Grid System Planning – Aligning to Climate Change

Adaptation & Resilient Infrastructure Seminar

May 29, 2014

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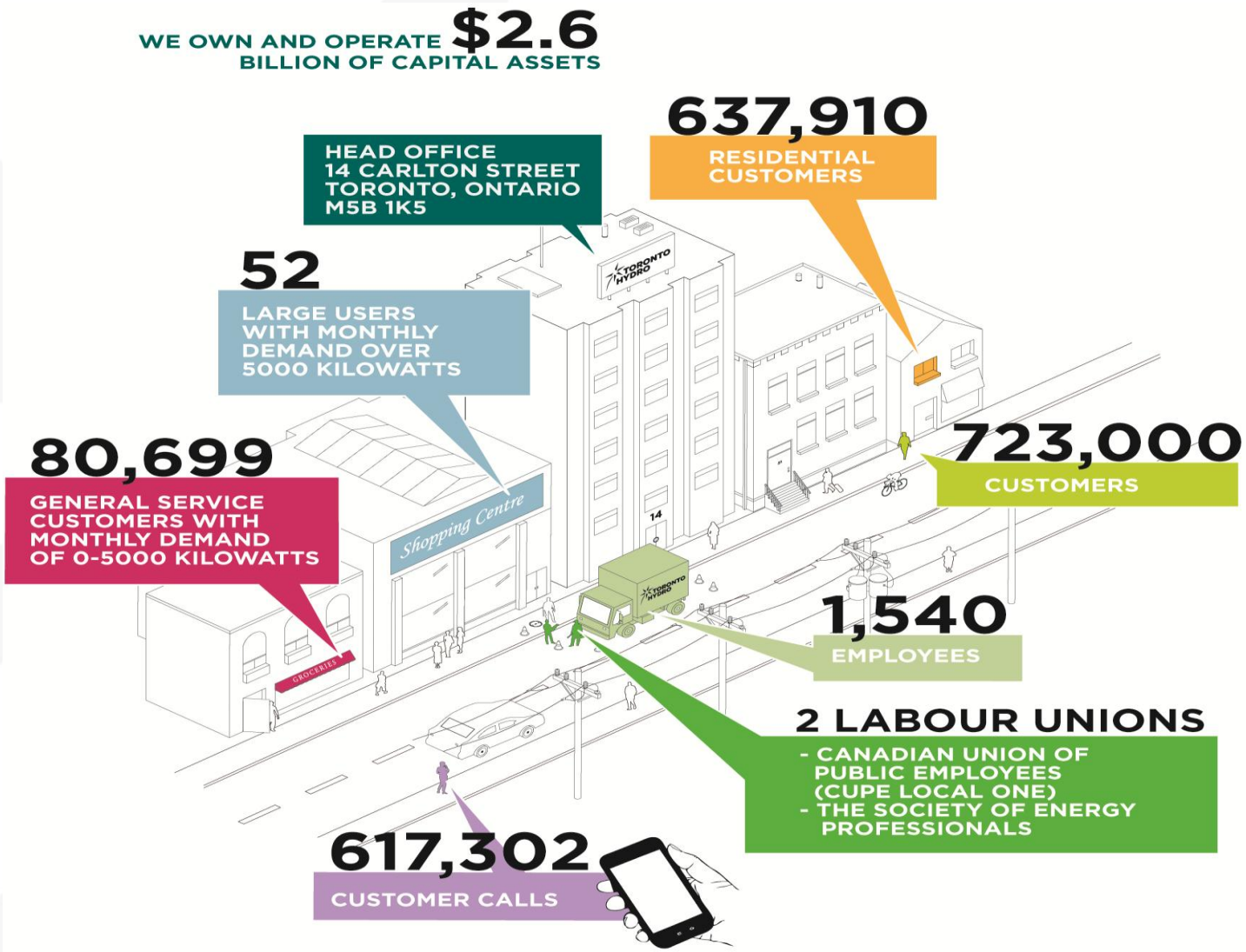
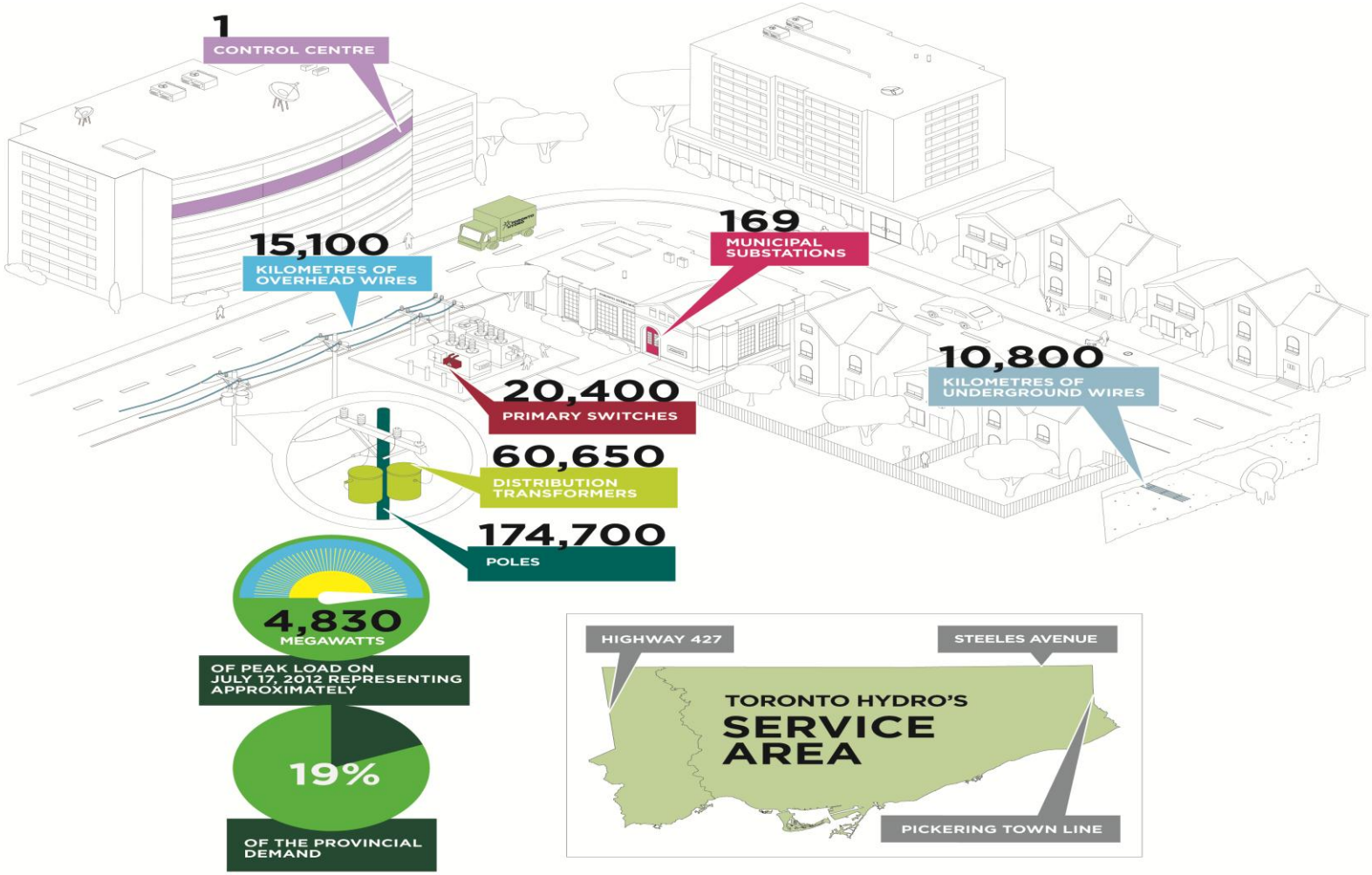
EVP and Chief Business Development Officer

