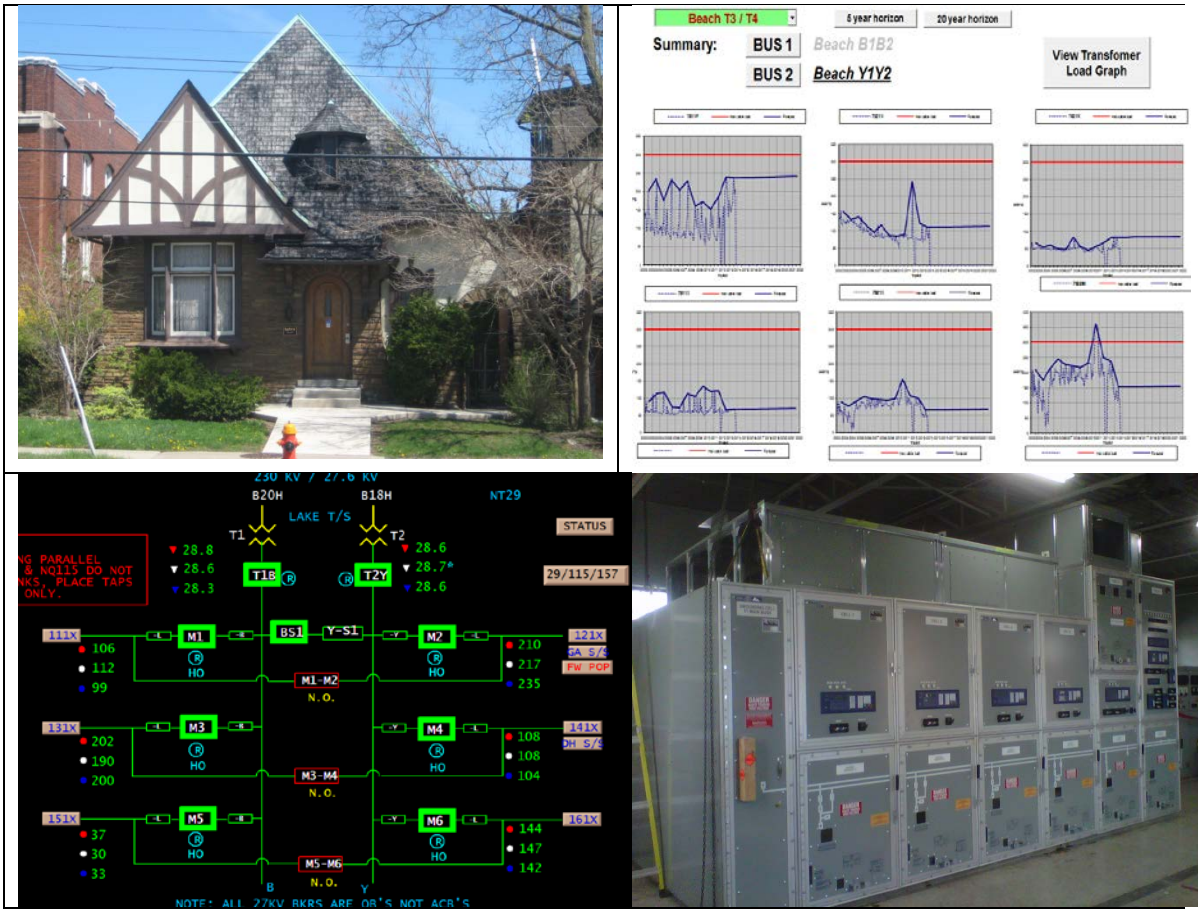
horizon UTILITIES Looking beyond

2013 Long Term Load Forecast Report



Prepared By: Networks **Date:** Nov 12, 2013

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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.

Contents

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*

  All customer driven commercial and industrial projects under development forecast to exceed 1MVA in demand were included in the forecast.

  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 three generators in St. Catharines directly connected to Horizon Utilities' distribution system to give an accurate value of the actual load on the feeders.

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 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 health care facilities. Hydro One has approached Horizon to plan asset renewal at Elgin TS in the near future.

Gage TS:
Gage TS serves mainly industrial customers. 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 on the DK and B1Y1 busses, and is split residential/industrial on the EJ bus. There are no capacity issues at Kenilworth TS.

Lake TS:
Lake TS serves mainly residential/commercial customers 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 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 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 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 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 in the Northeast quadrant of St.Catharines, and also has 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 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, including both load and generation customers, in the Southeast quadrant of St. Catharines. 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 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 a large industrial customer is served on this feeder and is proposing a significant Co-generation facility to displace its 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 in the education and health care sector 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 a large health care facility in this area. 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 a large health care facility 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 a generating station in the north end of St. Catharineswhich 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