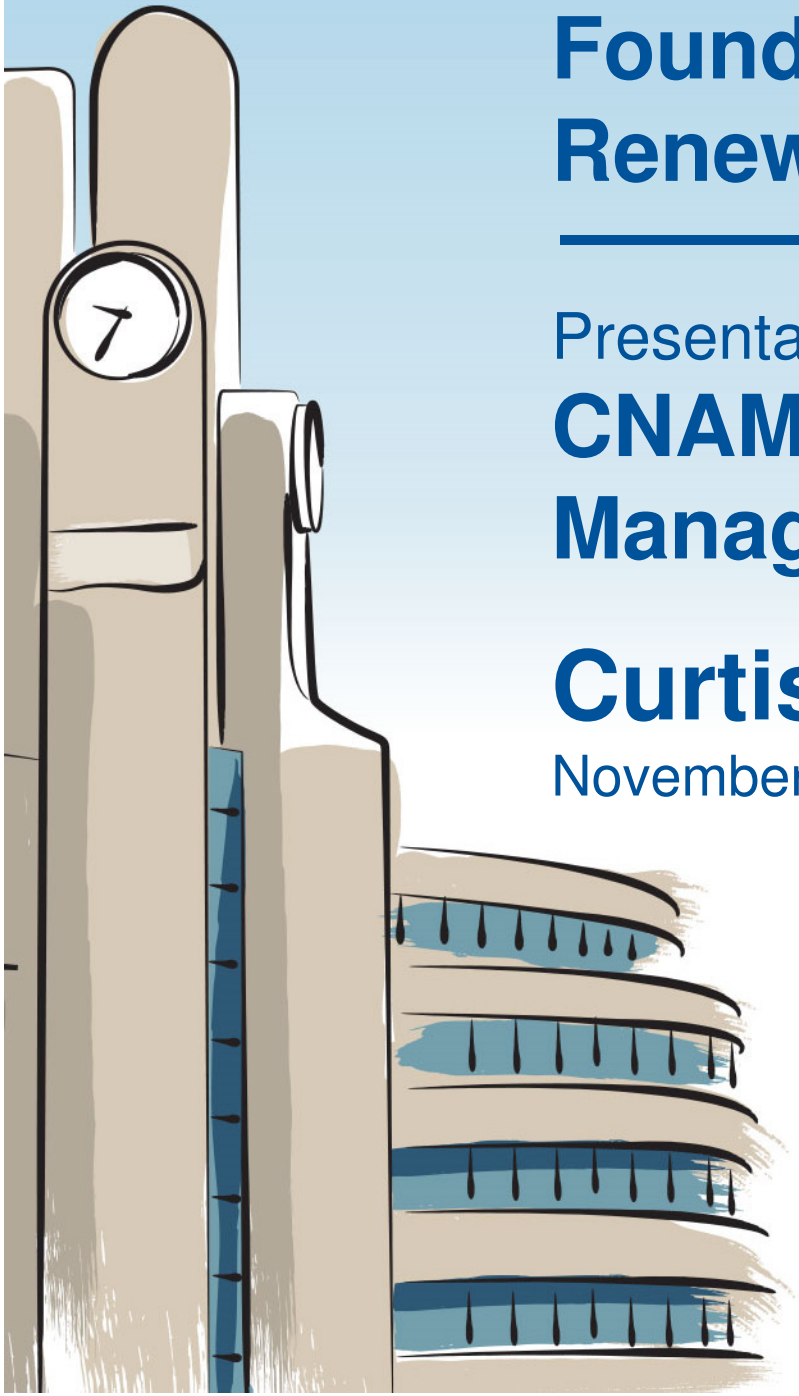


Foundational Long Term Asset Renewal Needs in York Region

Presentation to

CNAM Ontario Asset Management Working Group

Curtis Ching

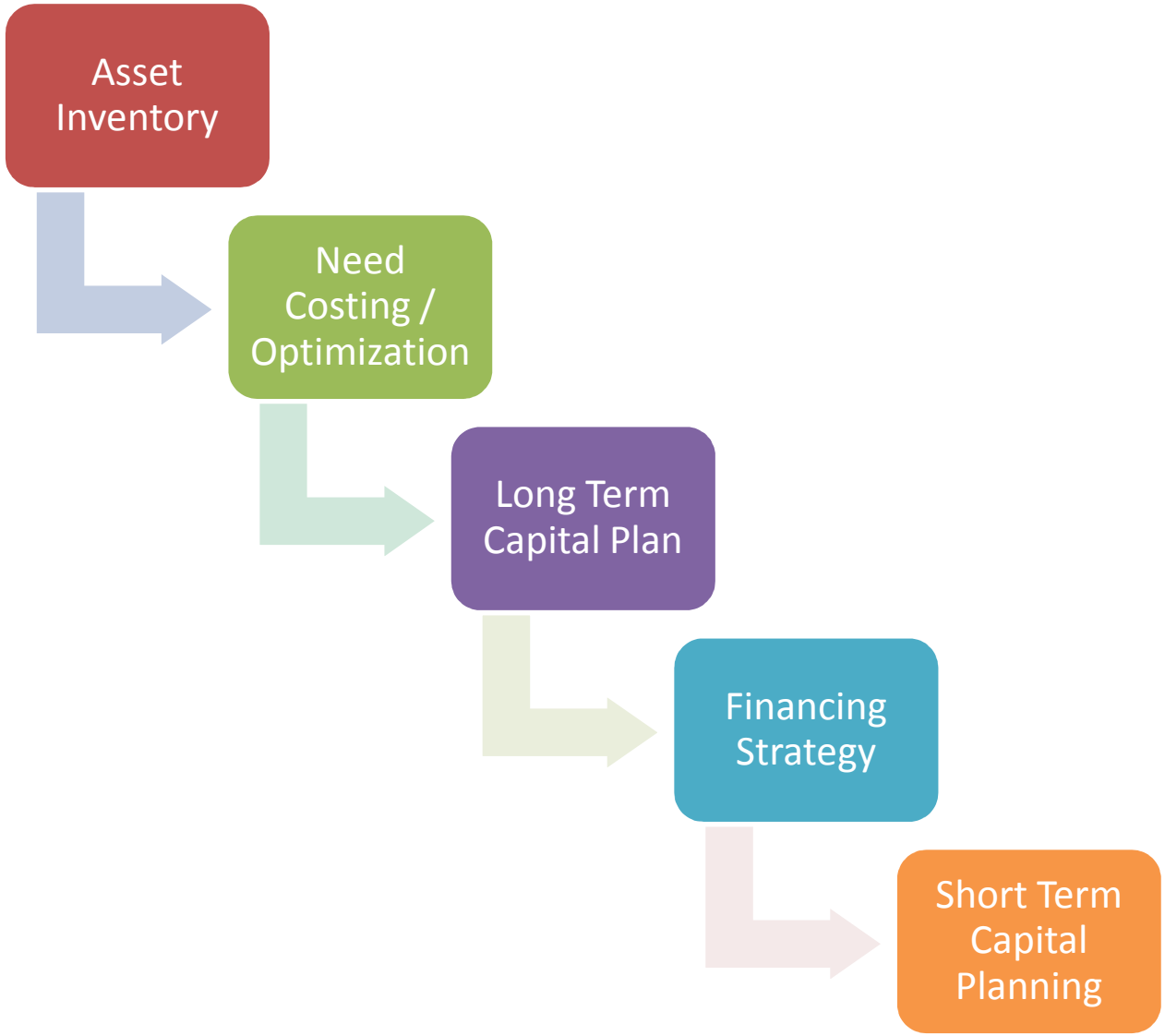
November 23, 2015

York Region

Agenda

1. Asset Replacement Costs
2. Long Term Infrastructure Needs
3. Next Steps

Simplified AM Planning Process



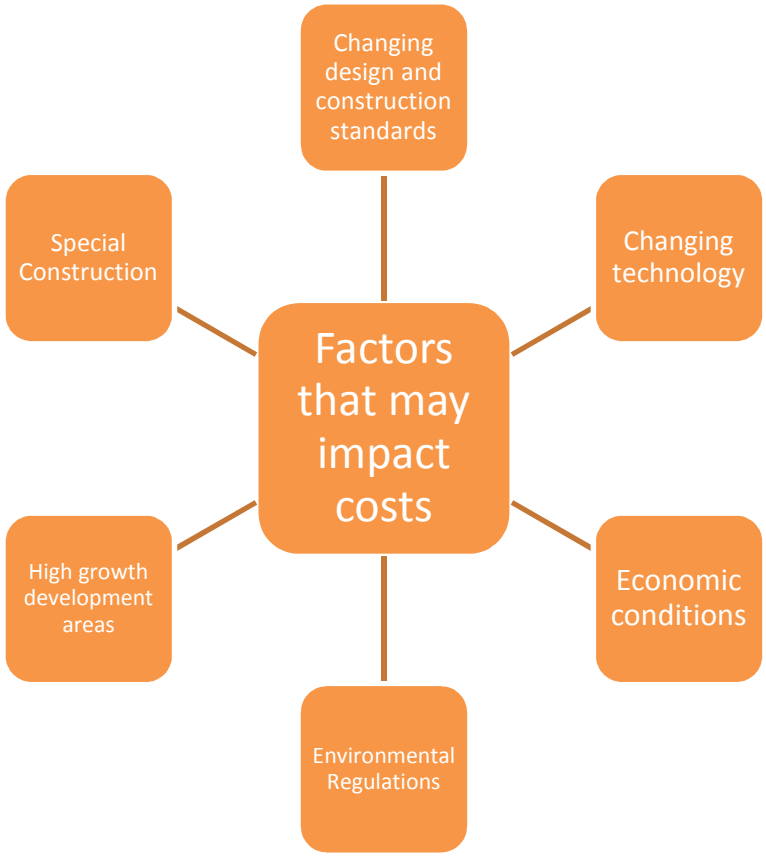
Asset Replacement Costs

Challenges:

1. Actual financial spend has regularly exceeded long term projection
2. Scope of planned work is often ‘improved’ as dependent components are identified during construction or design
3. Majority of historical work is new construction in greenfield
4. Indexing and inflation methods magnify baseline errors and deviations

Objective:

1. Asset Replacement Hierarchy (ARH)
2. Replacement cost estimate for existing assets ‘if they were replaced today’
3. Methodical and repeatable method to update replacement costs



The Nature of W&WW Assets

- Assets constructed based on ‘projected’ population growth, service demand and location
- Expected facility life from 60 to 100+ years, extending into multiple generations in the workforce
- Asset life is significantly affected by operational history and external factors
- Compounded by demand variations and continually evolving regulations and technologies
- Transmission and collection systems are entirely below grade

York Region Water and Wastewater Services

- Responsible for treatment and trunk conveyance and transmission systems
- ‘High Value, Low Quantity’ system