Company Overview



Company Overview - Operations



TORONTO HYDRO

Recent Extreme Weather Events

October 29th 2012 Hurricane Sandy:

- Approximately 60,000 customers interrupted

July 8th 2013 Flood:

- Approximately 300,000 customers interrupted

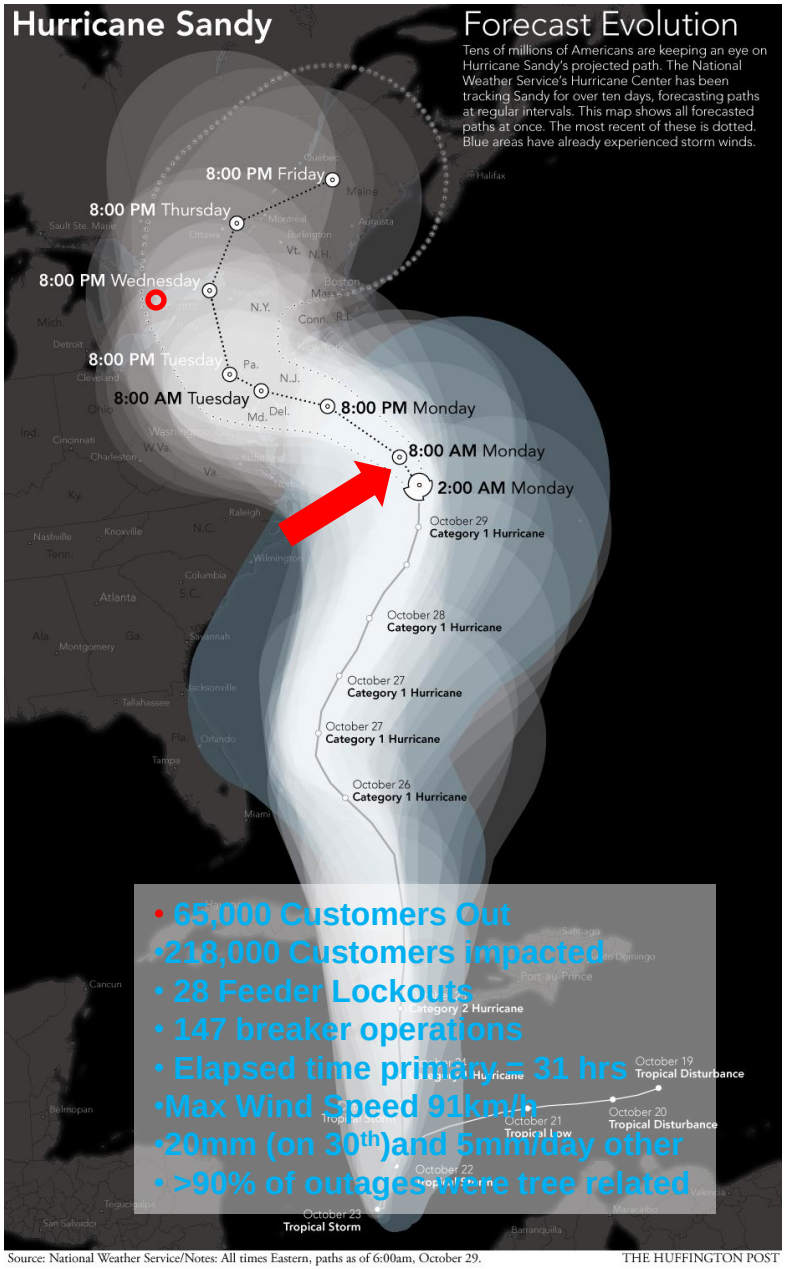
December 22nd 2013 Ice Storm:

