



Climate Change Adaptation



For You. The World.



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Overview

Climate Change?

**What can we expect for changing climate in the GTA
July 8 event**

What are we doing at the GTAA

PIEVC Protocol Case Study

Questions and Answers





Climate Change?



Climate Change?

WDS | TORONTO STAR SATURDAY, AUGUST 17, 2013

WORLDWEEKLY

The Arctic shipping rush

For years people have been speculating that the melting of Arctic sea ice due to climate change would open new shipping lanes. In fact, it's happening now.

204 Ships given permits as of mid-July to ply the Northern Sea Route, which connects East Asia to Europe via the waters off of Russia's northern coast

46 Vessels that made the Northern Sea Route trip in 2012

4 Vessels that made the trip in 2011

33 Days it takes to travel from Kobe to Rotterdam via the Suez Canal

23 Days it takes to do the same route via the northern passage



SOURCES: S&P, Reuters, Times

Canadian Climate Normals Environment Canada Station: Toronto Lester B. Pearson INT'L A

Data Range	Daily Average Temperature (°C)
1961 – 1990	7.2
1971 – 2000	7.5
1981 – 2010	8.2*

http://climate.weather.gc.ca/climate_normals/ and emails

State of the Climate – Global Analysis July 2013

- average global was 0.61°C above the 20th century average
- 341st consecutive month that the global monthly temperature has been higher than the long-term average for its respective month.

<http://www.ncdc.noaa.gov/sotc/global/2013/7>



Climate Change



Climate Change – Extremes and Means

Climate Change is expected to occur as both changes in extremes and means.

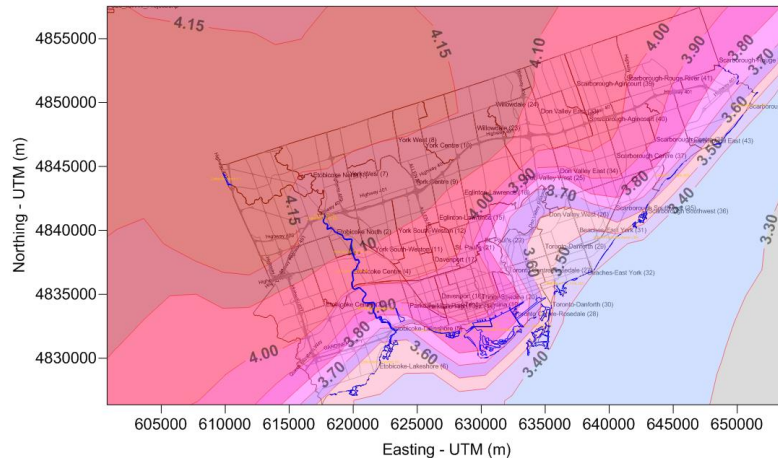
We will likely experience more extreme events

Historical observations (means/normals) will not be as useful in predicting future



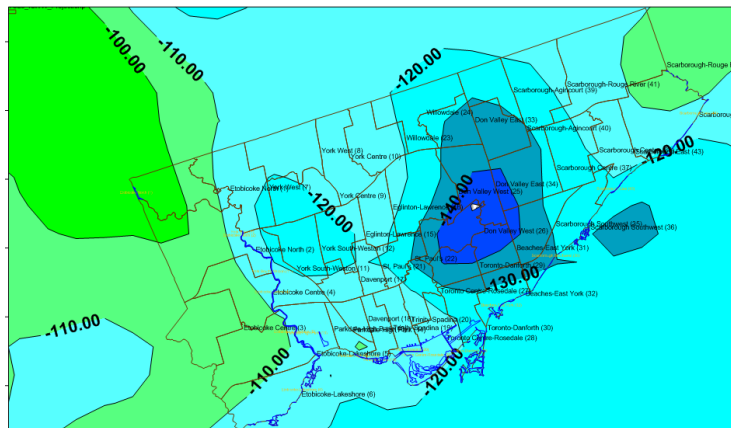
Regional Projections

City of Toronto's Future Weather and Climate Drivers Study



Regional Model

- Concerned with extremes due to the impact on City's operations
- 1 km x 1 km grid
- Projected 2000-2009 to 2040 - 2049
- Included significant regional features
 - Great Lakes
 - Oak Ridges Moraine
 - Niagara Escarpment

