

# Building Climate Resilience Across Infrastructure Ontario Managed Assets



# Introductions

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## Takeaway

In Ontario it is responsible, cost effective, and mandated to integrate climate considerations into infrastructure development and property management processes

# Presentation Outline

- 1) Priority Setting in Provincial Asset Management
- 2) Scoping a Resilience Analysis: IO's flood resilience project
- 3) Governance is what connects data to actions, as it affects:
  - information
  - implementation
  - ability to react
- 4) Conclusions
  - Embed resilience in existing work processes
  - Base resilience measures on both sector best practices and the field experience of asset management staff
  - Give staff the information and tools they need to take iterative site-specific actions towards resilience

# Infrastructure Ontario (IO)

- ▶ Infrastructure Ontario (IO) is a provincial Crown agency reporting to the Ministry of Government and Consumers Services and the Ministry of Infrastructure
- ▶ Provides a range of services that support the Ontario government's initiatives to modernize and maximize the value of public infrastructure and realty
- ▶ Upholds Ontario's commitment to renew public services, in partnership with the private sector
- ▶ Manages a host of core government buildings and special purpose facilities



# Real estate portfolio

- ▶ The provincial real estate portfolio is one of Canada's largest and most diverse
- ▶ Realty is integral to the delivery of public services across Ontario
- ▶ IO is fully responsible for the General Real Estate Portfolio, which is comprised of:



Nearly 5000 buildings and structures in over 350 communities



More than 44 million rentable square feet

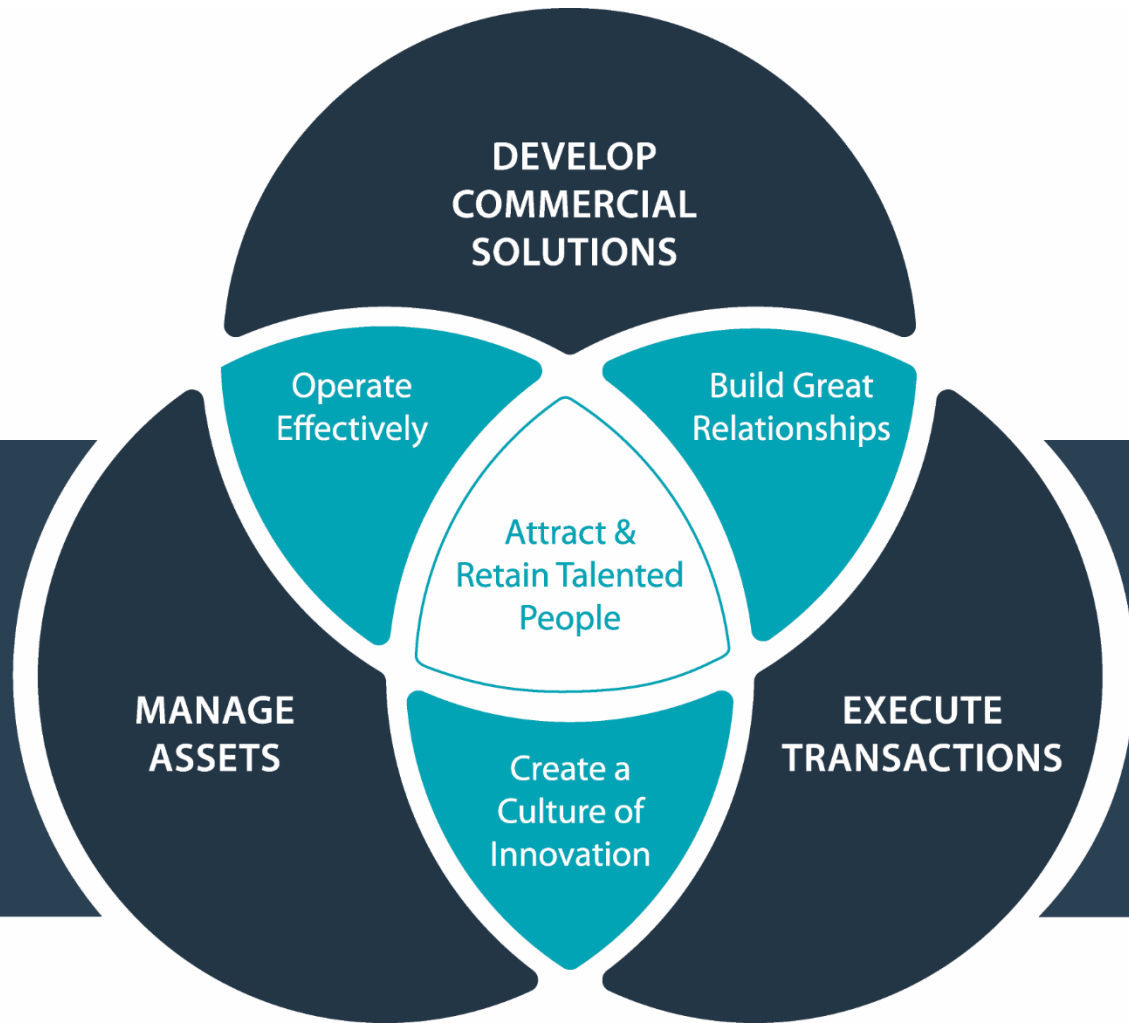


One million acres of land throughout the province

- ▶ IO also delivers realty services to other provincial and broader public sector entities

