vehicles after normal business hours of operation.

The Six-Year Vehicle Replacement Plan will outline the replacement criteria based on vehicle class, vehicle specifications, vehicle condition, customers' requirements, employee safety, and environmental risks. This plan also provides the Fleet group with clear guidance and focus in managing our fleet inventory.

Plan Objectives

- Annually update a long-term Vehicle Replacement Plan to support our customers' present and future needs
- Align our vehicle replacement criteria with utility, vehicle manufacturers, and other industry standards
- Develop vehicle specification standards by vehicle class to expedite delivery timelines and reduce processes
- Ensure that Horizon Utilities' fleet operates in compliance with federal, provincial, and municipal legislations, and specific licences
- Establish a fleet that can meet existing and future geographic challenges and environments
- On-going investigation and business case benefits of fleet inventory with vehicles powered by alternative sources of energy
- The six-year plan must support Horizon Utilities' Environmental and Sustainability Development initiatives

Vehicle Replacement Criteria

Horizon Utilities' six-year vehicle replacement forecast chart within this plan is based on the following criteria guidelines:

- Manufacturing Standards
- Industry Standards
- Non-Industry Standards
- Vehicle Operational Conditions
- Vehicle Age
- Vehicle Total Mileage
- *Highway Traffic Act* (HTA)
- Canadian Motor Vehicle Safety Standards (CMVSS)
- All related CSA standards, specifically those that relate to aerial devices and hydraulic equipment

- Motor Vehicle Inspection Station (MVIS) requirements
- Infrastructure Health & Safety Association (IHSA) of Ontario, where applicable
- Corporate Health & Safety and Environmental Policies

Replacement Screening Process

A “first pass” screening process is used based on vehicle age at which time, mileage, engine hours, utilization, and power take off (PTO) hours are documented. This provides a baseline to initiate the capital replacement process. During this time, vehicle utilization is also reviewed and discussions take place with Business Unit (BU) Managers/Directors on whether a vehicle should be retained, re-allocated, or replaced with the same class of vehicle or a completely different vehicle configuration.

Vehicle Replacement Assessment

Fleet Class	Replacement Assessment Criteria
Light Duty Vehicles:	Assessed at six years and every year after, and/or high mileage (excess of 150,000 km) Replacement schedule: at 6 to 8 years
Heavy Duty Vehicles:	Assessed at 11 year service, and every year after, and/or high mileage (excess of 200,000 km) High engine hours (excess of 15,000 engine hours) Replacement schedule: at 16 to 19 years
Trailers:	Trailer replacement will follow the same core principles as the vehicle replacement criteria with the following differences: • When assessing trailer conditions, trailers will be refurbished rather than replaced. • Where trailers cannot be refurbished due to application change or condition, trailers will be flagged for replacement.

Annual Replacement Schedule Plan

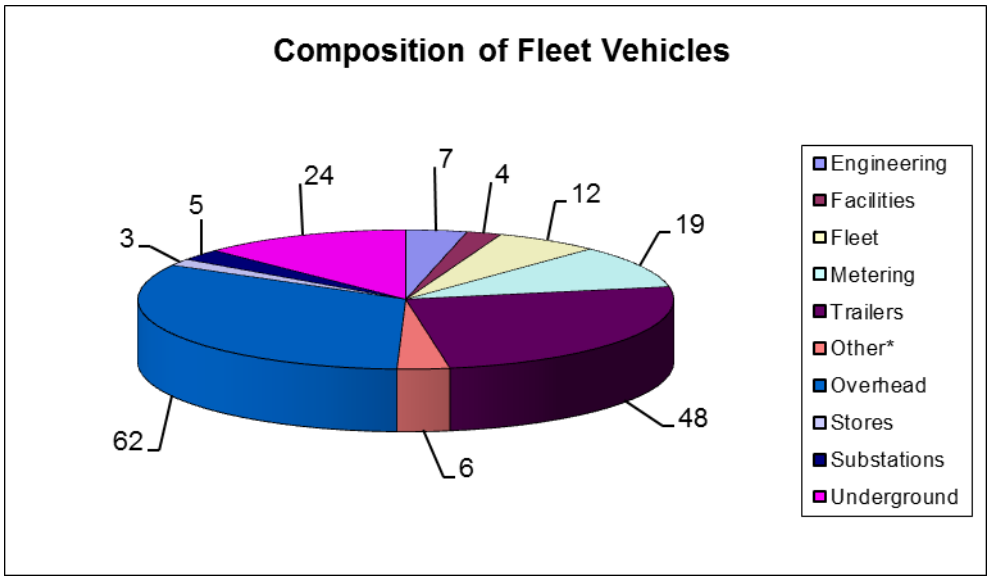
Initiatives	Objectives	Targets
Compile list of vehicles to be replaced	Fleet is assessed according to the Replacement Criteria Model.	May/June
Tender to reflect “turnkey” approach	Any changes in vehicle specifications are determined. Tenders are developed according to final specifications and published.	June/July
Fleet Capital Budget	Fleet capital budget is developed using figures from suppliers selected.	August/September
Place Order	Tenders are awarded and Purchase Orders are issued based on the approved budget.	January/February

Risks & Mitigations

The following risks and mitigations have been identified that may prevent the deliverables and targets of the initiatives and strategies within this plan.