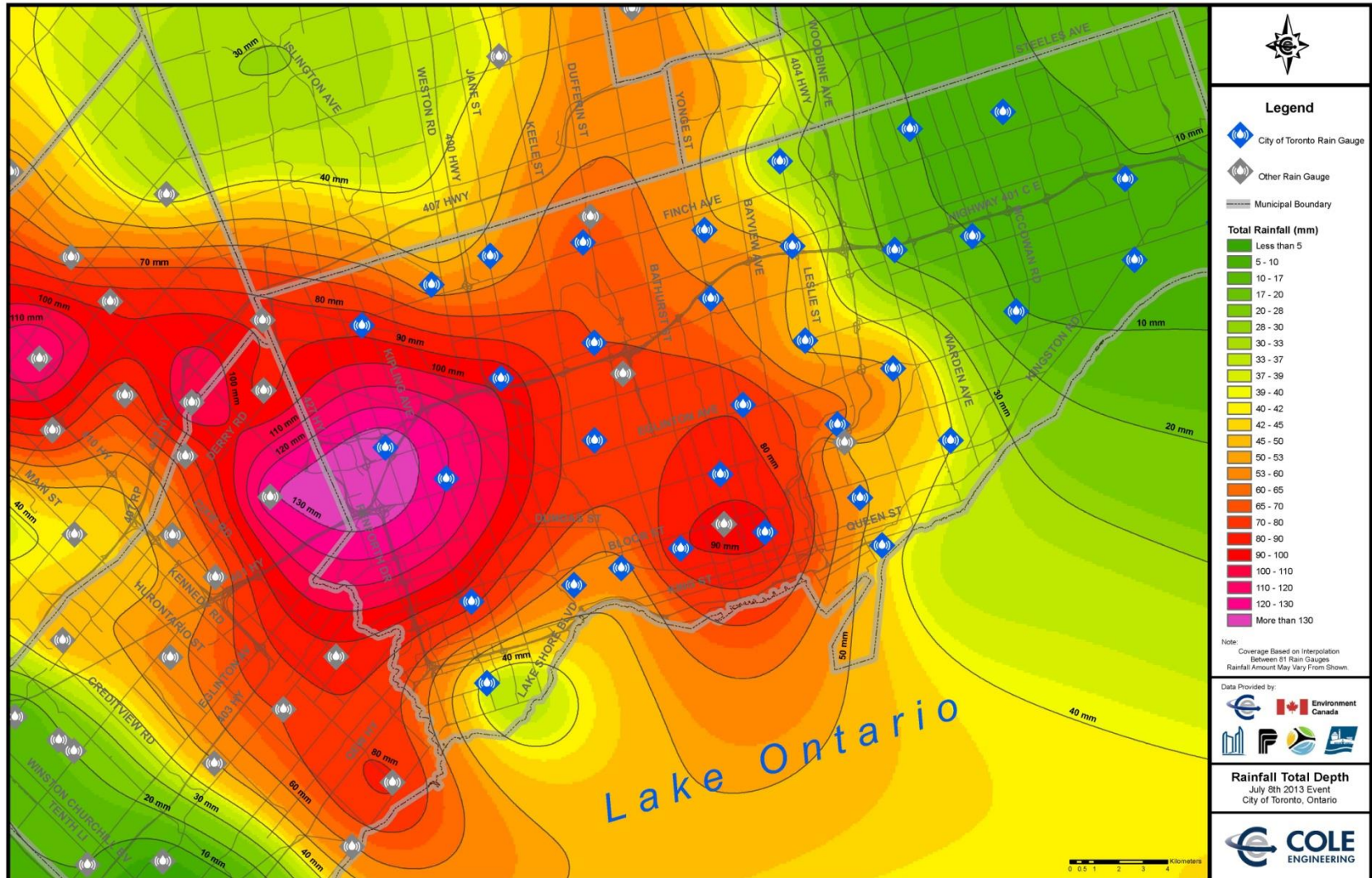


Local Climate Projections

- Fewer extreme storms but those few are more extreme (especially in July and August)
- Less snow & more rain
 - More freezing rain
- Average annual temperatures increase by $\sim 4^{\circ}\text{C}$
 - Milder winters with less extreme cold
 - Warmer summers with more heat waves