# Priority Setting Across the Portfolio

- ▶ Government Platforms and Plans
- ▶ Corporate Objectives
- ▶ Portfolio Management Strategies



# Partnering to Modernize Ontario's Public Assets

- Protecting the Public Interest
- Maximizing Value to Taxpayers
- Leading Innovative Delivery Models



# Government realty priorities

- ▶ Safe and sustainable provincial buildings
  - Ensuring the upkeep and operational efficiency of provincial assets
- ▶ Efficient and effective service delivery
  - Supporting effective delivery of provincial services through workplace modernization
- ▶ Right-size the portfolio
  - Ensuring that the composition of the real estate assets is appropriate and optimized to meet the needs of the portfolio and government programs

Realty priorities support broad government initiatives, such as:

- promoting economic growth and job creation
- modernizing the public service
- adaptation to climate change

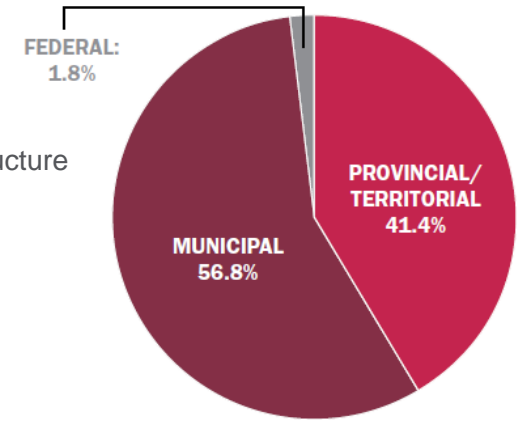


# Climate Impacts on Critical Infrastructure

## 2 out of 12 Actions on Resilience Outlined in Ontario's 2018 Environment Plan:

- Undertake a provincial **impact assessment** to identify where and how climate change is likely to impact Ontario's communities
- ▶ **Build resilience in the province's critical infrastructure**, through **better technology** as well as **back-up generation** and **energy storage** options, so that our vital services and infrastructure, such as hospitals, can better withstand and remain operational during extreme weather events.

Net Stock of Core Public Infrastructure by Level of Government, 2013  
www.canadianinfrastructure.ca



Infrastructure	Extrapolated Replacement Value of All Assets	Assets in Very Poor and Poor Condition	Assets in Fair Physical Condition	Anticipated Condition Based on Reported Reinvestment Levels (Improving, Stable, Declining)
		Replacement Value	Replacement Value	
Potable Water	\$207 billion	\$25 billion (12%)	\$35 billion (17%)	Declining
Wastewater	\$234 billion	\$26 billion (11%)	\$56 billion (24%)	Declining
Stormwater	\$134 billion	\$10 billion (7%)	\$21 billion (16%)	Declining
Roads	\$330 billion	\$48 billion (15%)	\$75 billion (23%)	Declining
Bridges	\$50 billion	\$2 billion (4%)	\$11 billion (22%)	Declining
Buildings	\$70 billion	\$12 billion (17%)	\$20 billion (28%)	Declining
Sport and Recreation Facilities	\$51 billion	\$9 billion (18%)	\$14 billion (27%)	Declining
Transit	\$57 billion	\$9 billion (16%)	\$15 billion (27%)	Unavailable
<b>Total</b>	<b>\$1.1 trillion</b>	<b>\$141 billion (12%)</b>	<b>\$247 billion (22%)</b>	
<b>Replacement Value per Household</b>	<b>\$80,000</b>	<b>\$10,000</b>	<b>\$18,000</b>	

# Scoping a Resilience Analysis: IO's Flood Resilience Project

- ▶ Frequency and Intensity of Flood Incidents
- ▶ Priority Assets that support Provincial Resilience
- ▶ Accessible/Useable Outputs