- Most assets constructed since 1971 (<44 years old)
- Average ~3% year over year pop. growth for past 10 years and anticipated to continue for next 20+ years

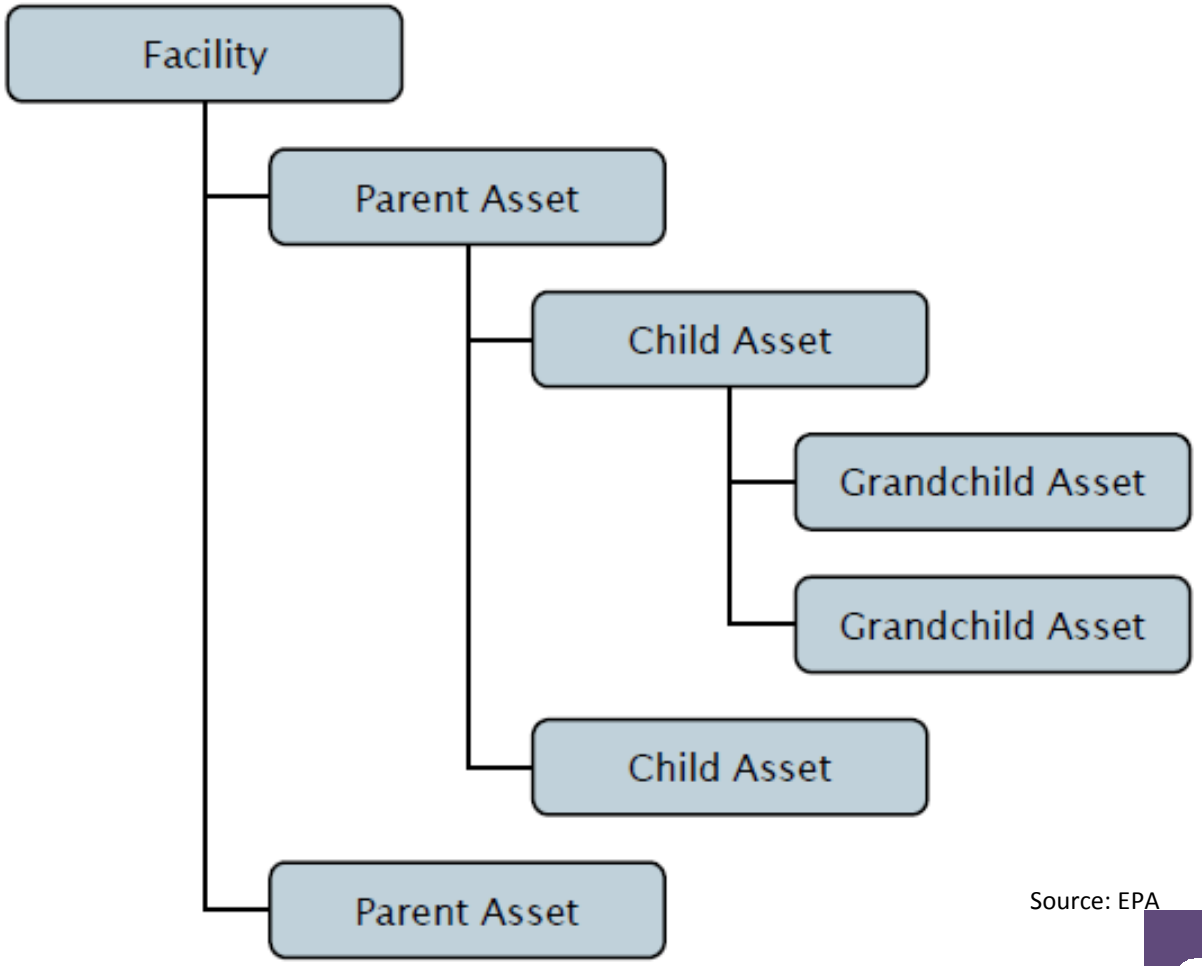
Costing Consultant Scope of Work

1. **Undertake replacement valuation for each asset – Linear, Discrete Water/Wastewater**
   - Estimating target is 100% with accuracy of +/- 25%
   - Replacement facility design to meet current standards; 'new' not 'as is'
2. **Identify and develop replacement hierarchies**
   - Process and Uni-Format major group used for system level replacement hierarchies
     - e.g. process mechanical and sub-structure
   - Unit process and Uni-Format group used for sub-system level replacement hierarchies
     - e.g. pumping and HVAC
   - Replacement logic built on Useful Life and project synergy*[1]
     - e.g. roof (UL =15 yrs) + doors (UL=12 years); chemical systems (UL=10 yrs) + I&C (UL =10 years)
3. **Develop a rehabilitation and full replacement cost model**
   - Facility Level
     - Use cost curves indexed to here and now e.g. EPA 2007 + RS Means City Index + NRB CPI
     - Calibrate with York project data e.g. Ballantrae Well 3
   - Component Level
     - Use cost curves and component costs e.g. RS Means Generator + Engineering %
     - Calibrate with York project data
4. **Develop a methodology to update the cost model**
   - Document the project process

Linear Assets	**CH2M** – Vanessa Chau
Discrete Water	**Cole & Yaku** – Bill S / Dean R
Discrete Wastewater	**Stantec** – Mike Gundry