- Approximately 300,000 customers interrupted

Hurricane Sandy – Oct 2013

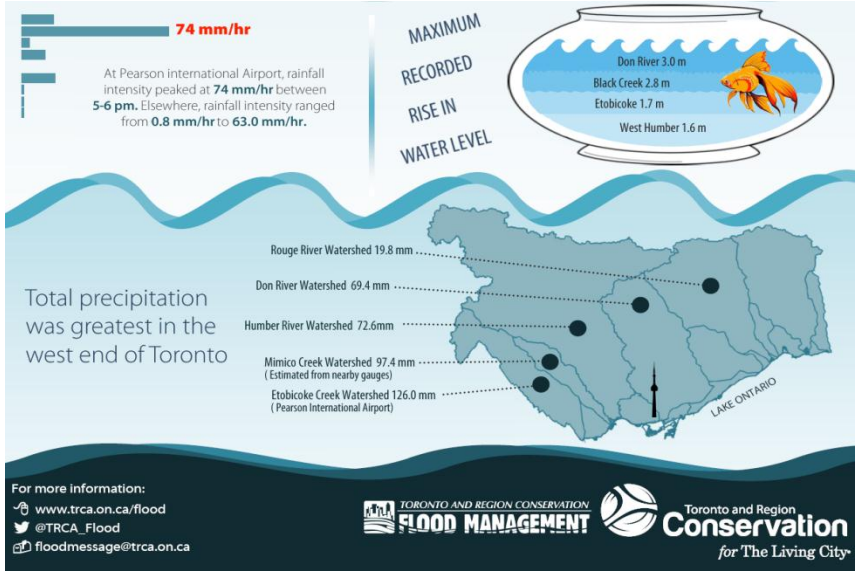
- Enhanced monitoring of storm telemetry (path, intensity)
- Opened lines of communication with key EM stakeholders
- Established emergency declaration objectives (Level II, III)
- Opened SOC at 07:00 Mon Oct 29
- At 01:00 Tues Oct 30, system conditions were "normal"
- Wind speeds peaked from 02:00 – 04:00 (<92 km/hr)
- Call volumes increased sharply between 04:00 – 05:00
- Level II declared at 04:30
- Level III declared at 07:30
- "All hands on deck"

Source: Data in Public Media. *May not be accurate



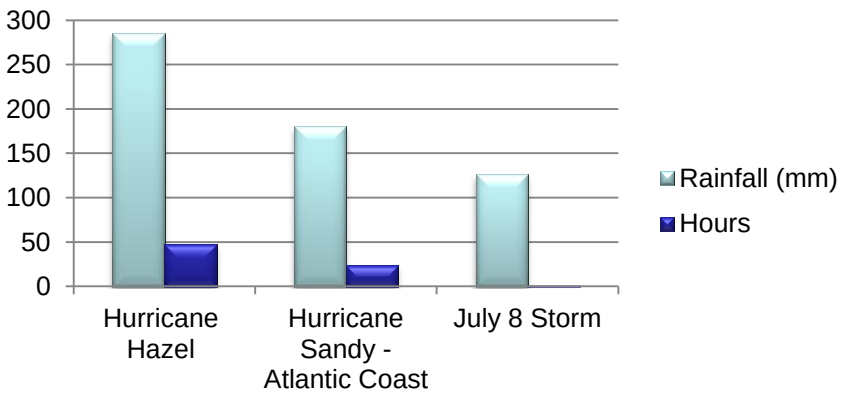
Water Storm July 8th

- The heaviest rainfall in one day since measurements began in Toronto.
- Environment of Canada didn‘t expect the rainfall to be more than 50 mm per hour and therefore didn´t issue a severe thunderstorm warning.