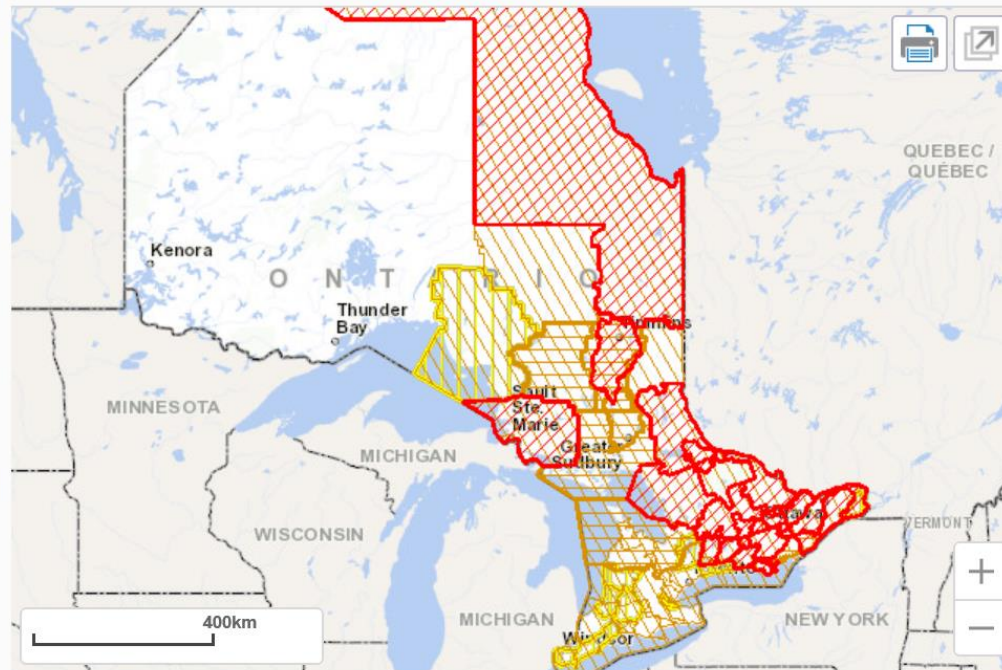
# Provincial Emergency Operations Centre (PEOC) Spring Flooding Update

Updated on: April 29, 2019 at 3:30 p.m.

As a result of flooding caused by heavy precipitation and ongoing snow melt, emergencies have been declared in the:

- City of Ottawa
- Town of Huntsville
- Town of Bracebridge
- Township of Minden Hills
- Township of Whitewater Region
- Township of Horton
- Township of McNab/Braeside
- City of Clarence-Rockland
- Township of Alfred-Plantagenet
- Township of Laurentian Valley
- Township of Greater Madawaska
- Township of Muskoka Lakes
- County of Renfrew
- District of Muskoka
- Town of Petawawa.

Ontario flood map



Flood Warning	Flood Watch	Condition Statement
<input checked="" type="checkbox"/> Locally Issued	<input checked="" type="checkbox"/> Locally Issued	<input checked="" type="checkbox"/> Locally Issued
<input type="checkbox"/> Provincially Issued	<input checked="" type="checkbox"/> Provincially Issued	<input checked="" type="checkbox"/> Provincially Issued

Updated: Provincial Flood Watch for Southern and Northeast Ontario Issued by the Surface Water Monitoring Centre of the Ministry of Natural Resources and Forestry on April 29, 2019 at 3:30 PM

<https://www.ontario.ca/law-and-safety/flood-forecasting-and-warning-program>

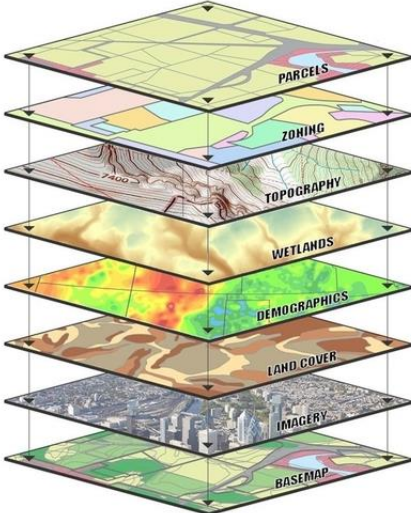
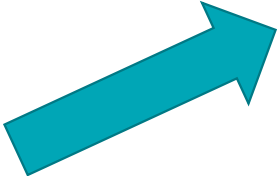
# Ontario Climate Consortium's Provincial Flood Resilience Assessment for Infrastructure Ontario

## Flood Risk Factors

- History of Flooding
- Proximity to Floodplain
- Stormwater Runoff Potential
- Groundwater Seepage Potential
- Potential for Combined Sewers
- Future Extreme Rainfall

- Asset Use
- Occupancy Type
- Building Condition & Materials
- Presence of Basement
- Social/Cultural Value
- Flood-related Injuries & Costs
- Occurrence of Spills
- O&M Costs

- Backup Power Availability
- Physical Flood Protection Measures
- Training & Awareness

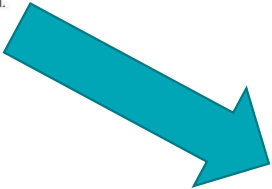


### GIS DATA LAYERS

Many different types of data can be integrated into a GIS and represented as a map layer.