Asset hierarchy- Levels

Asset hierarchy

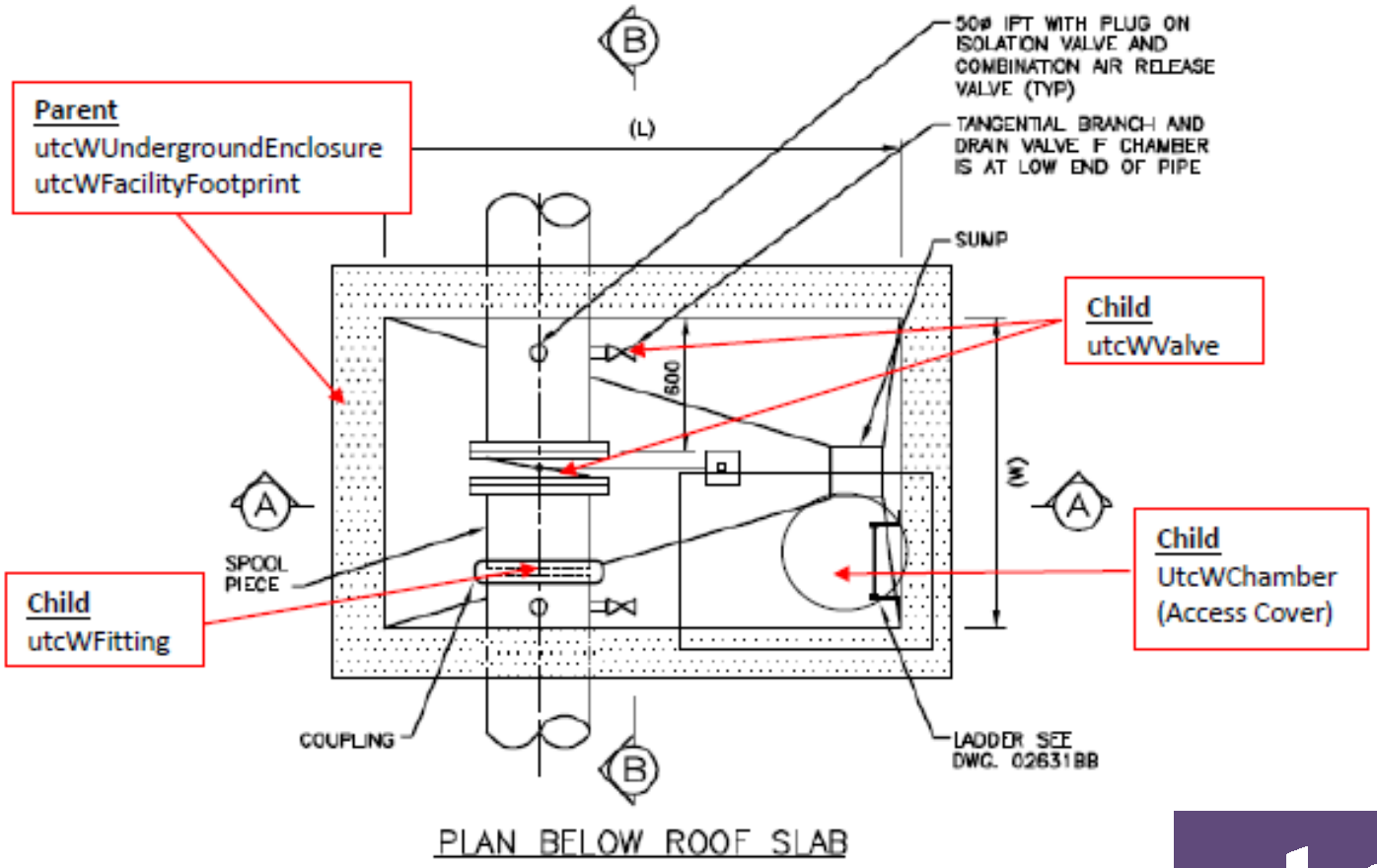


Source: EPA

Sample Hierarchy: Water Chambers

Water Chambers

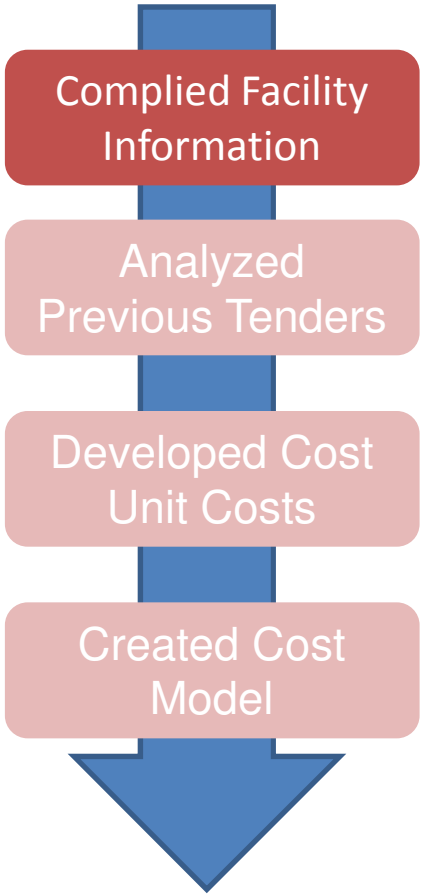
Taken from York Region Standard W-101 Precast Line Valve Chamber, Butterfly Valve



Linear VS Discrete

- Top-down vs Bottom-up Approach
- Now vs Then Replacement Considerations:
  - Service regulation & infrastructure complexity
  - Greenfield vs brownfield
  - Maintaining services
  - Inspectable?
  - Pre-planning/Design timing needs
- Redundancy Levels

Facility Information



- Site Area
- Driveway/Access Area
- Building Footprint
- Inlet and Outlet Sewers/Forcemains/Watermains
- Capacity – Design/Ultimate
- Equipment Details
  - Number of Pumps
  - Type of Equipment
  - Number of Trains
  - Processes
  - Chemicals
- Installed Standby Power
- Tankage Types

Water Pumping Station Example Breakdown

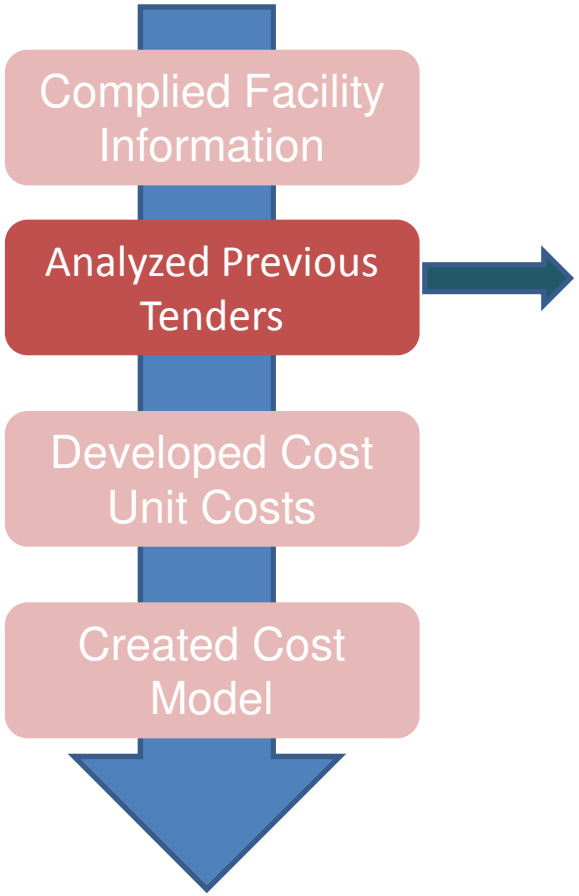
PSAB Replacement Cost

Facility	Asset Subtype	Year installed	PSAB 2013 Replacement Cost
Stouffville Zone 2 WPS	CONTROLSAFETY	2010	81,983
Stouffville Zone 2 WPS	ELECTRICAL	2010	276,126
Stouffville Zone 2 WPS	MECHANICAL	2010	45,674
Stouffville Zone 2 WPS	PROCESSMECHANIC	2010	413,472
Stouffville Zone 2 WPS	ARCHITECTURAL	2010	837,045
Stouffville Zone 2 WPS	STRUCTURAL	2010	2,511,135
Stouffville Zone 2 WPS	LANDSCAPING	2010	837,045
TOTAL:			**5,002,480**