Source: Toronto and Regional Conservation Authority

Total mm of Rainfall



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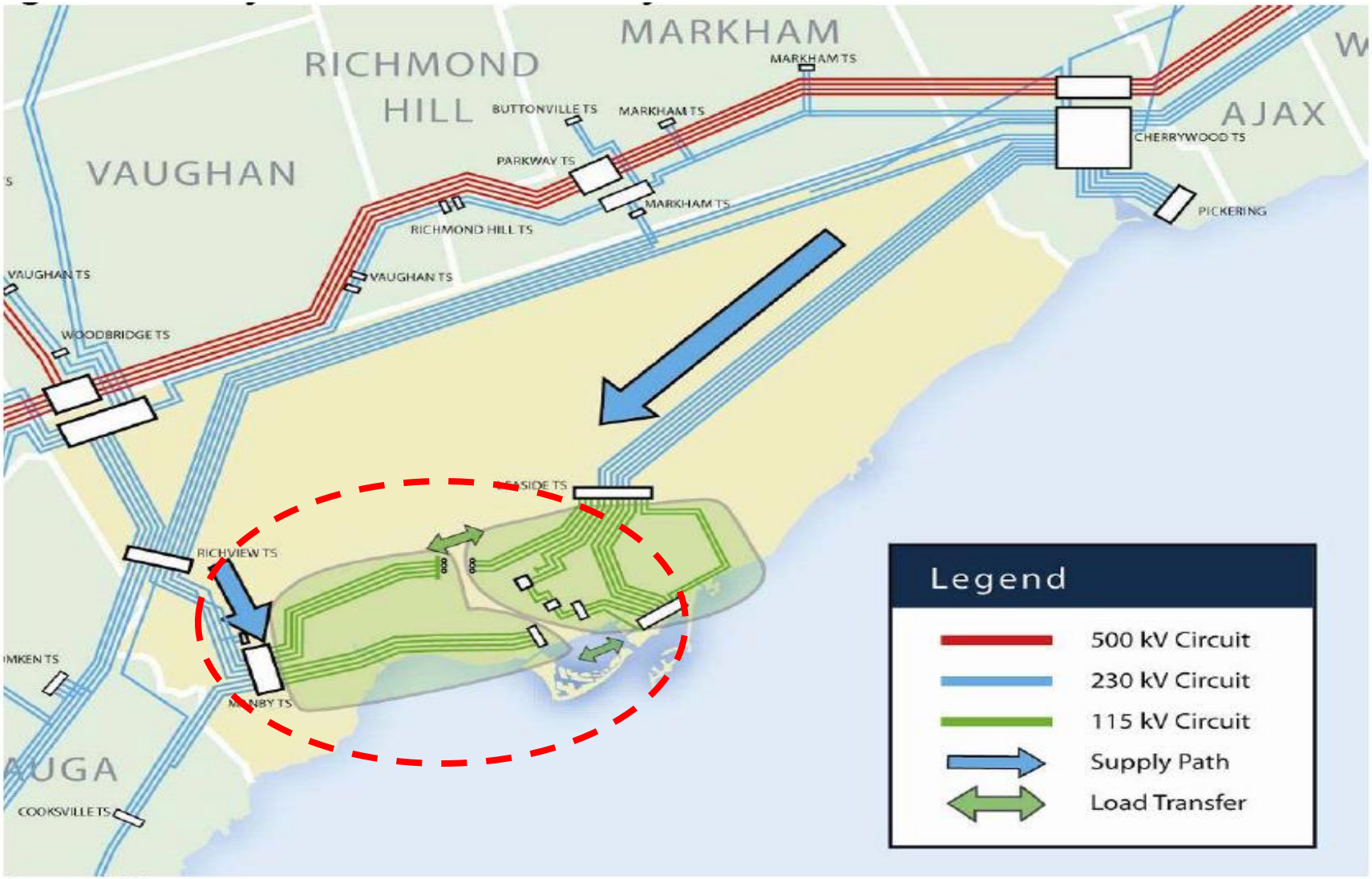
Toronto Regional Plan