Examples can include: streets, parcels, zoning, flood zones, client locations, competition, shopping centers, office parks, demographics, etc.

When these layers are drawn on top of one another, undetected spatial trends and relationships often emerge. This allows us to gain insight about relevant characteristics of a location.



# Governance Connects Data to Actions

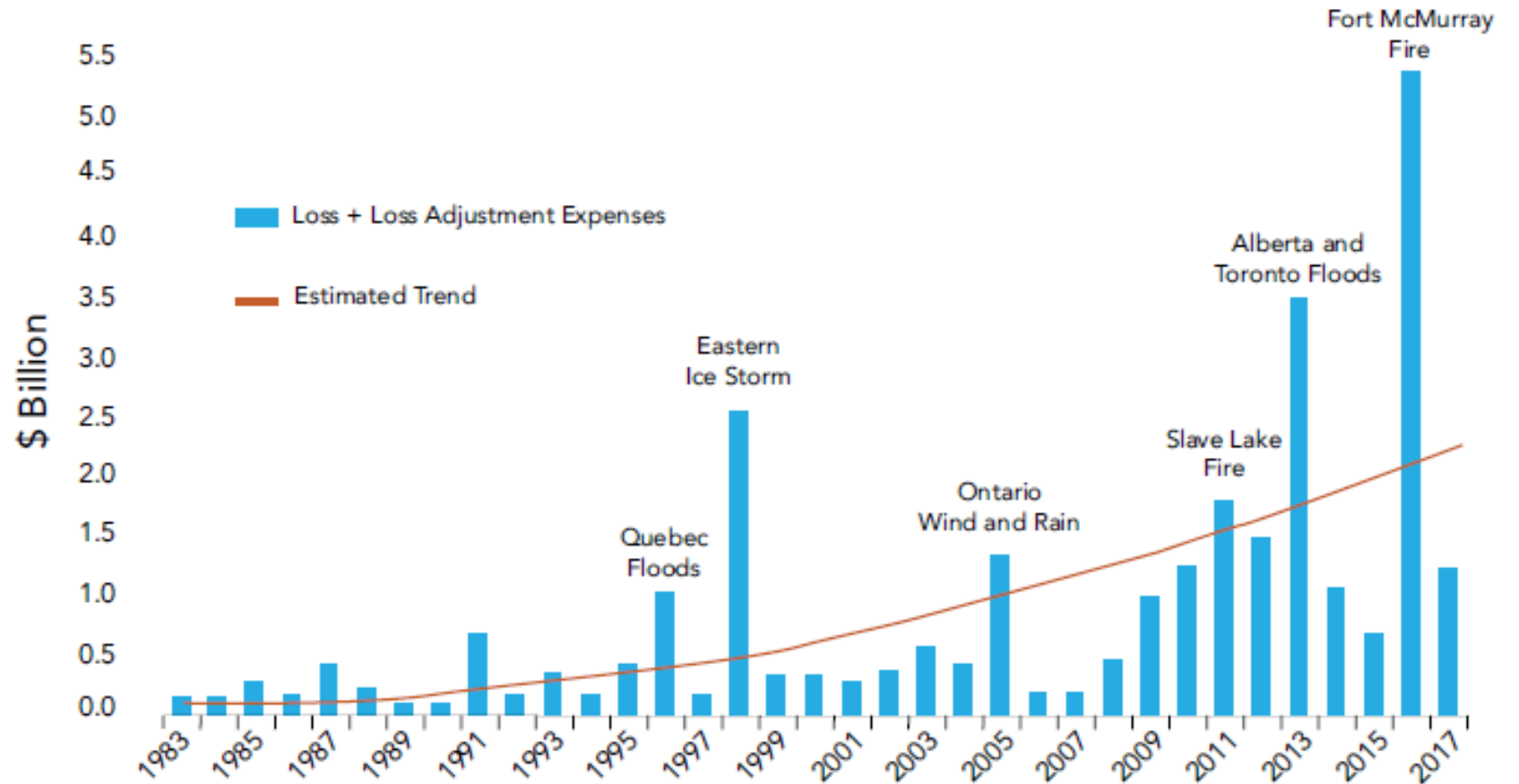
- ▶ Information
- ▶ Implementation
- ▶ Ability to react

# Costs of Climate Events

Extreme weather has a cost. Records of insured losses, have gone from millions to billions. While costs to government and homeowners are 3-4x as much as what private insurers are reporting.

