MECP Stormwater Design and Permissions Working Group
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IDF Trend Analysis, Future Climate Projections & System Design for Extreme Weather Resiliency

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Outline

- Policies on Infrastructure Climate Effect Assessment
- Environment and Climate Change Canada (ECCC) Engineering Climate Datasets (Version 2.3 & Version 3.0)
  - Annual Maximum Series Trends and Significance
  - Regional IDF Trends Since 1990

Ontario Drivers for Assessing Climate Change Risks

Provincial Policy Statement (2014):

"Infrastructure … shall be provided in a coordinated, **efficient and cost-effective manner that considers impacts from climate change** …."

Infrastructure for Jobs and Prosperity Act (2015):

"Infrastructure planning and investment should minimize the impact of infrastructure on the environment … **should be designed to be resilient to effects of climate change**."

Environmental Assessments (2017):

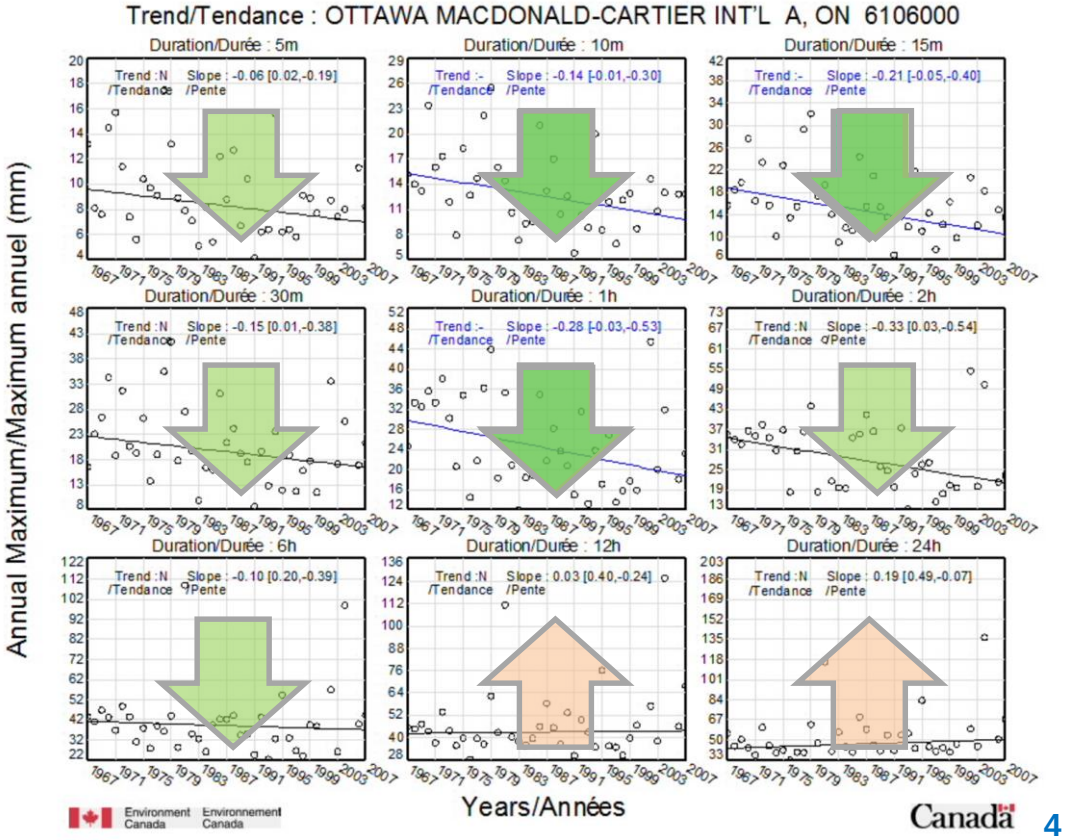
"… proponents to consider measures to adapt to climate change: **How vulnerable might a project be to a changing climate?**

Bill 139 (2017) Planning Act Amendments:

"OP shall contain policies that identify goals, objectives and actions to … **provide for adaptation to a changing climate, including through increasing resiliency."**