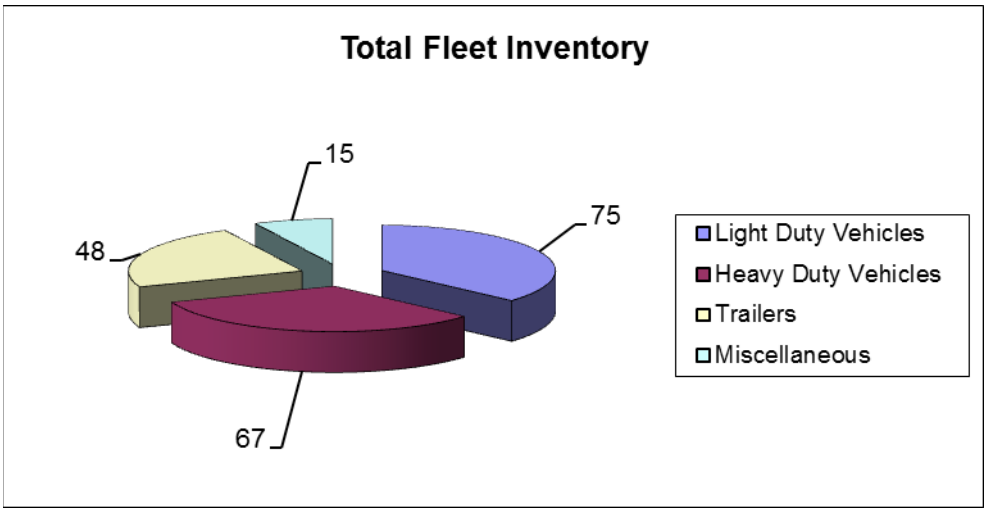
Risks	Mitigations
Capital Budget Reductions	Reassess scheduled replacements and determine other options such as refurbishing or postponing the replacement.
Refocus of Environmental Strategies	Reduce initiative scope.
New Vehicle Technologies	Ongoing understanding and knowledge of new technology.
Change to Customers’ Vehicle Requirements	Determined if the change is short or long-term. Reduce replacement forecasts and realign vehicles.
Outsourcing Initiatives	Understand the impact, and reduce replacement forecast scope.
Mergers	Proceed with safety related replacements and/or what is on order and hold any further orders.

Current Composition of Vehicles



* Other – Outside Contractors, Conservation Demand Management (CDM), Trouble

Total Fleet Inventory Structure:



* Miscellaneous – Air Compressors, Backhoes, Forklifts, Salt Spreaders

Alternative Energy Source Vehicles

Horizon Utilities is committed to being a leader in environmental initiatives and has identified its fleet as an area of focus to support our environmental social and community responsibilities. Currently, approximately 10% of Horizon Utilities' fleet are powered by alternative source of energy, reducing GHG Emissions and Carbon Footprint. Going forward, Horizon Utilities will develop and obtain management approval of procuring vehicles with alternative source of energy. This process will take place annually during the budget and business plan process.

Benefits of Alternative Source of Energy Vehicles:

- Reduce operating costs
- Reduce fuel consumption
- Longer vehicle life cycle
- Operate PTO while stationary for 4 + hours per day
- Reduce idling times
- Improve operating environment (quieter, lower emissions)
- Reduce carbon footprint (if mandated)
- Green image – community and social responsibility
- Improve air quality
- Reduce GHG emission (global warming)
- Reduce dependence on foreign oil
- Support sustainability initiative – Global Reporting Initiative (GRI)

Six-Year Vehicles Replacement Plan:

* The six-year replacement plan may change annually due to either availability of alternative technologies or other contributing factors, such as budget assessments or business unit needs.

Replacement Plan Key Initiatives

Initiatives	Strategy
Establish Replacement Criteria	Establish formally structured replacement criteria based on utility, other industries, and regulation and manufacturer standards.
Establish Specification Standards by Vehicle Classes	Develop standard vehicle specifications for all vehicle classes to improve the delivery timelines and reduce costs.
Yearly Assessment for Replacing or Refurbishing Trailers	Prior to proceeding with the replacement or refurbishing of any trailers, a need and condition assessment is conducted based on data collected in IFS on maintenance and repairs, and customers' requirements.