*Property owners now need to actively **consider climate risks** like flooding, warmer temperatures, heavier snowfall, and potential power outages to **avoid future costs and damages** to their building stock.*

– REALPAC



Catastrophic Insured Losses in Canada (1983 – 2017), IBC Facts Book, 2017.



# Infrastructure Resilience

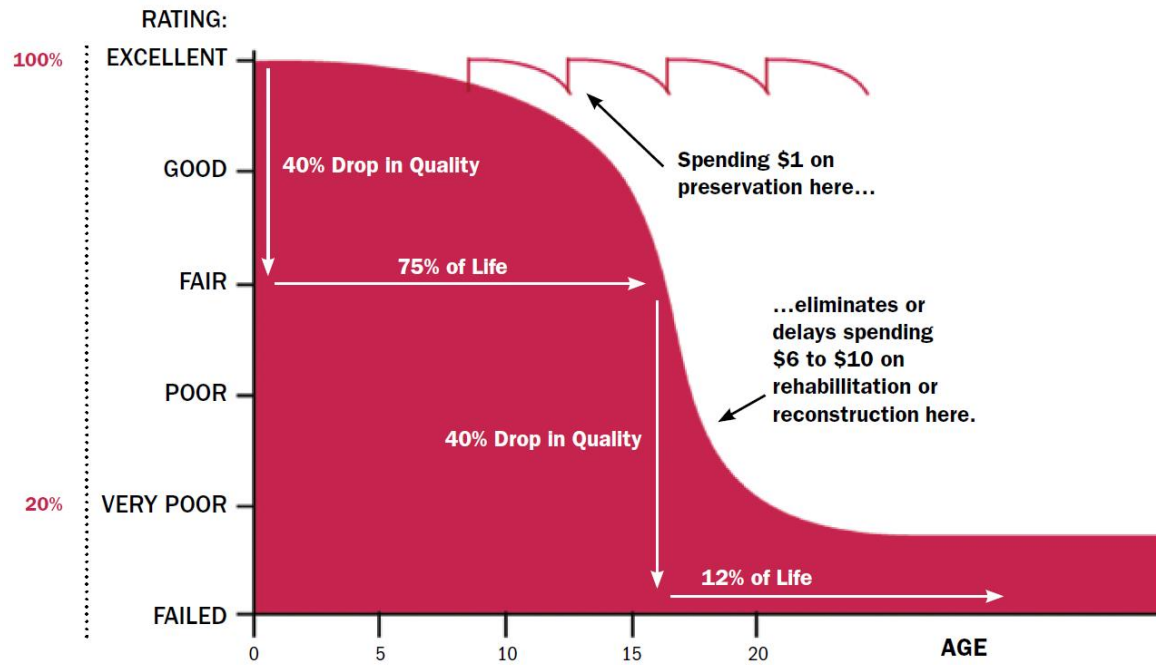


Figure 6 – Example of Asset Deterioration Curve (Roads)  
(Canadian Infrastructure Report Card, 2016)