Valuation Project Replacement Cost

Component	Sub-component	Cost Method	
Foundation		Building Area	1361633.28
Roofing		Building Area	203849.9624
Plumbing	Plumbing and Waste	Building Area	246767.2025
HVAC	All	Building Area	423170.4282
Building Electrical		Building Area	500145.5999
Building Assembly	Doors & Windows	Building Area	103268.7146
Building Assembly	Wall assembly	Building Area	437870.1532
I&C	Security Systems	Unit Cost	95098.41562
Conveyance	Conveyance	Building Area	61533.69
Health & Safety		Unit cost	17351
Finishes	Interior Finishes	Building Area	174048
Finishes	Building speciality finishes	Unit cost	67579.68
Coatings	Tank finishes	Unit cost	23820.1755
Underground process piping		Unit cost	114242.64
Communications	Enterprise network system	Capacity	37858.07467
Chemical Systems	Chlorination System	Unit Cost	239210.094
Process Electrical	Generator	Capacity	307793.0448
Process Piping	Piping & Valving (all)	Capacity	159573.504
Process Equipment	Pumps (all)	Capacity	184981.4672
Process Equipment	Pump surge protection	Capacity	80337.69216
Process Electrical	Power supply	Capacity	94644.4304
Process Electrical	Distribution	Capacity	288420.4288
Process Electrical	Motor Control	Capacity	67545.7472
I&C	Instrumentation	Capacity	45175.6896
I&C	Controls	Capacity	124885.464
Services	Underground domestic services	Unit Cost	227626.23
Access Road	Roads & Driveways	Lineal m	527836.5
Site Works	Fences & gates	Unit Cost	51814.09
Site Works	Landscaping	Unit Cost	145893.08
Site Works	Parking lot & walkways	Area	65684.64
Trunk Mains		Lineal m	1676592
Total			**8,156,251**

Historical Information



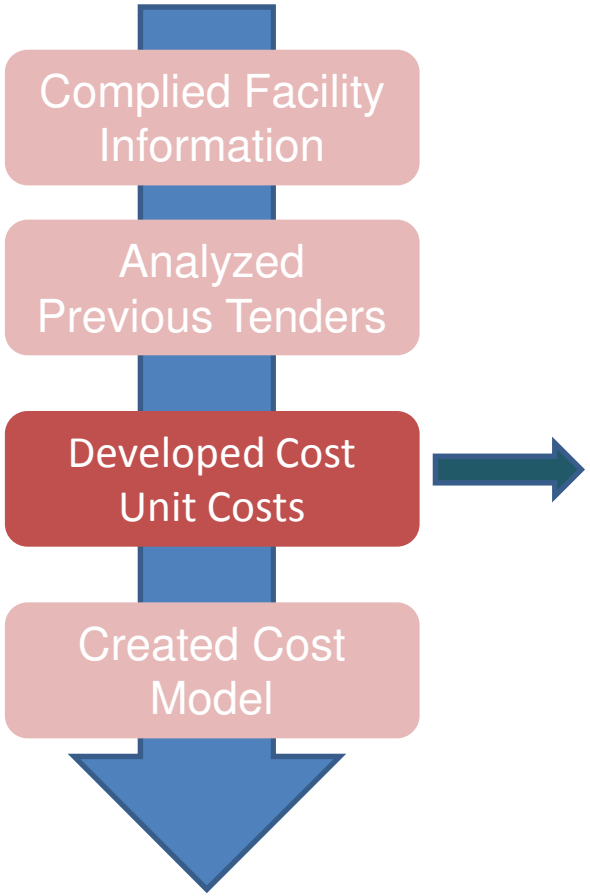
- Used RMY and other recent tenders/projects
- Sorted Form of Tender price items in accordance with hierarchies developed in Task 2
- Summarized Project specific facility Information for tenders being analyzed

- Site Area
- Driveway/Access Area
- Building Footprint
- Inlet and Outlet Sewers/Forcemains/Watermains
- Capacity – Design/Ultimate
- Equipment Details
  - Number of Pumps
  - Type of Equipment
  - Number of Trains
  - Processes
  - Chemicals
- Installed Standby Power
- Tankage Types

Additional Data Sources

- Facility and system (select sub-system e.g. well pump)
  - Ministry of Public Infrastructure 2004
  - US EPA Modelling the Cost of Infrastructure 2007
  - Cost Estimating Manual (Wiley) 2007
  - RS Means (building)
  - York and Cole project data
- System and sub-system
  - RS Means
  - Random - e.g. Honeywell VFD
  - York and Cole project data
  - York IIP Cost Model (generators)

Cost Breakdown Review



- Using tender values, developed unit costs based on:
  - Building foot print
  - Site area
  - Tankage area
  - Capacity – existing and ultimate
  - Types of equipment
  - Type of facility
- Developed % of each cost factor for processes and building for facilities with multiple processes – i.e. Aeration Tanks are 55.1% of the overall tankage in a WPCP

Costing Methods

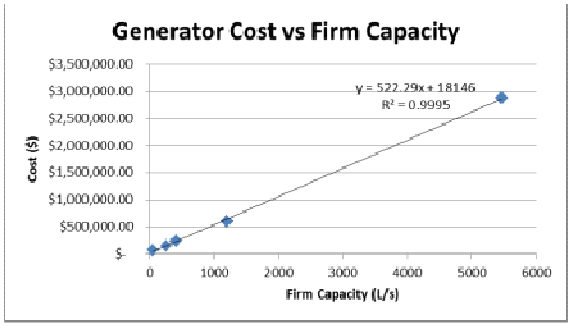
Complied Facility Information

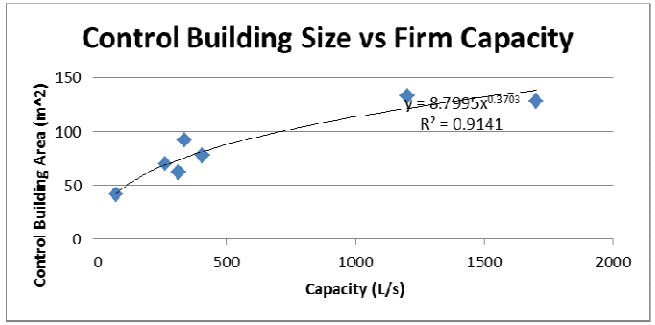
Analyzed Previous Tenders

Developed Cost Unit Costs

Created Cost Model

Examples





- Division 1 costs as percentage of Division 2 to 16 costs
- Unit costs based on building/site areas
- Piping and Valve costs as percentage of equipment cost
- Etc.