Focus on Smaller Heavy Duty Vehicles	In the coming years, Horizon Utilities will continue to focus on procuring smaller and lighter vehicles whenever possible by working with manufacturers' vehicle specifications and design. Larger vehicles increase fuel consumption, operating costs, and emissions, and are difficult to operate in older downtown areas due to narrow streets and overhead tree limbs.
Maintain 10% of Total Fleet, Operated by Alternative Energy Source	Identify alternative means of energy to operate vehicles to support environmental and sustainable development initiatives and regulations.
Turnkey Vehicle Order Approach	To date, Horizon Utilities has had good success in procuring vehicles based on turnkey orders that have reduced the hours of mechanics time. Horizon Utilities will continue to work with manufacturers in improving delivery times and vehicle specifications.
Reduce Fleet Inventory	Reinforce the Fleet Idling Policy using the GPS solution. KPIs using GPS data are measuring, tracking and reporting on fleet activity to improve productivity that in turn will reduce fuel consumption.
Replace Aging Fleet and Trailers	A number of existing vehicles have surpassed their life cycle and have been scheduled for replacement during this six-year plan.
Vehicles' Refurbishing Opportunities	For heavy duty vehicles, Horizon Utilities has extended the replacement cycle to 16 - 19 years with an assessment on the 11th year. During the assessment we may decide to refurbish vehicles to extend their life cycle to meet budget limitations.

Six-Year Replacement Forecast

The following chart provides a six-year replacement forecast of our fleet between Hamilton and St. Catharines, based on the replacement criteria. The replacement forecast captures the vehicles that should be replaced based on the replacement criteria and is used as a guide for the Manager Fleet annually during the budget process. Vehicle replacement is based on both the fleet replacement forecast and available capital budget. The forecast may change due to yearly budget availability and/or adjustments to business unit needs.

Centre	Vehicle Class	Replacement Year					
		2014	2015	2016	2017	2018	2019
Hamilton	Single Bucket Manlift Truck	0	0	1	1	2	2
	Knuckle Crane Truck	0	0	1	0	0	0
	Passenger Vehicle/Cargo/Step Van	0	2	1	1	0	1
	Cable Pulling/Digger Derrick Truck	0	0	0	0	0	0
	Trailer	0	0	0	0	0	0
	Double Bucket MHAD Truck	1	1	0	0	0	0
	Heavy Duty / Light Duty Pickup	1	3	1	3	2	0
	Air Compressor	0	0	0	0	0	0
	SUV	0	0	1	1	0	0
	Flat Deck	0	0	0	0	0	0
	Hybrid or Electric Car	0	0	0	0	0	0
	TOTALS	2	5	4	6	4	3
St. Catharines	Single Bucket Manlift Truck	0	0	0	0	0	0
	Knuckle Crane Truck	0	0	0	0	0	0
	Passenger Vehicle/Cargo/Step Van	0	0	0	0	0	0
	Cable Pulling/Digger Derrick Truck	0	0	0	0	0	0
	Trailer	2	0	0	0	0	0
	Double Bucket MHAD Truck	0	0	0	0	0	0
	Heavy Duty / Light Duty Pickup	0	1	0	0	0	0
	Air Compressor	0	0	0	0	0	0
	SUV	0	0	0	0	0	0
	Flat Deck	0	0	0	0	0	0
	Hybrid or Electric Car	0	0	0	0	0	0
	TOTALS	2	1	0	0	0	0
Grand Total	**Hamilton & St. Catharines**	4	7	4	6	4	3

Conclusion

By maintaining a long-term Fleet Replacement Plan, Horizon Utilities will move forward in a better position to support our internal and external customers, reduce operating costs, decrease carbon footprint, and continue to provide a safe and dependable fleet inventory.

Prepared By: Joseph Botas, Manager Fleet
November, 2013

COST OF ELIGIBLE INVESTMENTS FOR THE CONNECTION OF QUALIFYING GENERATION FACILITIES

Horizon Utilities has not incurred any cost or investment related to the connection of qualifying generation facilities.

PERFORMANCE METRICS

SERVICE QUALITY AND RELIABILITY INDICATORS

Horizon Utilities tracks service reliability statistics SAIDI and SAIFI including and excluding Hydro One related incidents. The following Table 2-120 shows actual results for the past five years.