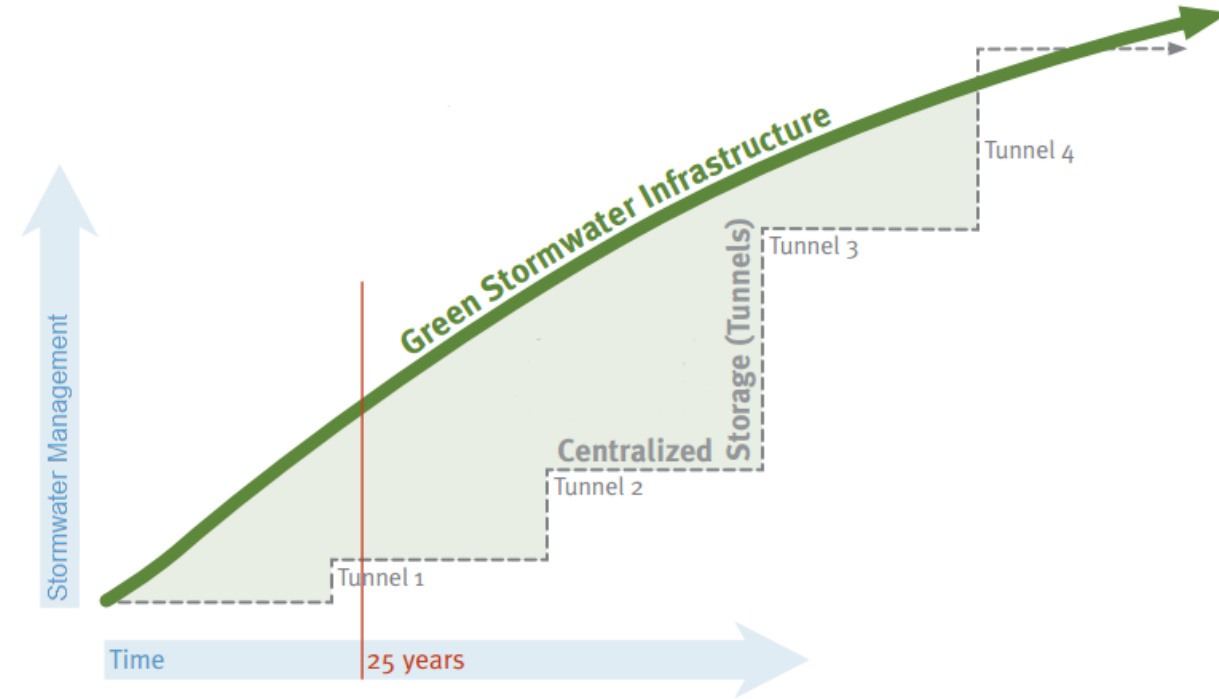
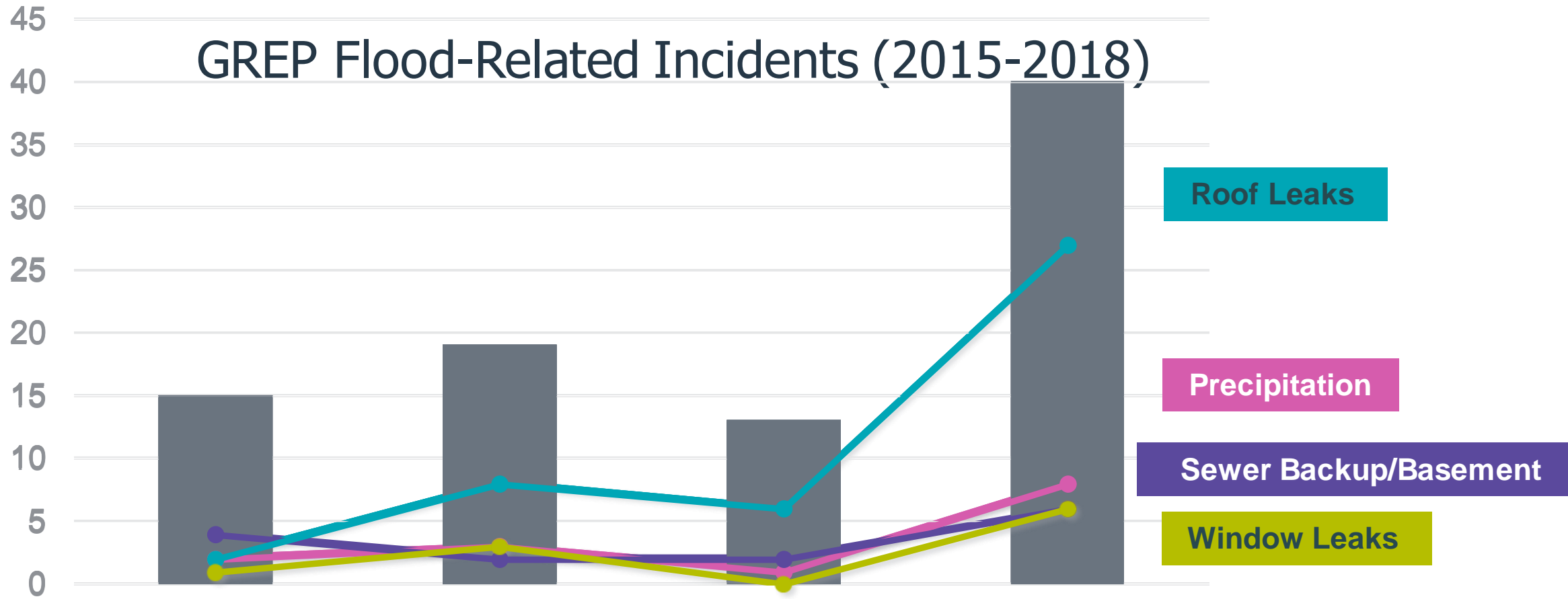


Figure 1 – Comparison of green infrastructure and targeted traditional infrastructure in managing stormwater over time (Adapted from diagram by Philadelphia Water Department, 2011)