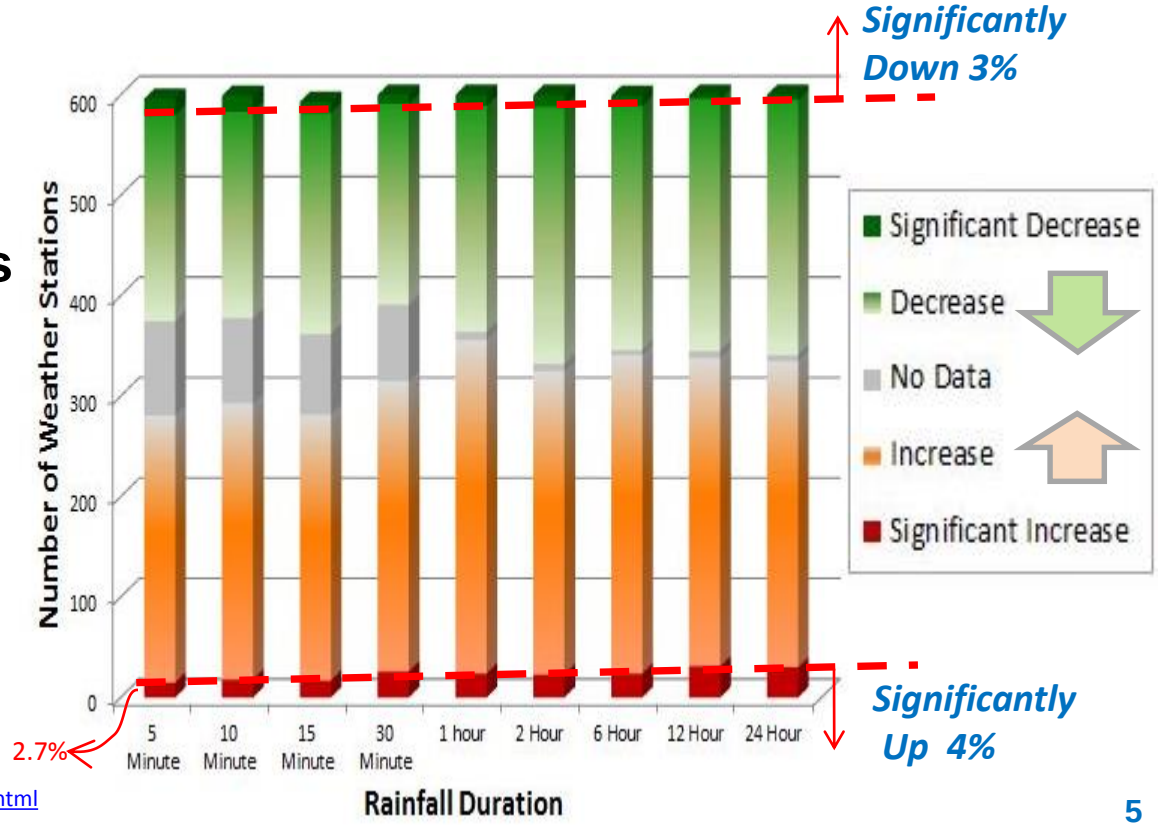
ECCC Annual Maximum Rainfall Trends

- ECCC introduced trend analysis in the v2.3 Engineering Climate Dataset, showing **trend direction and statistical significance** at each station: http://climate.weather.gc.ca/prods_servs/engineering_e.html
- Ottawa Airport
  - Decrease 5-min to 6-hrs.
  - Increase 12 to 24 hrs.
  - Statistically significant decrease over 10-min, 15-min, and 1-hr.



Very Few Significant Trends in Canada (random)

- **93% of trends are not significant or 'no data'.**
- **5-min rainfall maxima have significant increases at 2.7% of stations.**
- **Decreasing regional trends in southern QC and Atlantic. Increasing on coasts (SW BC and NFLD).**



http://www.cityfloodmap.com/2015/12/trends-in-canadian-shortduration.html

National Data Trends Contradict Marketing Claims

- **Insurance 'facts' & infographics on rain trends refuted by ECCC:**

Data facts from ECCC:

- "No Detectable Trend Signal" (Atmosphere-Ocean, 2014)
- "ECCC studies have not shown evidence to support statement" (Cdn Underwriter, 2016)
- **Advertising Standards Canada complaint resolutions 2015-2018 reject ads**
- "If this is used as the basis for statements about actual changes in extreme rainfall in Canada, then I would have concerns." (ECCC, 2018)
- "failed to comply with the CBC/Radio-Canada Journalistic Standards and Practices regarding accuracy and impartiality." (CBC Ombudsman, 2019)

http://https://www.slideshare.net/RobertMuir3/storm-intensity-not-increasing-factual-review-of-engineering-datasets

Mixing-up Annual Precipitation Data and Extreme Storm Risks

"Indeed in Canada, in southern Canada we are getting about 18% more rainfall on an annual basis than was the case just over 100 years ago. So when you see in the news and the media people talk about storms seem bigger and more intense and so forth, those perceptions are correct. And there's a lot of data to show it. I'm just giving one quick illustration here."