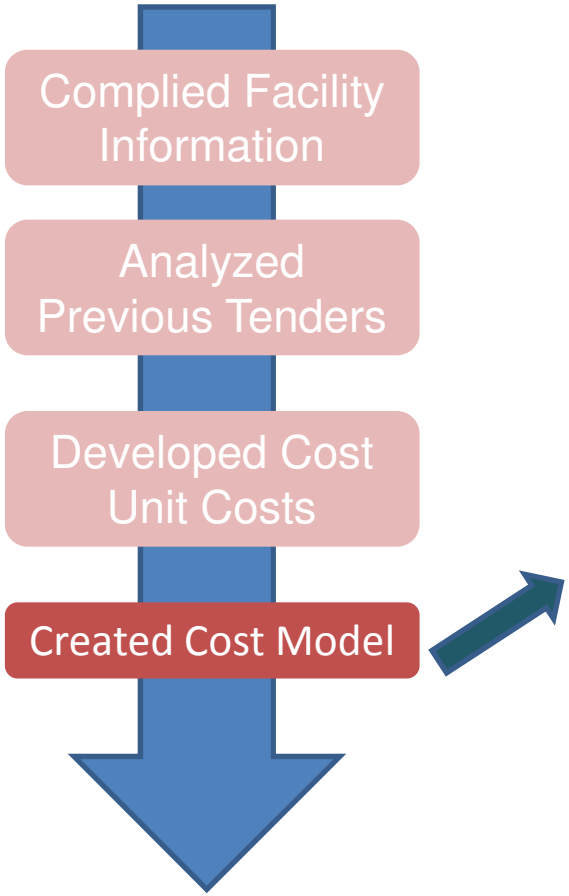
ch2m

Typical Non-Infrastructure Costs

WPCP Example

	8.1.11 Effluent water	2%	%	(% total sect 8 cost - 8.1.1 to 8.1.13)	
	8.1.12 Odour Control	$ 117,000.00	Lump Sum	Kleinberg WPCP tender	
	8.1.13 Post Aeration		Not Applicable RMY		
	8.1.14 Overflow Diversion Lagoons	$ 2,000,000	Lump Sum	Lump Sum	
	8.1.15 Septage Receiving	$ 450,000	%	Lump Sum	
	8.1.16 Process Piping & Valves	24%	%	% Process Equipment Cost	
	8.1.17 Sluice & Slide Gates	2%	%	% Process Equipment Cost	
	8.1.18 Lab Equipment	$ 51,000.00	Lump Sum	Average Nobelton & Schomberg WPCP tenders	
	8.3 Process Electrical	17%	%	% Process Equipment Cost	
9.0	0				
	9.1 Fences & Gates	$5.72		($ / m^2)	
	9.2 Landscaping	$4.23		($ / m^2)	
	9.3 Parking Lots & Driveways	$1.62		($ / m^2)	
10.0	I&C	$ 203,500		Per Train	
SOFT COSTS					
		Construction Value			
		<$1M	$1M to $10M	$10M to $50M	>$50M
		1,000,000	10,000,000	50,000,000	
Values - % of Construction Value					
Permits and Approvals		3%	2%	1%	1%
Engineering - Planning to Construction		20.0%	12.0%	10.3%	9.0%
Project Management		10.00%	2.00%	0.70%	0.650%
Contingency		50%	50%	50%	50%

Cost Model Approach



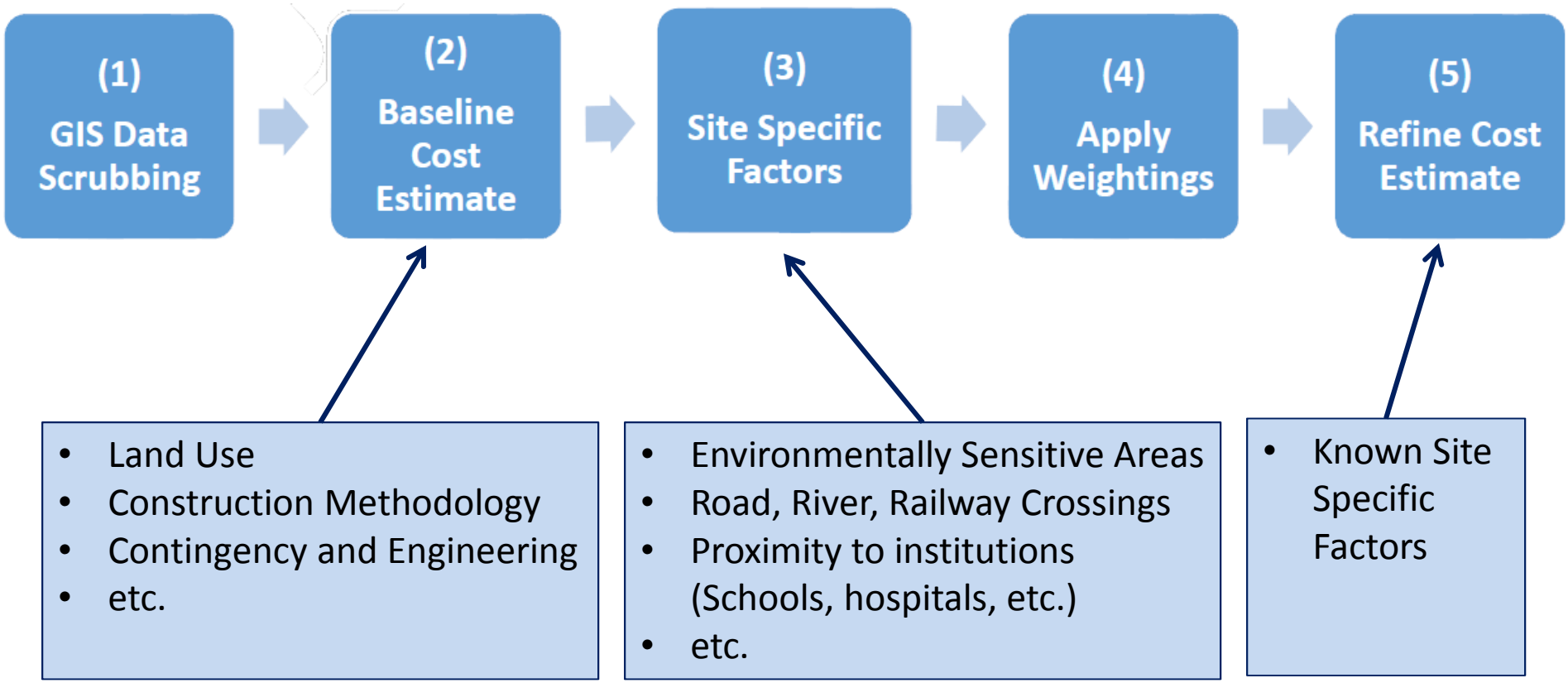
- Using facility information developed project replacement costs
- Based on unit costs applied to actual facility information
- Incorporated “Engineering, Permits/Approvals, Project Managment/Coordination and Contingencies

Aligning Across Facility Types

Discrete Wastewater Facilities

Input Data	Sewage Pumping Stations	Water Pollution Control Plants	Odour Control Facilities
Capacity (L/s, m^3/day, m^3/s)	●	●	●
Number of Trains		●	
Number of Pumps	●		
Inlet Sewer Diam. (mm)	●	●	●
Inlet Sewer Length (m)	●	●	●
Outlet Sewer Diam. (mm)	●	●	●
Outlet Sewer Length (m)	●	●	●
Grinder (Y/N)	●		
Deep Well Screen (Y/N)	●		
Odour Control (Y/N)	●	●	
Standby Power (kW)	●	●	●
Chemicals Used			
Alum (Y/N)		●	
NaOH (Y/N)		●	
Polymer (Y/N)		●	
Overflow/Diversion Lagoon/Tanks (Y/N)		●	
Administration Building Area (m^2)		●	
Site Area (m^2)	●	●	●
Landscaping Type (Ind, Comm., Res)	●	●	●

Valuation Cost Model – Linear Assets



Gravity Sewer Examples

Diameter	EID	Facility Name	Pipe Length	Depth (m)	Construction Methodology	Max US Flow (L/s)	Unit Cost ($/m)	BASELINE REPLACEMENT COST	Total % Weightings	REPLACEMENT COST (W/ FACTORS)
750	431102811	Leslie Collector	102.4	5	**Open Cut**	193.3	$1,501	$153,694	**21.5%**	**$195,789**
750	431103037	East Holland River	105.9	6	**Tunneling**	76.1	$7,031	$744,848	**13.0%**	**$856,147**

Snapshot of Result Summary

Facility Type	PSAB 2013	PSAB 2014	Valuation Replacement Cost	Percentage Difference (from PSAB 2014)
Linear Water and Wastewater	$ 1,883,047,758	$ 1,956,793,274	$ 3,013,352,101	**+54%**
Discrete Water	$ 638,262,584	$ 664,062,463	$ 910,321,763	**+37%**
Discrete Wastewater*	$ 365,174,507	$ 451,017,618	$ 709,062,000	**+57%**
Duffin Creek**	$ 677,494,432	$ 751,664,786	$ 973,623,383	**+30%**

- PSAB 2013 Total = $3,729,593,128
- PSAB 2014 Total = $3,994,640,940
- Replacement Total based on Valuation = $5,606,359,247

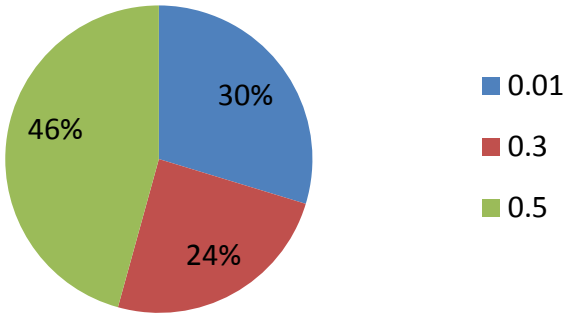
- **Overall % Difference from PSAB 2014 = 40%**

*Wastewater Discrete Assets - contingency adjusted using valuation tool to 35%
**not valued by consultants

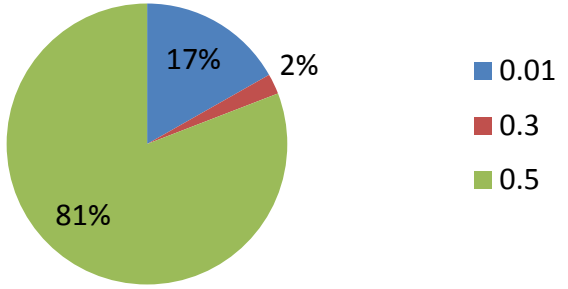
Long Term Infrastructure Needs (100 Year Plan)

- Two different Levels of Service (LOS) were modeled.
- The **Lower LOS** assumes replacement at end of ESL for **<u>all asset components</u>**.
- The **Higher LOS** assumes replacement at 50% or 30% remaining life for a majority of assets.