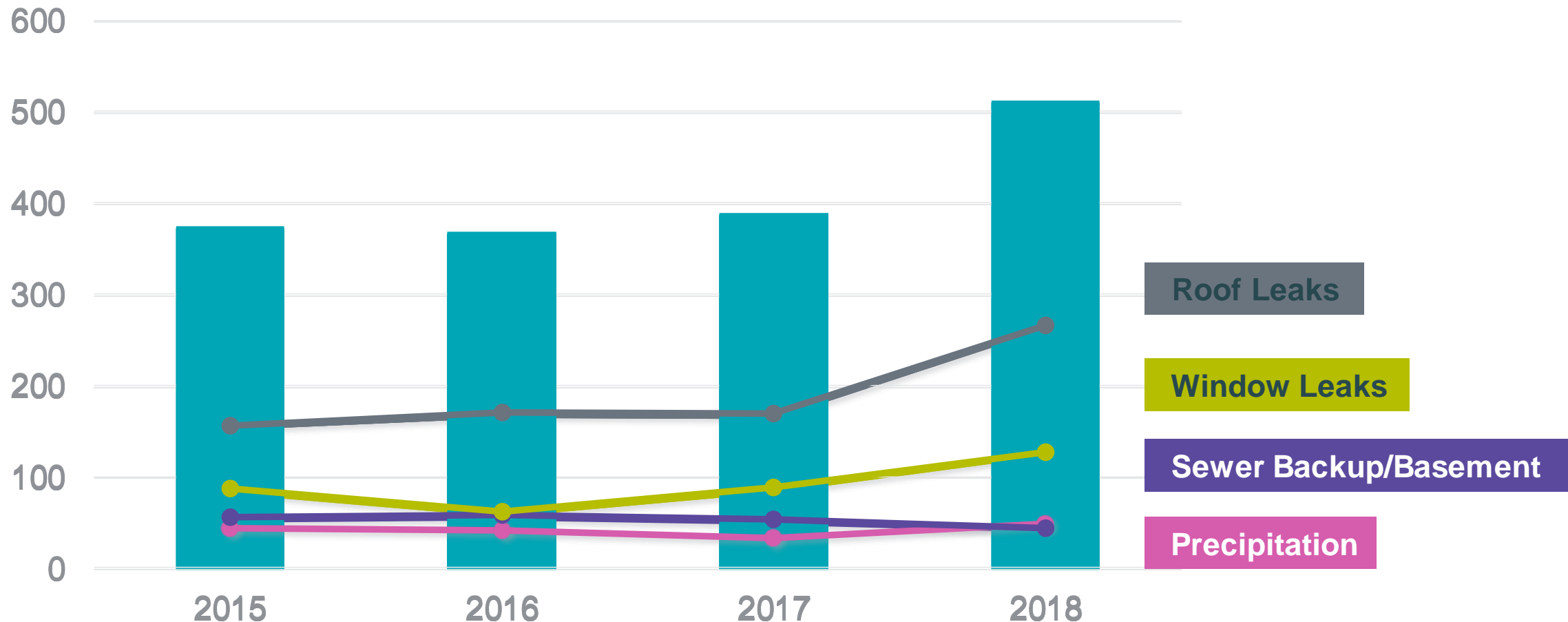
# Leveraging Portfolio Analytics

## GREP Flood-Related Incidents (2015-2018)



<b>Total</b>	15	19	13	40	<b>87</b>
<b>Percent</b>	17%	22%	15%	46%	<b>100%</b>

# Flood-Related Work Orders (2015-2018)



<b>Total</b>	374	368	389	512	<b>1643</b>
<b>Percent</b>	23%	22%	24%	31%	<b>100%</b>

# Implementing Resilience

## Governance

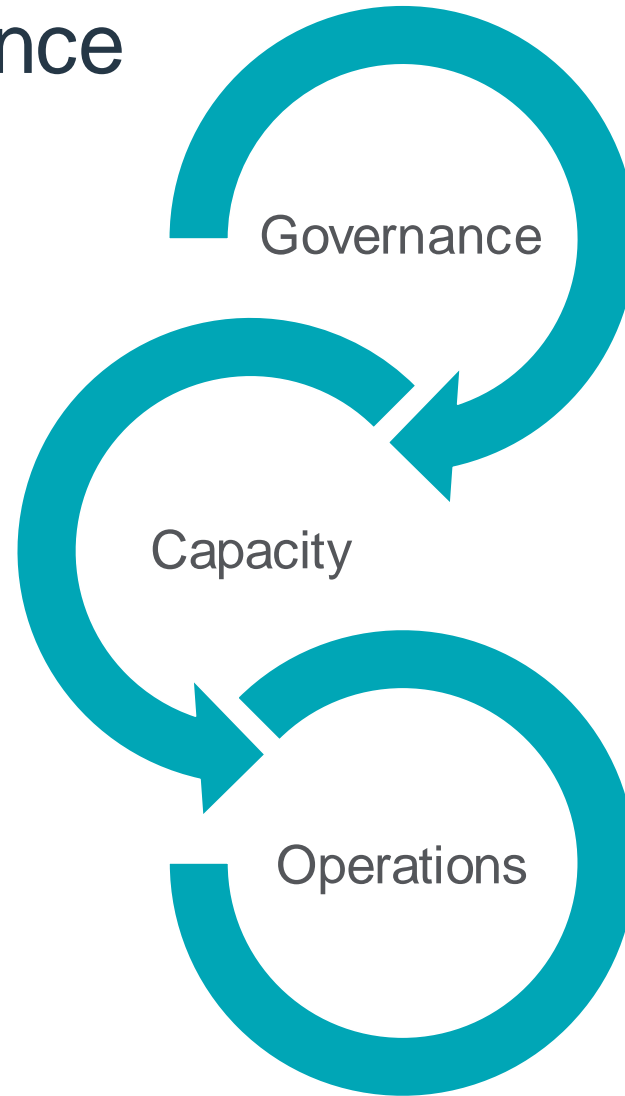
- Vision & Leadership
- Facilitating Legislation
- Financial & Planning Tools
- Relevant Research