Blair Feltmate, Intact Centre on Climate Adaptation, February, 8, 2018

Standing Senate Committee on Energy, the Environment and Natural Resources

FOI Request Revealed No Data on Bigger Storms:

link: University of Waterloo letter March 27, 2018

Less Extreme Short Duration Rain - Southern Ontario

- **97 % of trends not statistically significant (mild trends up & down).**
- **2.3% statistically significant decreases and only 1.0 % significant increases in intensity. No short duration significant increases.**

Southern Ontario Extreme Rainfall Trend and Significance Climate Station Count	Rainfall Duration									Sub-Total	Pct of Total
	5 Min	10 Min	15 Min	30 Min	1 Hr	2 Hr	6 Hr	12 Hr	24 Hr		
Decrease / Significant	1	2	1			2	2	2	3	13	2.3%
Decrease / Not Significant	29	20	21	19	23	26	30	28	34	230	39.9%
No Data	11	10	10	10	2	2	1	2	2	50	8.7%
Increase / Not Significant	23	32	32	34	39	34	30	30	23	277	48.1%
Increase / Significant				1			1	2	2	6	1.0%
Climate station latitude < 44 degrees									Total	576	100%

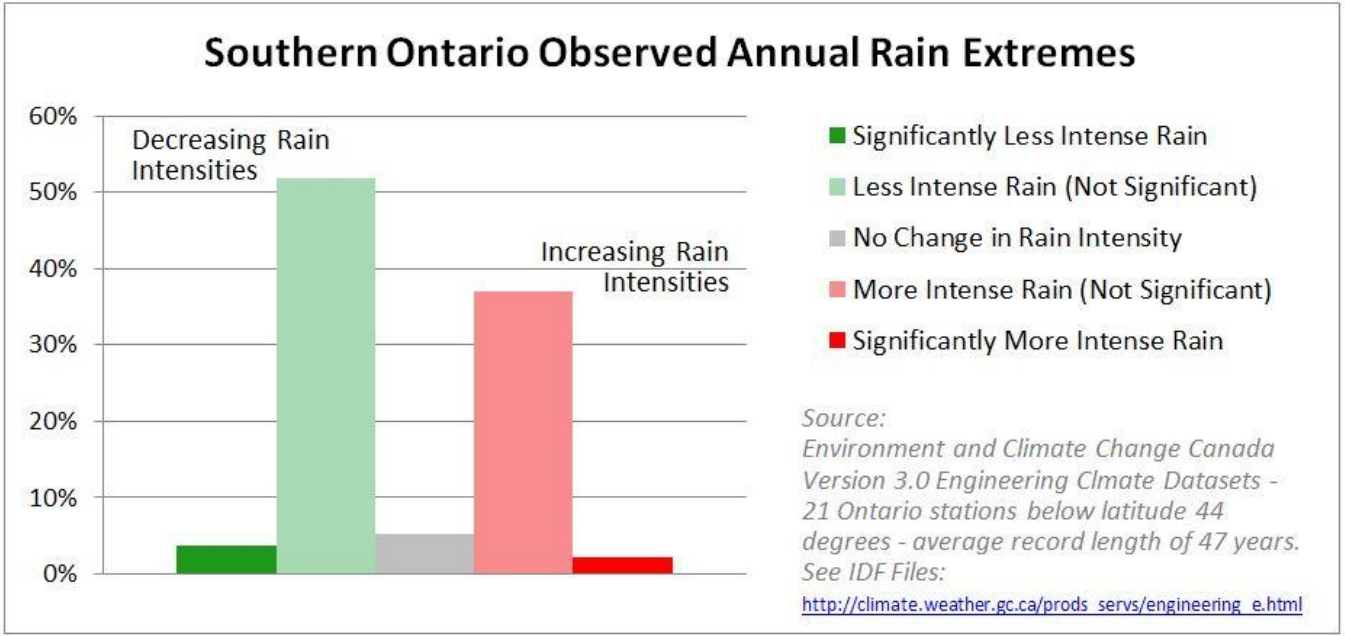
97%

V2.3 Datasets

http://www.cityfloodmap.com/2016/02/ontario-climate-change-trends-going.html

Decrease in Maximum Annual Observed Rain in S. Ontario

- **21 stations with 47 years of data (average) have 42% more decreasing maximum rain trends than increasing trends.**