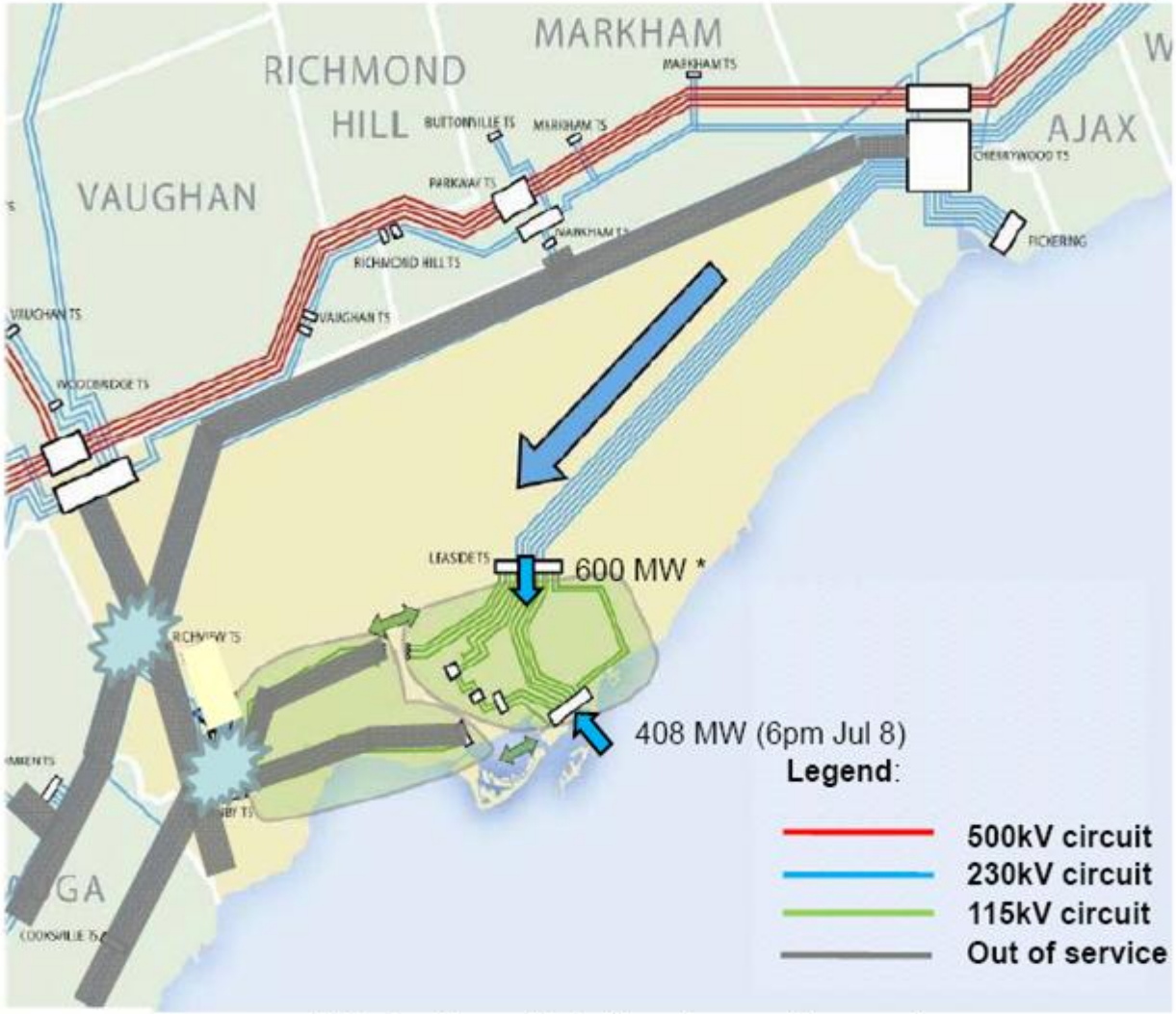


Source: OPA

During the Storm

Note: All circuits in and out of Richview and Manby were affected.

Flooded control circuits.



Note: Graphics are illustrative only, may not be accurate.

HONI update:
A total of 3,770 MW interrupted across the GTA affecting up to 500,000 residents.

Leaside sector maintained.

* Values estimated based upon provincial system peak just prior to outage.