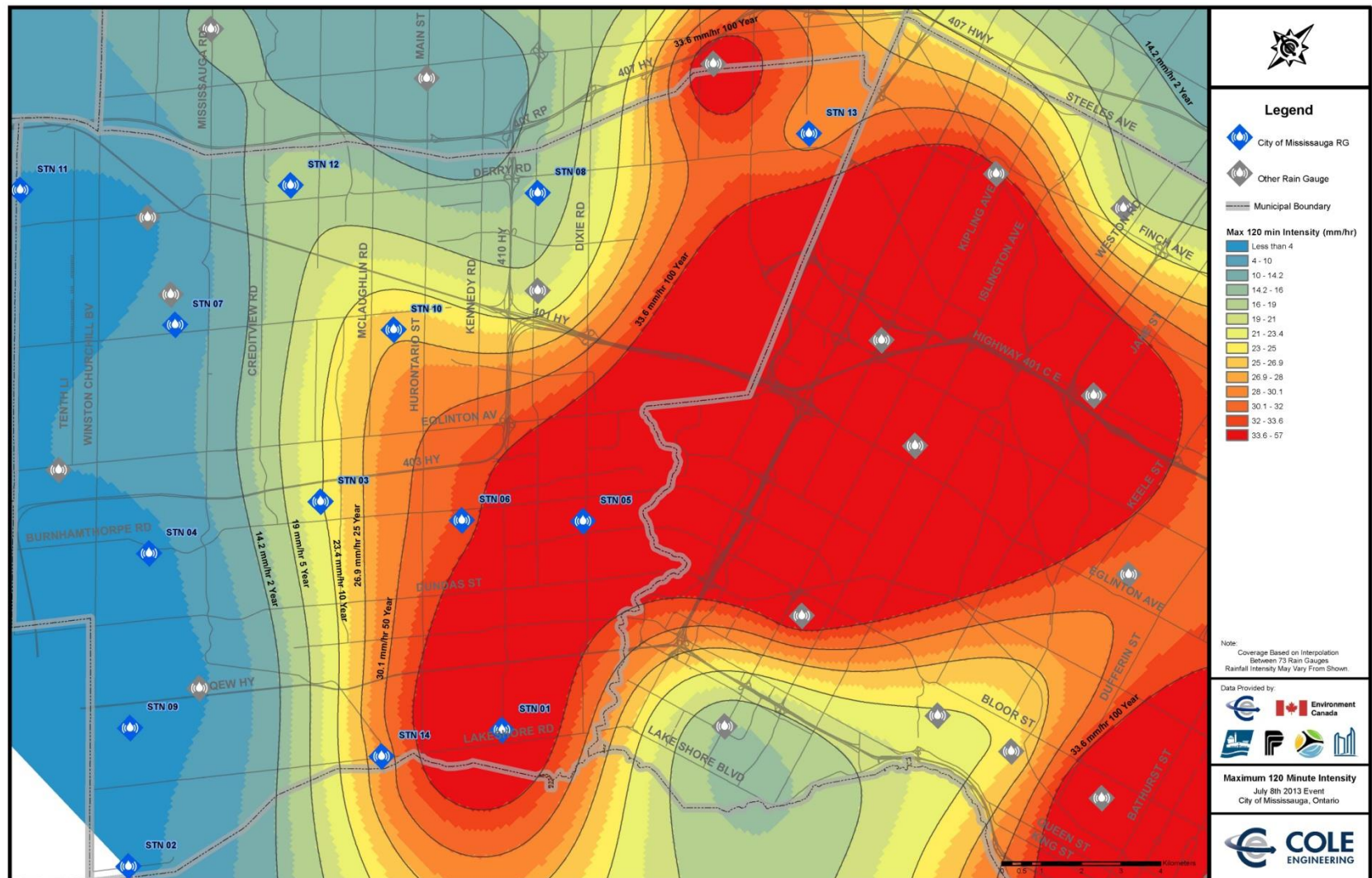
July 8 Event

1/4



July 8 Event

2/4





July 8 Event

4/4



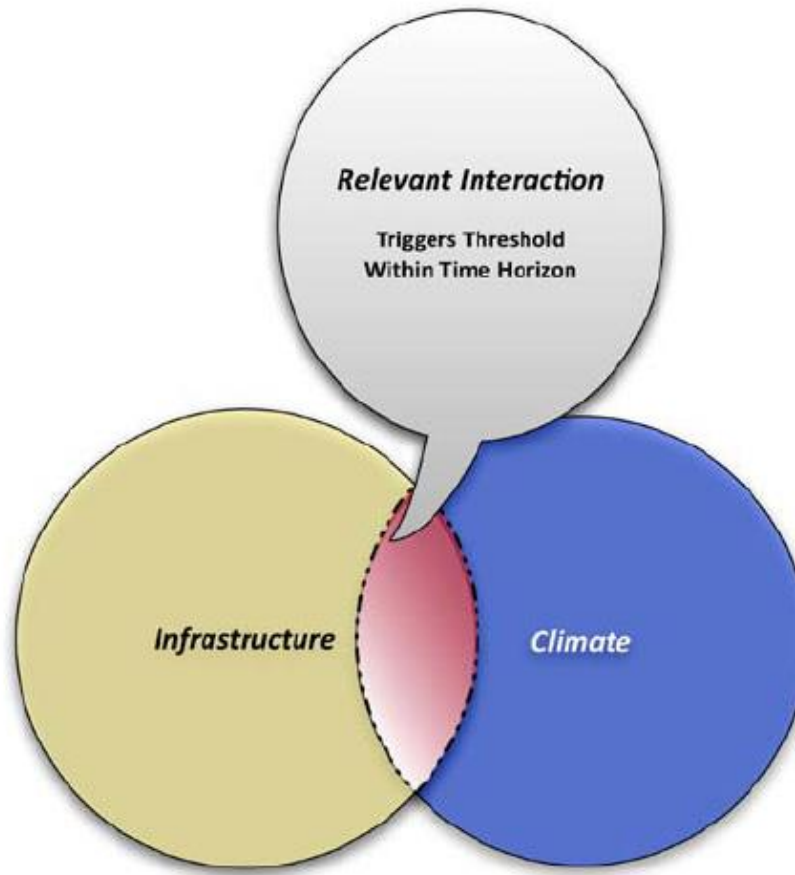


What we are doing

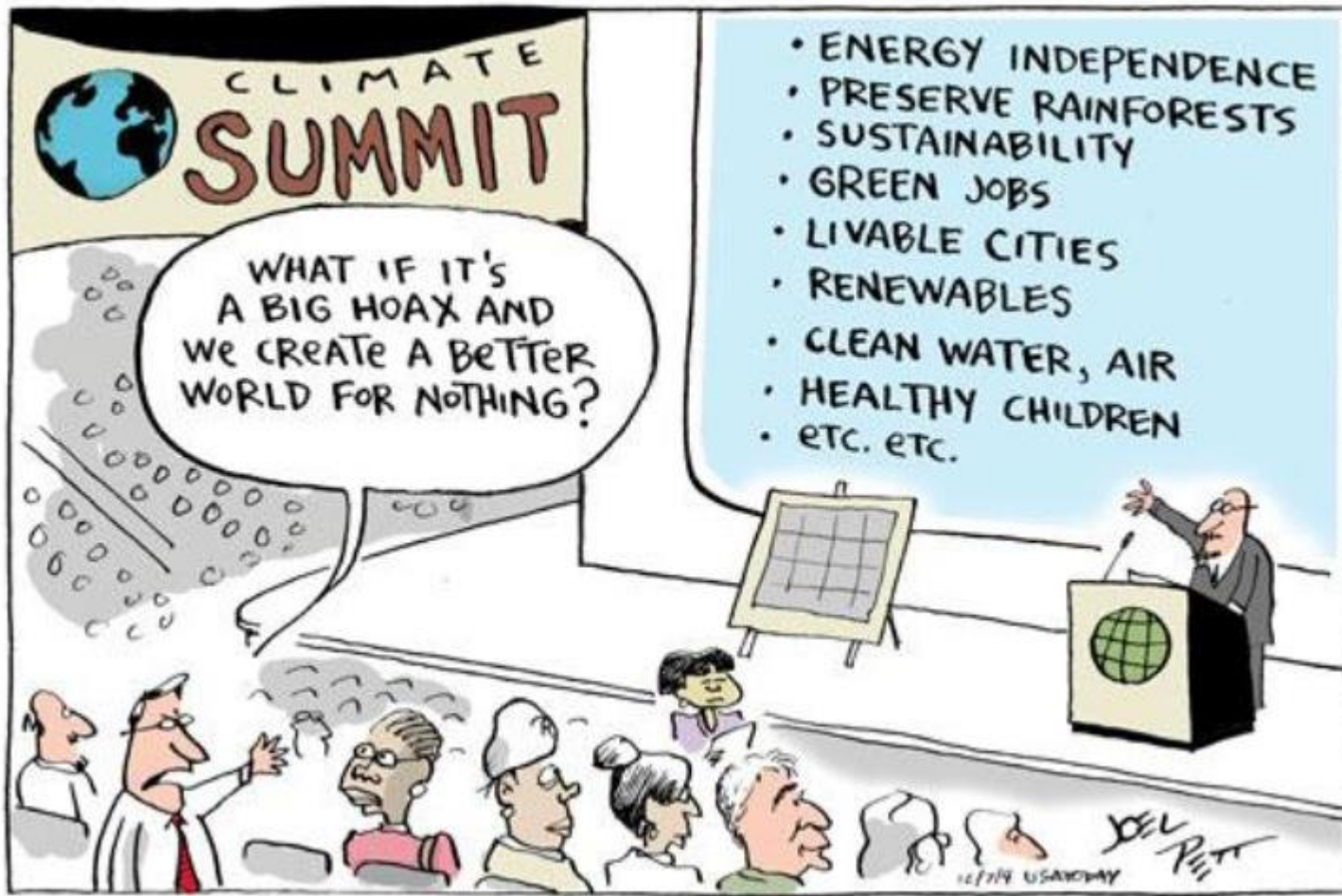


What are we doing

Figure 3: Relevant Interactions between Climate and Infrastructure



Closing





Thank you

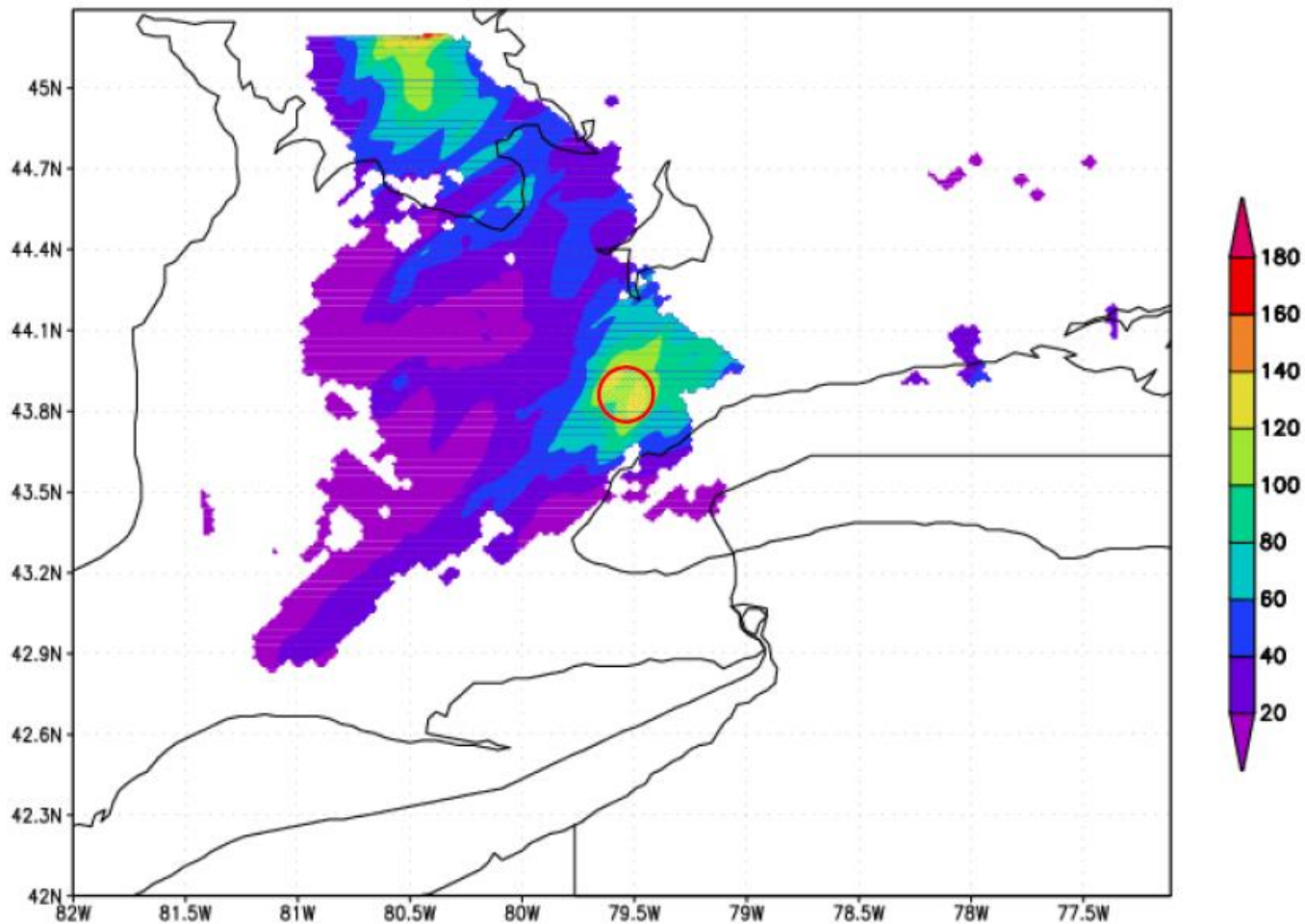