V3.0 Engineering Climate Datasets – 2019

https://www.cityfloodmap.com/2019/03/environment-and-climate-change-canada.html

More Decreases Than Increases Across All Durations

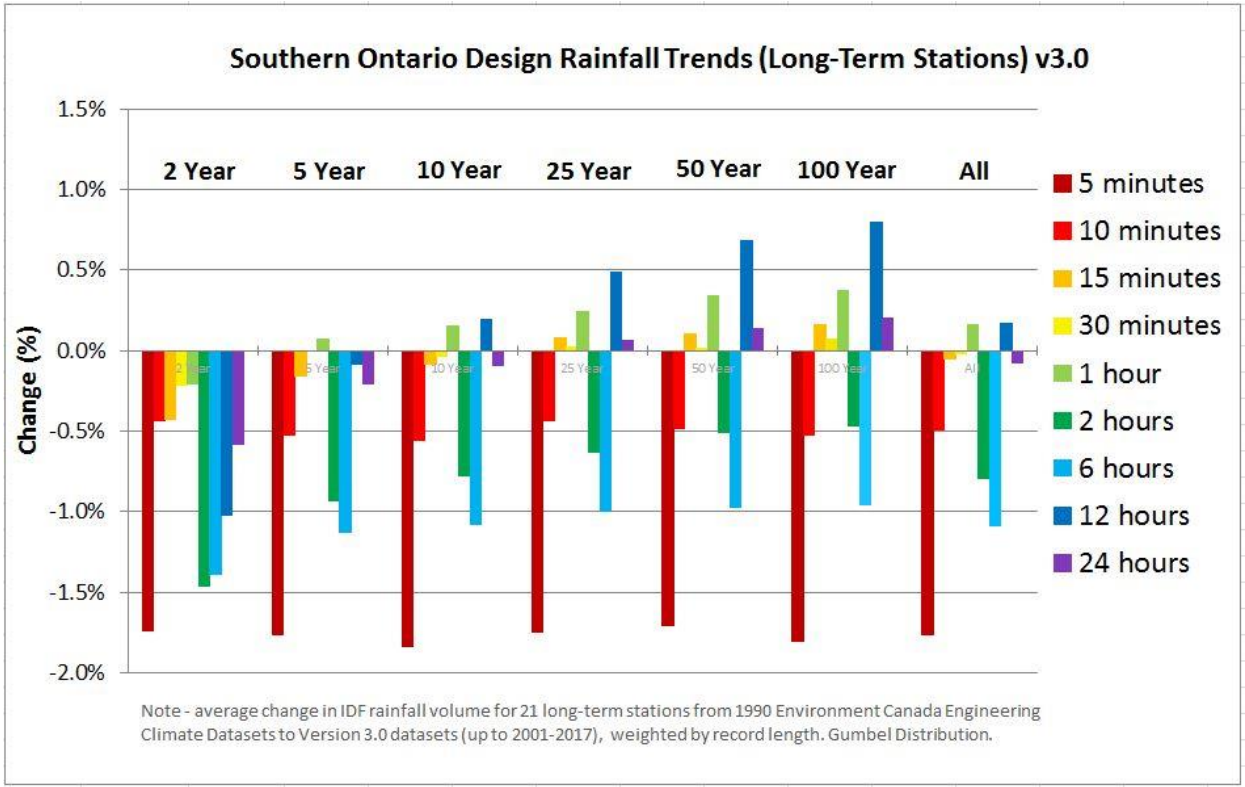
Climate Station Name		Station ID	Engineering Climate Datasets Annual Maximum Rainfall Trend and Significance (v3.0)									Max. No. of Years	Most Recent Year
			5 min	10 min	15 min	30 min	1 hr	2 hr	6 hr	12 hr	24 hr		
Ontario South (Lat. < 44 deg.)													
Sarnia Airport	ON	6127514										49	2016
Chatham WPCP	ON	6131415										40	2007
Delhi CS	ON	6131983										51	2015
Port Colborne	ON	6136606										38	2007
Ridgetown RCS	ON	6137154										38	2016
St Catharines A	ON	6137287										39	2005
St Thomas WPCP	ON	6137362										76	2007
Windsor A	ON	6139525										60	2007
Brantford MOE	ON	6140954										37	2001
Fergus Shand Dam	ON	6142400										43	2007
Guelph Turfgrass CS	ON	6143090										53	2017
London CS	ON	6144478										67	2016
Mount Forest (Aut)	ON	6145504										38	2016
Stratford WWTP	ON	6148105										37	2004
Waterloo Wellington A	ON	6149387										34	2007
Bowmanville Mostert	ON	6150830										31	2001
Hamilton A	ON	6153194										33	2003
Hamilton RBG CS	ON	6153301										53	2016
Oshawa WPCP	ON	6155878										32	2006
Toronto City	ON	6158355										69	2017
Toronto Intl A	ON	6158731										65	2017