Table 2-120 – Appendix 2-G Service Reliability Service Indicators

Index	Includes outages caused by loss of supply					Excludes outages caused by loss of supply				
	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
SAIDI	1.180	1.240	2.250	1.450	4.970	0.690	1.150	2.230	1.430	4.360
SAIFI	1.810	1.800	1.740	1.950	2.090	1.120	1.550	1.740	1.830	1.760

	5 Year Historical Average				
SAIDI			2.218		1.972
SAIFI			1.878		1.600

SAIDI = System Average Interruption Duration Index
SAIFI = System Average Interruption Frequency Index

Horizon Utilities' system reliability has been trending negatively in recent years with the 2013 actual being outside of the OEB threshold. This decrease in system performance is consistent with an aging distribution system requiring significant renewal investment. Further analysis and classification of outages by the primary cause code reveals that outages caused by equipment failures, adverse weather, and foreign interference account for approximately 78% of the total customer minutes of outages from 2010 to 2013. Foreign interference is defined by the Canadian Electricity Association as: customer interruptions beyond the control of the utility such as birds, animals, vehicles, dig-ins, vandalism, sabotage and foreign objects.

As elements of the system age, they become less resilient to adverse weather and foreign interference. Horizon Utilities' distribution system has many components which have reached the end of their useful life and are contributing to a greater amount of equipment failures and service interruptions to customers. These service failures are further exaggerated as the aged assets require longer repair times or outright replacement, extending the duration of the outage experienced by the customer.

Equipment failures are the largest contributor to service interruptions from 2010 to 2013, when the impact of the April 2011 windstorm, the July 2013 windstorm, and the December 2013 ice storms are excluded. This is consistent with an aging distribution system with a significant volume of assets having a "very poor" or "poor" Health Index as identified in the Kinectrics' ACA. Underground XLPE primary cable is the asset group with the largest risk to the continued safe and reliable operation of Horizon Utilities' distribution system, as identified in the Kinectrics' ACA. Analysis of Horizon Utilities' outage history from 2010 to 2013 reveals that 51% of outages caused by equipment failures are due to failures of underground assets, consistent with Kinectrics' ACA.

Horizon Utilities will reverse the negative trend in system performance and improve system reliability through the following initiatives and programs:

- Renewal investments: The increase in equipment failures and resulting impact to reliability are consistent with an aging infrastructure. Renewal of aging, end-of-life infrastructure is Horizon Utilities' primary investment driver and over time these renewal investments will lead to a reduction in the volume of outages resulting from material and equipment failures leading to improved system reliability.

- Distribution Automation: Distribution automation provides the ability to sectionalize and isolate failed sections during service interruptions, allowing the quick restoration of service to customers. This can dramatically reduce the number of customer minutes of outage experienced and improve SAIDI. Automation is particularly effective during storm events when the number of concurrent outage events exceeds the number of crews available to restore service. Restoration can be initiated and partially completed remotely from the system control centre. As the volume and penetration of automation increases, dramatic reductions in the number of customer minutes of outage experienced and the corresponding improvement in SAIDI can be realised.

- Tree Trimming: Horizon Utilities has been experiencing rising costs since 2011 as a result of increased internal and contractor repairs and maintenance costs to support storm restoration efforts. Further details are provided in Exhibit 4, Tab 3, Schedule 3. Tree damage during adverse weather is the single largest contributor to service

interruptions. Tree trimming is an important component of preventative line maintenance that mitigates service interruption and public safety risks. The entire service territory is trimmed on a 3-year cycle.

In addition to the reliability indices, Horizon Utilities also measures Service Quality Indicators ("SQIs"). Table 2-121 below summarizes Horizon Utilities' last five years of reported SQIs. All event performance is within the established standard.

Table 2-121 – Reported Electricity Service Quality Requirements ("ESQR")

Indicator	OEB Minimum Standard	2009	2010	2011	2012	2013
Connection of New Services - Low Voltage	90% within 5 days	99.80%	99.70%	99.36%	99.16%	99.90%
Connection of New Services - High Voltage	90% within 10 days	N/A	100.00%	100.00%	100.00%	100.00%
Appointment Scheduling	90% within 5 days	99.50%	98.70%	99.02%	99.46%	98.80%
Appointments Met	90% of the time	96.30%	96.60%	97.32%	95.41%	98.18%
Rescheduling a Missed Appointment	100% on yearly basis	N/A	N/A	100.00%	100.00%	100.00%
Telephone Accessibility	65% within 30 seconds	81.60%	81.70%	73.96%	79.96%	81.03%
Telephone Abandon Rate	10% Less After 30 seconds	N/A	2.20%	3.08%	1.89%	1.72%
Wirtten Responses to Inquiries	80% within 10 days	98.90%	99.00%	91.76%	98.60%	99.69%
Emergency Response - Urban Areas	80% within 60 minutes	99.20%	95.40%	96.00%	99.64%	98.63%
Reconnection Performance Standard	85% within 2 days	N/A	N/A	N/A	99.97%	99.89%

N/A = data was not tracked for these indicators