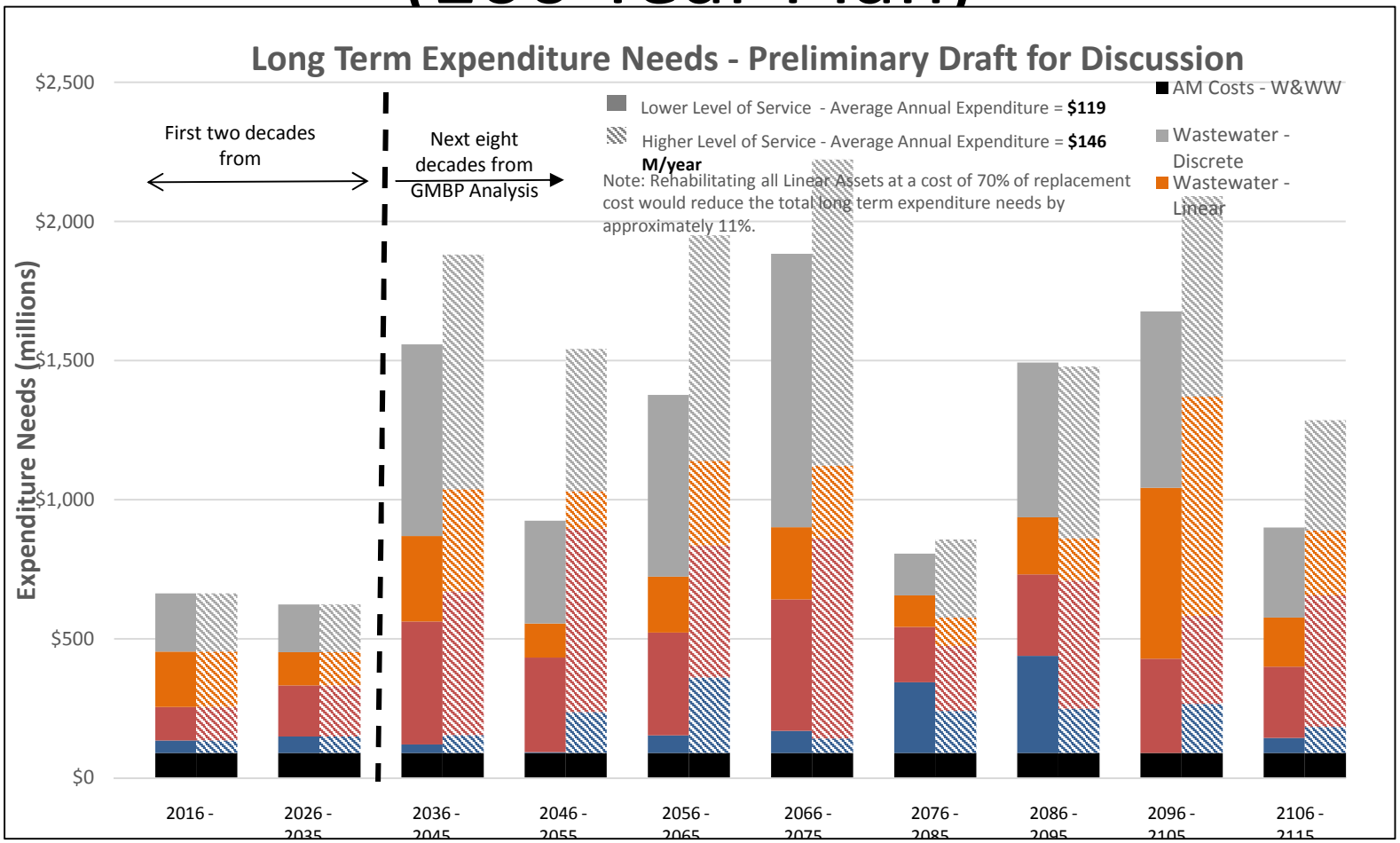
High Level of Service Remaining Life Thresholds – By % of Total Assets



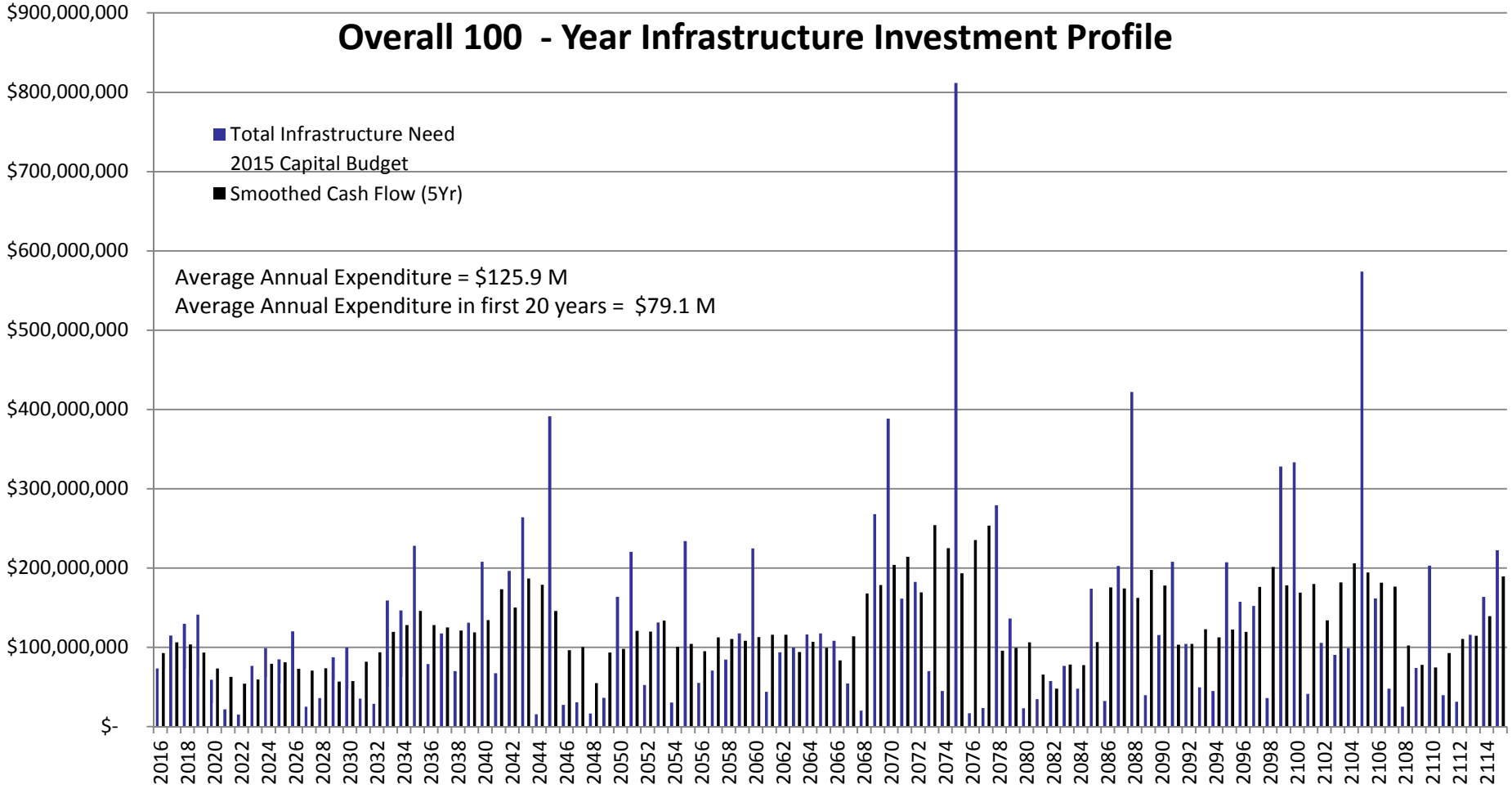
High Level of Service Remaining Life Thresholds - By % of Total Asset Value