- Decreasing extreme rain / Significant Trend
- Decreasing extreme rain / Not Significant
- No change
- Increasing extreme rain / Not Significant
- Increasing extreme rain / Significant Trend

https://www.cityfloodmap.com/2019/03/environment-and-climate-change-canada.html

Decrease in Derived IDF Values in S. Ontario

- **Long term stations have decreasing IDF design intensity values since 1990:**
  - **5-Min -1.8 %**
  - **24-hr -0.1 %**
  - **Overall -0.4 %**



https://www.cityfloodmap.com/2019/03/idf-updates-for-southern-ontario-show.html

Decreases Across 2 Year to 100 Year Design Intensities

- **Long term stations have decreasing IDF design intensity values since 1990:**
  - **2 Yr -0.8 %**
  - **100 Yr -0.2 %**
  - **Overall -0.4 %**

Average Trend in S. Ont. Design Rainfall Severity (weighted by record length) v3.0

	Return Period						
Duration	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	All
5 minutes	-1.7%	-1.8%	-1.8%	-1.8%	-1.7%	-1.8%	-1.8%
10 minutes	-0.4%	-0.5%	-0.6%	-0.4%	-0.5%	-0.5%	-0.5%
15 minutes	-0.4%	-0.2%	-0.1%	0.1%	0.1%	0.2%	-0.1%
30 minutes	-0.2%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
1 hour	-0.2%	0.1%	0.2%	0.2%	0.3%	0.4%	0.2%
2 hours	-1.5%	-0.9%	-0.8%	-0.6%	-0.5%	-0.5%	-0.8%
6 hours	-1.4%	-1.1%	-1.1%	-1.0%	-1.0%	-1.0%	-1.1%
12 hours	-1.0%	-0.1%	0.2%	0.5%	0.7%	0.8%	0.2%
24 hours	-0.6%	-0.2%	-0.1%	0.1%	0.1%	0.2%	-0.1%
Average	-0.8%	-0.5%	-0.5%	-0.3%	-0.3%	-0.2%	-0.4%

https://www.cityfloodmap.com/2019/03/idf-updates-for-southern-ontario-show.html

Short Duration (5 Minute) Decreases Greatest

- **Intensities that govern much sewer design (< 1 hour durations) have decreasing IDF design values since 1990.**

Mississauga Extreme Rainfall Trends Environment Canada Climate Station 6158733 (Pearson Int'l A)						
Return Period (Years)	5 Minute Rainfall Intensity (mm/hr)					Change in Rainfall Intensity
	1990	2003	2007	2013	2017	1990 - 2017
2	107.4	100.8	100.0	101.9	100.4	-6.5%
5	141.5	134.7	133.2	135.2	133.2	-5.9%
10	164.2	157.3	155.2	157.3	155.0	-5.6%
25	192.7	185.7	183.0	182.2	182.4	-5.3%
50	213.9	206.8	203.6	206.0	202.8	-5.2%
100	235.0	227.7	224.0	226.5	223.0	-5.1%
					Overall:	**-5.6%**

https://www.cityfloodmap.com/2019/03/idf-updates-for-southern-ontario-show.html

Short Duration (5 Minute) Decreases Greatest

- **Intensities that govern much sewer design (< 1 hour durations) have decreasing IDF design values since 1990.**

Toronto Extreme Rainfall Trends Environment Canada Climate Station 6158355 (Toronto City)					
Return Period (Years)	5 Minute Rainfall Intensity (mm/hr)				Change in Rainfall Intensity
	1990	2003	2007	2017	1990 - 2017
2	113.9	110.8	109.2	108.1	-5.1%
5	159.4	154.4	151.9	149	-6.5%
10	189.6	183.3	180.1	176.1	-7.1%
25	227.7	219.8	215.8	210.4	-7.6%
50	256.0	246.8	242.3	235.8	-7.9%
100	284.0	273.7	268.5	261.0	-8.1%
				Overall:	-7.1%

https://www.cityfloodmap.com/2019/03/idf-updates-for-southern-ontario-show.html