## Capacity

- Education and Training
- Resources: people, adaptation plans, climate data, risk assessment tools, funding
- Guidance manuals, building codes

## Operations

- Climate Resilient Designs & Retrofits
- Natural Infrastructure
- Emergency Plans, Supplies, & Power



D. Meadows (1999),  
Leverage Points: Where  
to intervene in a System

Places to Intervene in a System  
(in increasing order of effectiveness)

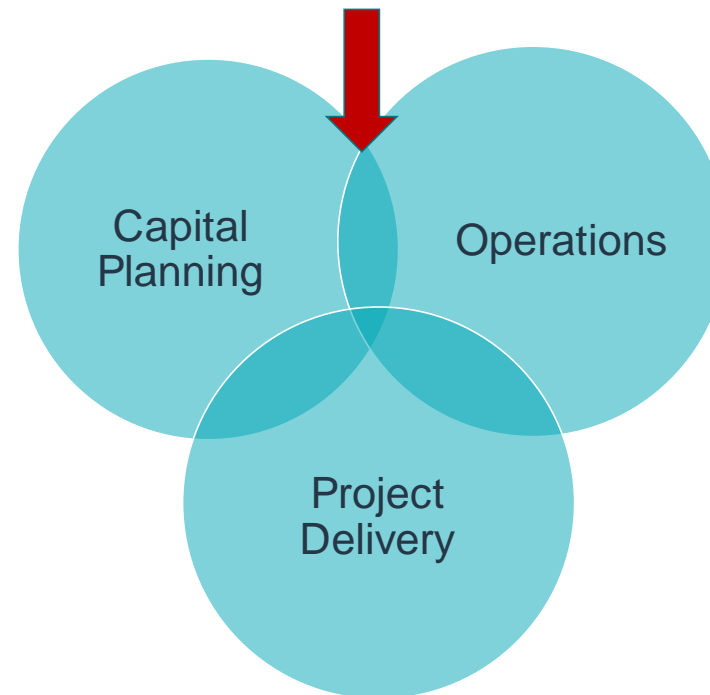
12. Constants, parameters, numbers (such as subsidies, taxes, standards)
11. The sizes of buffers and other stabilizing stocks, relative to their flows.
10. The structure of material stocks and flows (such as transport networks, population age structures)
9. The lengths of delays, relative to the rate of system change
8. The strength of negative feedback loops, relative to the impacts they are trying to correct against
7. The gain around driving positive feedback loops
6. The structure of information flows (who does and does not have access to what kinds of information)
5. The rules of the system (such as incentives, punishments, constraints)
4. The power to add, change, evolve, or self-organize system structure
3. The goals of the system
2. The mindset or paradigm out of which the system—its goals, structure, rules, delays, parameters—arises
1. The power to transcend paradigms

# IO Resilience Strategy

## ❖ Vision

Develop IO into a leader in infrastructure climate resilience: A targeted set of resilience measures to be implemented within existing IO infrastructure programs

## Resilience Measures



## Resilience Measures

Resilience output specifications for P3 projects

Flood Risk Assessment Project: 130 asset risk rankings, geoportal mapping & assessment matrix

Measures to mitigate flooding in high risk buildings

Resilience checklist for base building assessments

Resilience measures in Design Guidelines for equipment replacement

Climate considerations for Environmental Assessments

Water conservation program and reduction target

Foster awareness of Resilience across multiple IO, CBRE, and PMSP divisions

# Conclusions

- ▶ Embed resilience in existing work processes
- ▶ Improve data collection processes to better inform resilience related decisions
- ▶ Partner to increase data resources and project capacity
- ▶ Base resilience measures on both sector best practices and the field experience of asset management professionals
- ▶ Give IO staff and IO service providers the information and tools they need to take iterative site-specific actions towards resilience

Overview of Water Usage vs Cost





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