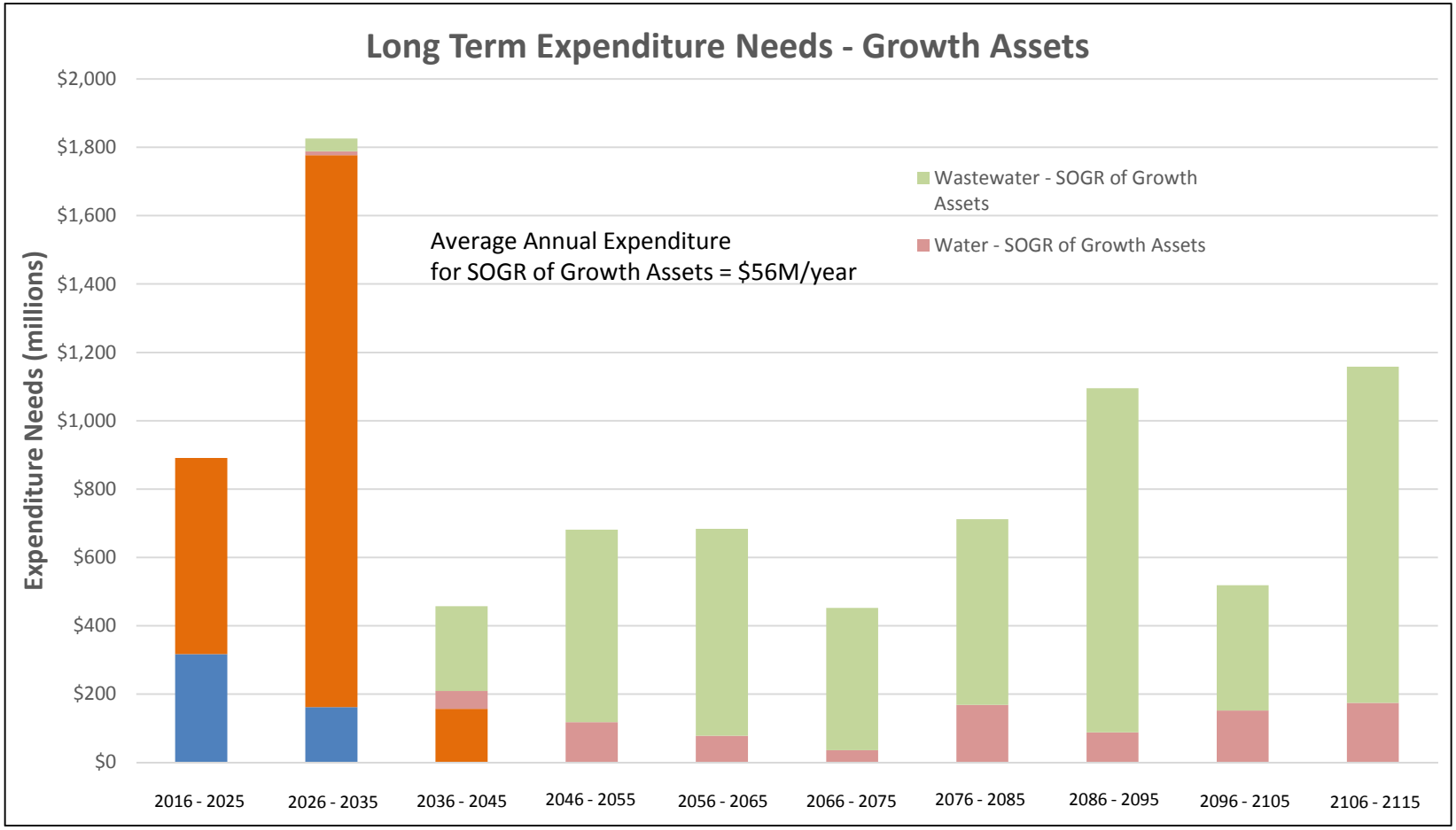
Long Term Infrastructure Needs (100 Year Plan)



Long Term Infrastructure Needs (100 Year Plan)



100 Year Plan Growth Assets – Results



Next Steps

1. Automate current costing methodology and 100yr Planning methodology directly from source data in real-time
2. Understanding Remaining Service Life and Asset Deterioration
3. Monitor and track cost premium of unplanned asset work
4. Understanding the factors that significantly affect asset replacement work and quantifying impacts of external factors such as severe weather, treatment technology enhancements, realignment, etc… on design requirements
5. Examine financial risk of unplanned asset renewal vs reduced asset replacement frequency vs increased asset monitoring
6. Extend/improve costing methodology from replacement today to replacement in 20++ years in the future (when work will actually happen)
7. Improve 100yr Planning methodology to incorporate new knowledge

Thank you!

Questions?

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Bill 6 and Implications

Bill 6
(Chapter 15 Statutes of Ontario, 2015)
An Act to enact the Infrastructure for Jobs and Prosperity Act, 2015

INFRASTRUCTURE ASSET MANAGEMENT PLANS

Infrastructure asset management plans

6. (1) Every broader public sector entity prescribed for the purposes of this section shall prepare the infrastructure asset management plans that are required by the regulations and that satisfy the prescribed requirements.

Infrastructure asset management planning information

(2) Every broader public sector entity prescribed for the purposes of this section shall prepare such additional infrastructure asset management planning information as may be prescribed by the regulations and that satisfies any prescribed requirements.

Submission of plans, information to Minister

(3) If required by the Minister, a broader public sector entity shall, in accordance with any requirements the Minister may specify, provide to the Minister or to any other minister of the Crown the Minister may specify, a copy of an infrastructure asset management plan it has prepared under subsection (1), or of information it has prepared under subsection (2).

Bill 73 and Implications

Bill 73

An Act to amend the Development Charges Act, 1997 and the Planning Act

Asset management plan

(3) The asset management plan shall,

(a) deal with all assets whose capital costs are proposed to be funded under the development charge by-law;

(b) demonstrate that all the assets mentioned in clause (a) are financially sustainable over their full life cycle;

(c) contain any other information that is prescribed; and

(d) be prepared in the prescribed manner.

Some of the amendments to the *Development Charges Act, 1997* are:

1. Subsection 2 (4), which deals with ineligible services, is rewritten to identify these in the regulations (rather than partly in the Act and partly in regulations, the current approach).

2. Regulations may be made to require municipal councils to use development charge by-laws only with respect to prescribed services and areas (new subsection 2 (9)) or to use different development charge by-laws for different parts of the municipality (new subsection 2 (11)).

3. Transit services are added to the list of services for which no reduction of capital costs is required in determining development charges (subsection 5 (5)).