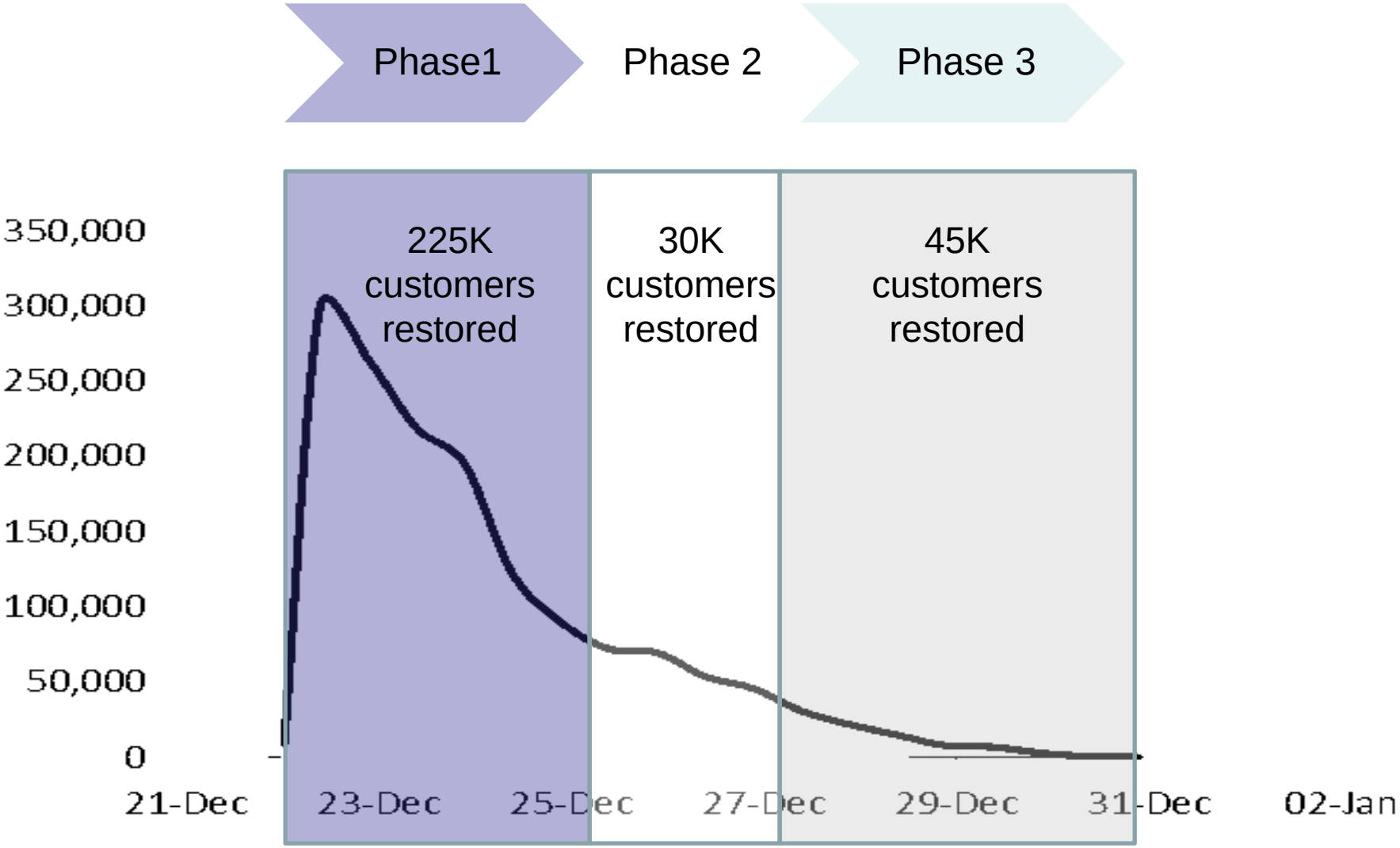
TORONTO HYDRO

Source: Toronto Hydro Planning

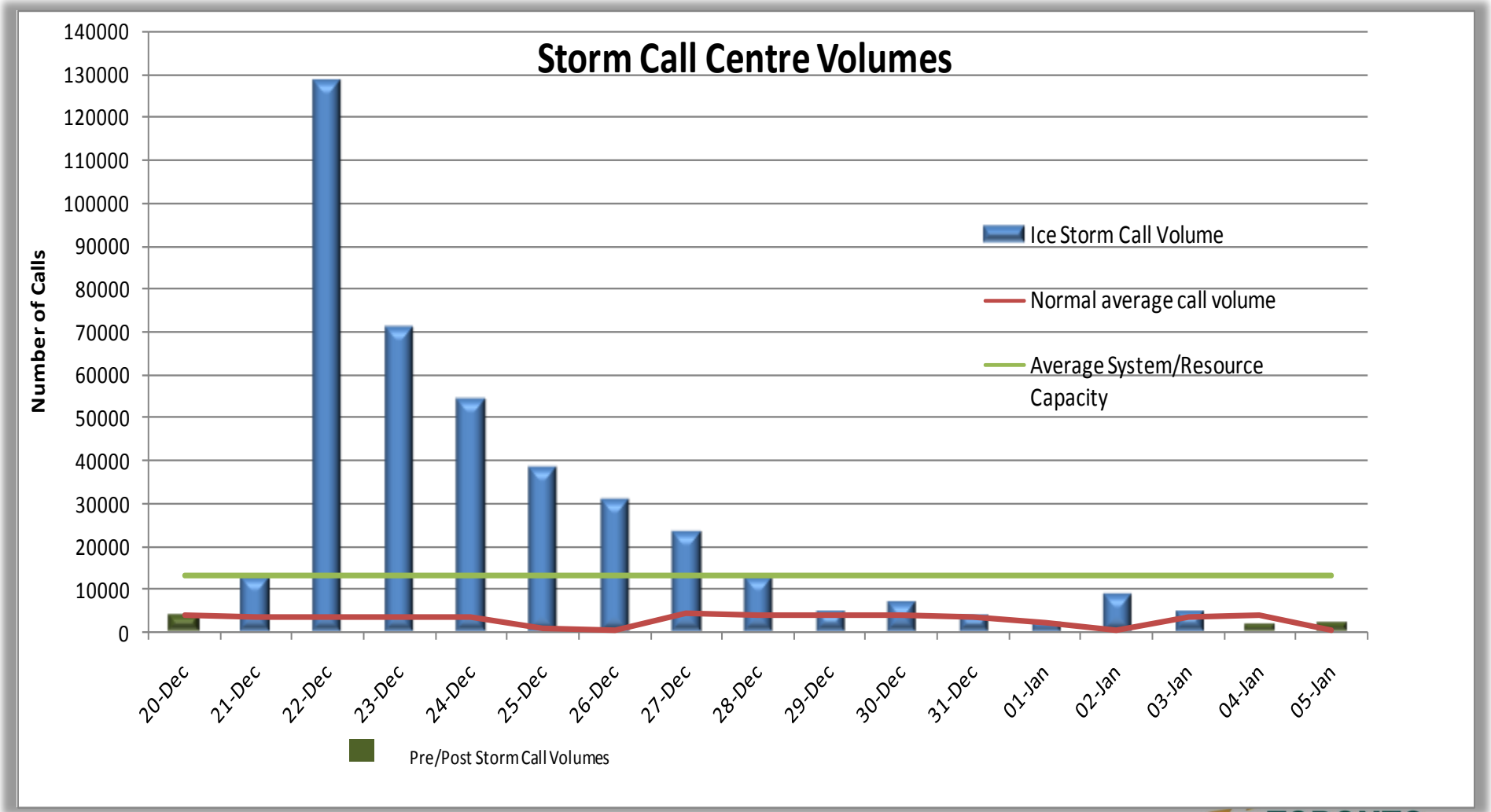
ICE Storm - Dec 22, 2013

The most disruptive incident we have faced

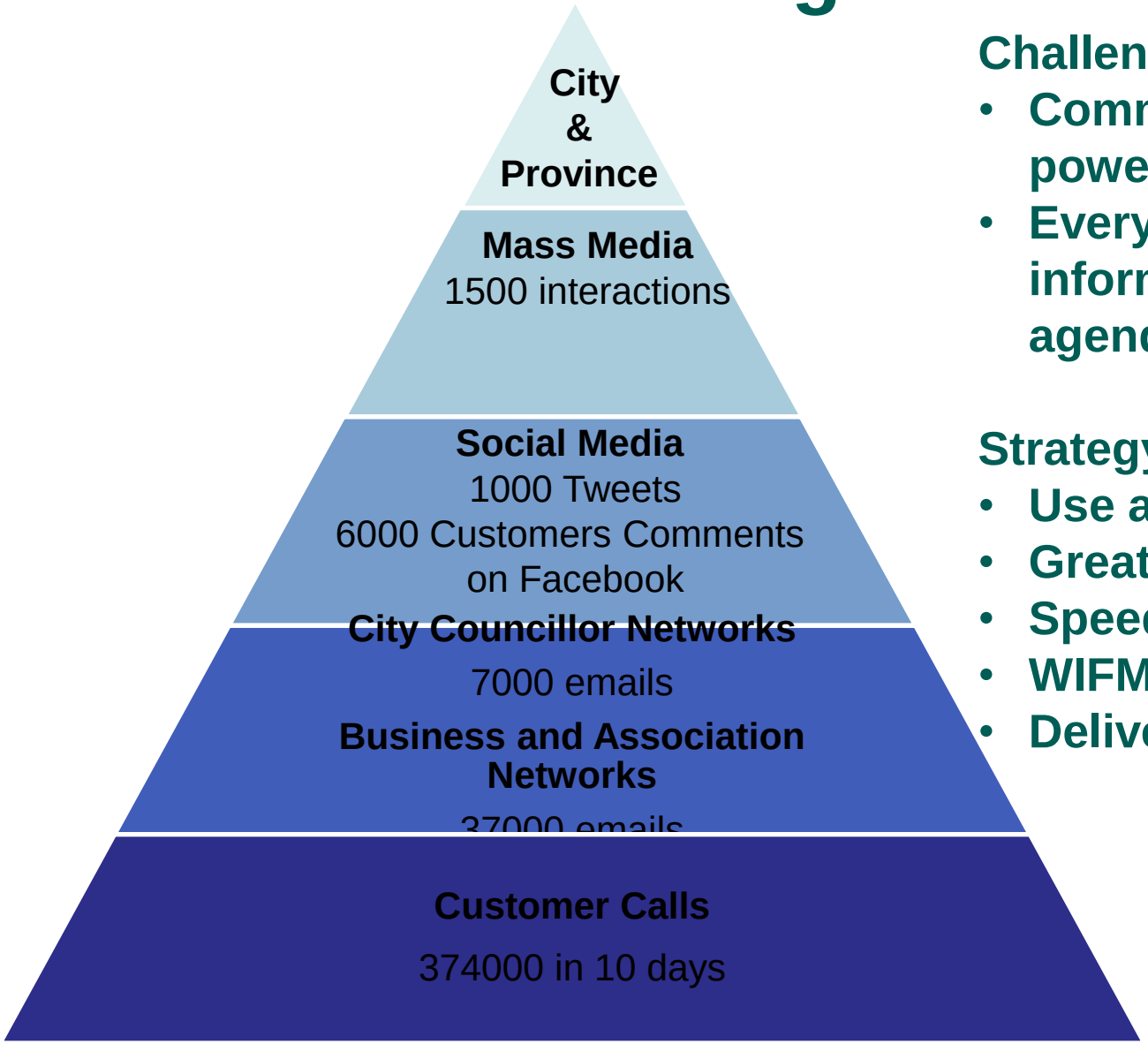