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Figure 42 Map of Total Precipitation over the GTA on 19 August 2005

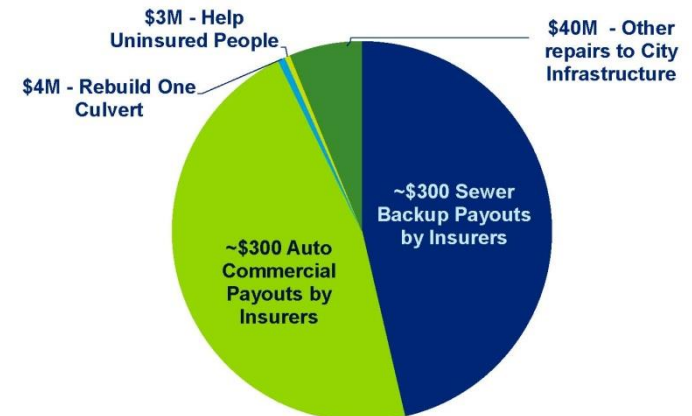


August 19, 2005

2/2



Toronto: August 2005 Storm



TOTAL
\$647 Million

 TORONTO

Climate Change Adaptation

Using PIEVC Protocol as Case Study

- **Assets**
 - Stormwater Facilities
 - Stormwater Ponds
 - Triple Box Culvert
- **Internalize knowledge**
- **Expand to other assets**
- **Also to soft assets?**
 - Sanitary Surcharge Agreements
 - Departure Metering Program



PIEVC Protocol

Public Infrastructure Engineering Vulnerability Committee

- Founded in August 2005 by Engineer's Canada and National Resources Canada
- Developed an Engineering Protocol is a five step evaluation process:
 - A tool derived from standard risk management methodologies
 - Intended for use by qualified engineering professionals
 - Requires contributions from those with pertinent local knowledge and experience
 - Focused on the principles of vulnerability and resiliency

www.pievc.ca