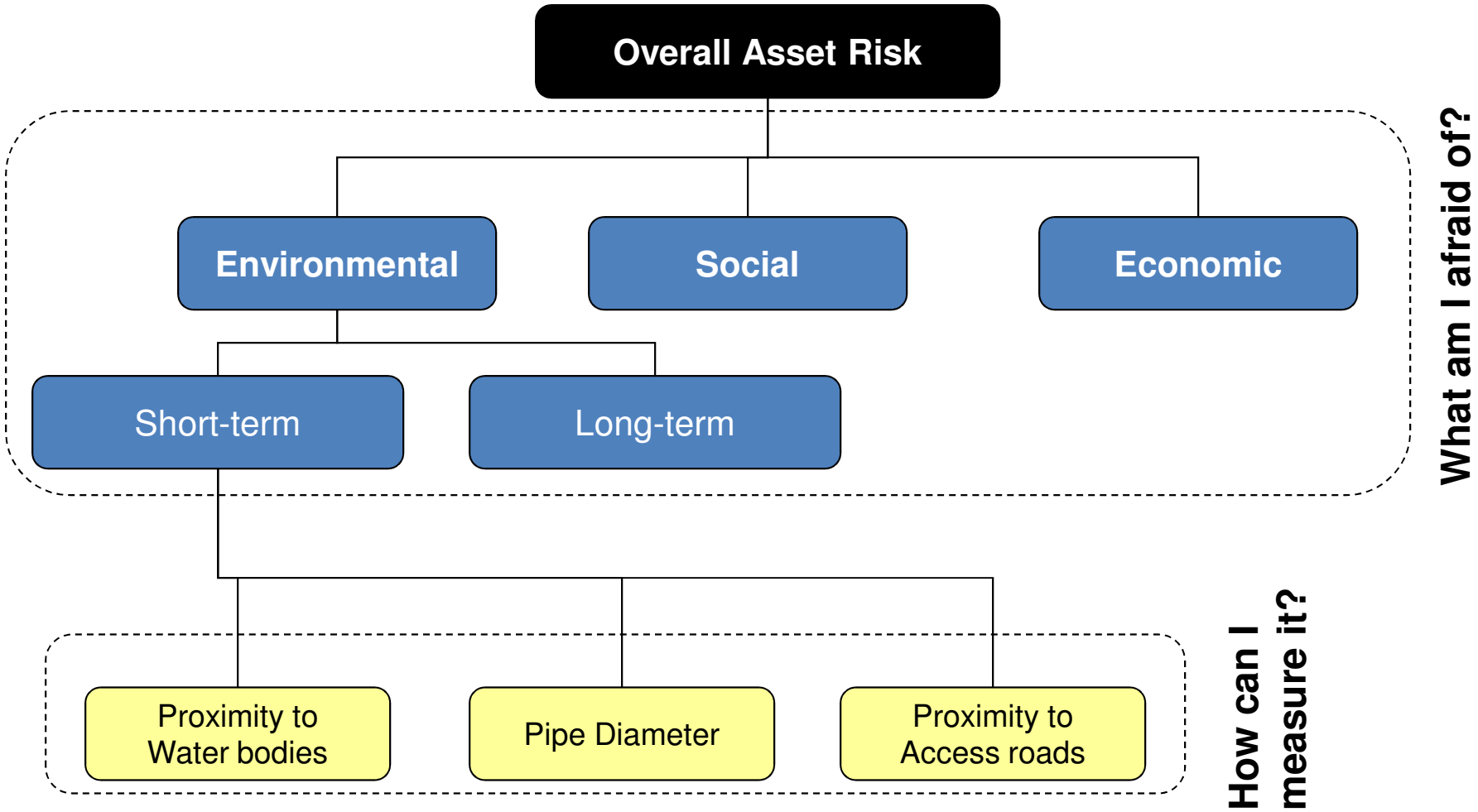
4. New section 5.2 provides that services prescribed by the regulations would use a planned level of service rather than being subject to paragraph 4 of subsection 5 (1).

5. The requirements for development charge background studies are expanded to include consideration of the use of multiple development charge by-laws and preparation of an asset management plan (subsection 10 (2)).

Additional Background Information from Global Sources

As Provided By:

Risk Hierarchy



Site Specific Factors Considered

ENVIROMENTAL						
Within TRCA ESA	Within LSRCA ESA	Within TRCA CA	Within LSRCA CA	Within LSRCA Reg Area	Within Provincial Park	Within TRCA Reg Area
5.0%	5.0%	1.5%	1.5%	0.5%	5%	0.5%

LOCATION						
Beneath Roads	Beneath Walkway	Beneath Bus Route	<250m from Railway Crossing	Beneath Railway	Beneath Watercourse	Beneath Waterbody
1.5%	0.5%	0.5%	Tunneling	Tunneling	Tunneling	Tunneling

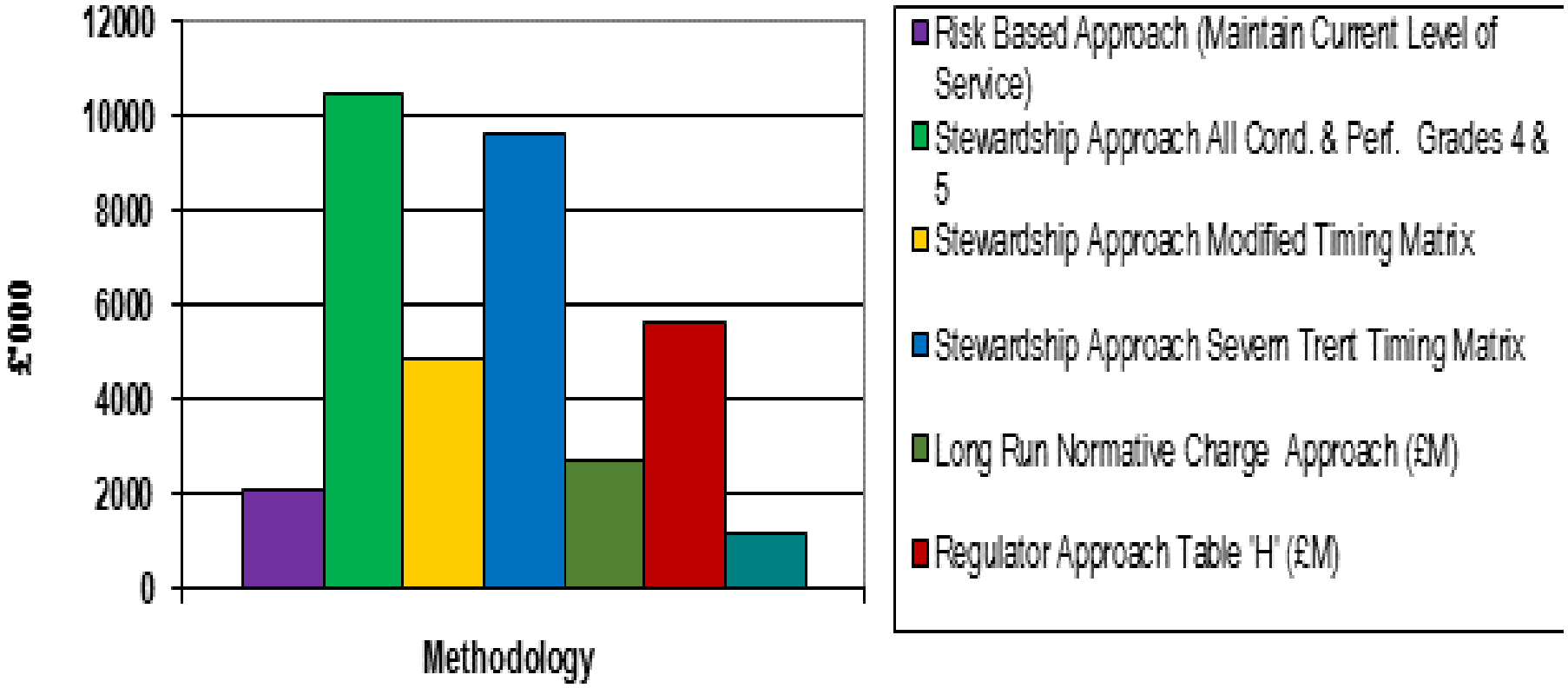
PROXIMITY (Maximum 1%, except Golf)					
Hospital	School	Child Care Centre	Shopping Centre	Fire Station	Golf Course
1%	1%	1%	1%	1%	9%

PLACEHOLDERS		
Placeholder - Soil	Placeholder - Pressure	Placeholder - Condition
-	-	-

Summary Site Specific Factors

Environmental	• Within TRCA ESA • Within LSRCA ESA • Within TRCA CA • Within LSRCA CA • Within LSRCA Regulated Area • Within TRCA Regulated Area • Within Provincial Park
Location	• Beneath Roads • Beneath Walkways • Beneath Bus Routes • < 250m from Railway Crossing • Beneath Railway • Beneath Watercourse • Beneath Waterbody
Proximity	• Hospital • School • Child Care Centre • Shopping Centre • Fire Station • Golf Course
Bypass System	• By-pass (for Gravity Mains)

Past Utility PerformanceStatistics from UK



Asset Valuation (Condition vs Risk based)