Customer Restoration Profile



Customer Response Profile



Communicate Enough ?



Challenge

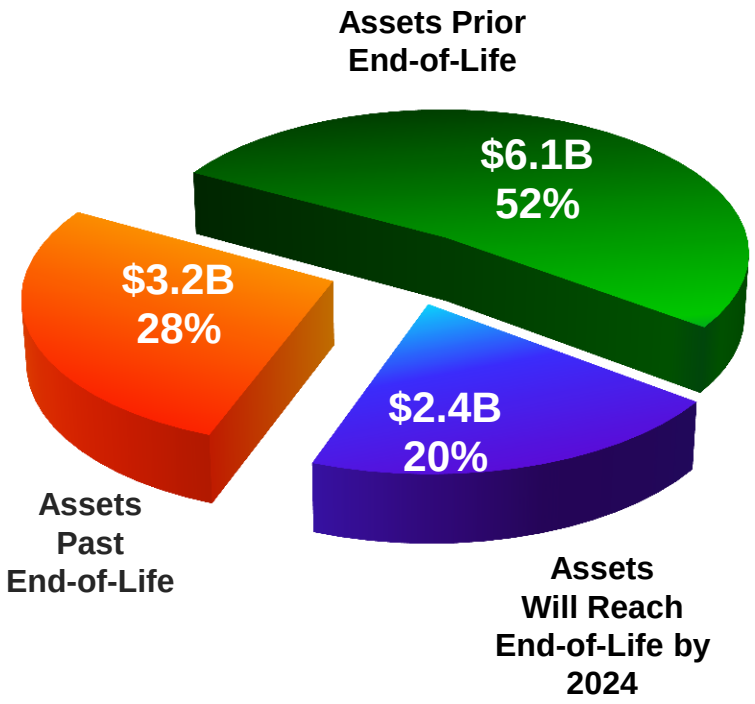
- Communication needs power
- Everyone looking for information for various agendas.

Strategy

- Use all available channels
- Greatest reach
- Speed to target
- WIFM - Richness Factor
- Deliver frequently

Current Situation – Opportunity To Invest ?

- $3.2B of Asset Replacement Value is currently beyond Useful Life
- Additional $2.4B of Assets will exceed their Useful Life by 2024.
- $431M of Asset Replacement Value per year over the 13-year period from 2012 to 2024.



Awareness and Preparation of a Changing Climate

Toronto Hydro

- PIEVC (Public Infrastructure Engineering Vulnerability Committee)

City of Toronto

- Toronto's Future Weather and Climate Driver Study

Industry

- IPCC (Intergovernmental Panel on Climate Change)
- ConEd approval for one billion dollars for climate adaptation

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PIEVC Assessment of Weather Events

Low Risk

- *Extreme Humidity and Severe Heat Wave*
- *Low temperature and cold wave*
- *Freeze-thaw cycles*
- *Temperature variability*
- *Fog, Frost, Hail*
- *Drought periods*

Medium Risks

- *High Temperature, Heat Waves, Extreme Humidity, and Severe Heat Wave*
- *Heavy Rain and Heavy 5 day total rainfall*
- *Freezing Rain and Ice Storms*
- *Blowing snow, heavy snowfall and snow accumulation*
- *Lightning strikes on equipment*

High Risk

- *High wind/downburst at 70 km/h and 90 km/h*
- Hurricane (e.g. Sandy)
- Tornadoes (Low Probability)

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Risks → Prepare & Mitigate

Standards

- Storm Hardening
- Maintenance
- Targeted Resilience

System & Process enhancements

- Automation
- Dispatch

Support

- Office of Emergency Management
- Mutual Aid

TORONTO HYDRO

Climate Analysis of Toronto Hydro Distribution Assets

Weather Type Increase/Decrease based on Current Climate	Distribution Equipment Impacted	Vulnerable
Extreme Heat (Increase)	Overhead/ Underground Equipment	Yes
Extreme Precipitation (Increase)	Underground Equipment	Yes

Existing Climate Adaptations at Toronto Hydro

Overhead Assets

- Installation of tree proof conductor to prevent faults on overhead conductor due to tree contact
- Tree trimming maintenance programs
- Compliance with CSA standards for overhead infrastructure
- Pole loading analysis software used to design a structurally reliable overhead system

Existing Climate Adaptations at Toronto Hydro

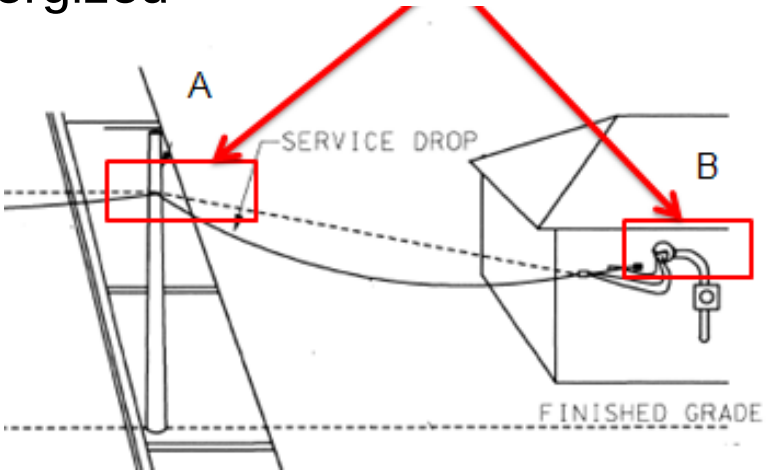
Underground Assets

- All below grade major equipment (i.e. Transformers and switches) are rated for submersible applications
- All below grade major equipment enclosures are now built using marine grade stainless steel
- All underground vaults are equipped with sump pumps and drainage systems (Network vaults maintained 3 times a year)

Future Climate Adaptations at Toronto Hydro

1. New adapter at meter base to provide safe method of connecting a generator

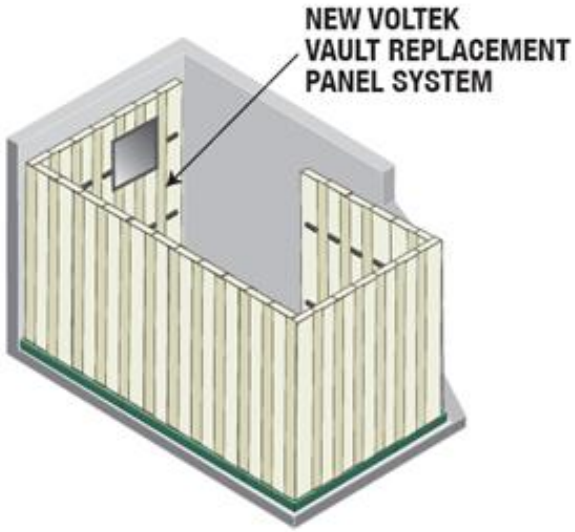
2. Connection at hydro pole designed to fail prior to connection at service mast to ensure that cut service wire is not energized



Future Climate Adaptations at Toronto Hydro

3. Distribution Reclosers - Used to reduce momentary faults caused by tree contact, and to sectionalize and isolate permanent faults

4. Underground Structure Support System – Used on deteriorated structures to restore loading strength and provide waterproof barrier



Thank You

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