

High Level Conceptual Remediation Options and Costs by Service Level

The first three of five risk level one flood zones were analyzed to determine the feasibility and relative cost of remediation. These three zones include:

- Ruth Street/Cairns Avenue
- First Street/Dufferin Avenue
- Cascade Street/Dufferin Avenue

The following five remediation solutions were considered:

- Up-size pipes
- Storm water ponds and underground storage
- Flood walls
- Redevelop flood-prone areas
- Combination of ponds/underground storage and redevelop flood-prone areas

The necessary conceptual design for each method was evaluated against five different design storms: 2, 5, 10, 25, and 100 years.

The following tables and graphs below outline the estimated cost in millions of dollars for the five options and five design storms. The 2014 costs have been inflated at 3.2% annually for three years to 2017 dollars. The pipe up-size option is the most expensive option and is not included in the individual flood zone tables and graphs as this solution would be a coordinated cost sharing amongst the three zones. Flood walls are the least expensive but not recommended because they may not be effective and consultations indicated a low acceptance among residents.

Total Solution Concept Costs for All Three Zones Cost in Millions of Dollars (\$2017)					
Modelled Solution/ Rain Event Risk	2 YR	5 YR	10 YR	25 YR	100 YR
Up-size pipes	\$ 31.3	\$ 48.8	\$ 61.0	\$ 70.0	\$ 79.2
Pond/Underground storage	\$ 12.8	\$ 16.6	\$ 19.0	\$ 42.7	\$ 57.7
Flood walls	\$ 0.7	\$ 5.8	\$ 10.1	\$ 16.8	\$ 28.0
Redevelop flood-prone areas	\$ 7.9	\$ 29.0	\$ 48.2	\$ 73.3	\$ 105.9
Combinations	\$ 10.1	\$ 17.9	\$ 29.2	\$ 41.2	\$ 68.1

The optimal concept solutions in the following table are generally based on a storm water retention system (ponds/ underground storage) and/or redevelop flood-prone areas. The optimal type of solution can depend on the rain risk event.

Top 3 Modelled Flood Zones Optimal Concept Solution by Risk Zone and Rain Risk Event Cost in Millions of Dollars (\$2017)					
Flood Zone/ Rain Event Risk	2 YR	5 YR	10 YR	25 YR	100 YR
Ruth-Cairns	\$ 0.4	\$ 3.7	\$ 4.3	\$ 6.4	\$ 6.6
1st - Dufferin	\$ 3.8	\$ 3.8	\$ 3.8	\$ 16.0	\$ 27.2
Cascade-Dufferin	\$ 3.0	\$ 5.3	\$ 10.9	\$ 14.2	\$ 23.9
Total Cost	\$ 7.2	\$ 12.7	\$ 19.0	\$ 36.6	\$ 57.7
Average Cost Per Area	\$ 2.4	\$ 4.2	\$ 6.3	\$ 12.2	\$ 19.2
# of Properties Affected	22	79	130	197	286

Flood Zone 1: Ruth - Cairns Concept Solutions and Rain Risk Events Cost in Millions of Dollars (\$2017)					
Modelled Solution/ Rain Event Risk	2 YR	5 YR	10 YR	25 YR	100 YR
Pond/Underground storage	\$ 4.2	\$ 3.7	\$ 4.3	\$ 6.4	\$ 6.6
Flood walls	\$ 0.1	\$ 1.9	\$ 3.3	\$ 6.9	\$ 10.7
Redevelop flood-prone areas	\$ 0.4	\$ 7.6	\$ 20.1	\$ 33.7	\$ 46.6
Combinations	\$ 2.7	\$ 5.5	\$ 8.2	\$ 11.0	\$ 16.1
# of Properties Affected	1	20	53	89	123

Flood Zone 2: 1st - Dufferin Concept Solutions and Rain Risk Events Cost in Millions of Dollars (\$2017)					
Modelled Solution/ Rain Event Risk	2 YR	5 YR	10 YR	25 YR	100 YR
Pond/Underground storage	\$ 3.7	\$ 3.8	\$ 3.8	\$ 19.8	\$ 27.2
Flood walls	\$ 0.2	\$ 1.8	\$ 3.4	\$ 4.9	\$ 7.5
Redevelop flood-prone areas	\$ 3.8	\$ 8.7	\$ 12.8	\$ 20.9	\$ 37.3
Combinations	\$ 4.4	\$ 7.2	\$ 10.3	\$ 16.0	\$ 27.2
# of Properties Affected	11	25	36	58	104

Flood Zone 3: Cascade - Dufferin Concept Solutions and Rain Risk Events Cost in Millions of Dollars (\$2017)					
Modelled Solution/ Rain Event Risk	2 YR	5 YR	10 YR	25 YR	100 YR
Pond/Underground storage	\$ 4.6	\$ 8.6	\$ 10.9	\$ 16.5	\$ 23.9
Flood walls	\$ 0.4	\$ 2.2	\$ 3.4	\$ 4.9	\$ 9.8
Redevelop flood-prone areas	\$ 3.7	\$ 12.7	\$ 15.3	\$ 18.7	\$ 22.0
Combinations	\$ 3.0	\$ 5.3	\$ 10.7	\$ 14.2	\$ 24.8
# of Properties Affected	10	34	41	50	59

The cost per property based on the optimal storm water solution varies by area and the number of properties impacted for each modelled rain risk event. The cost per property impacted for a “1-in-10 year” rain event averages \$146,000 per property for the three areas, and ranges from \$80,255 for Ruth-Cairns up to \$265,394 for Cascade-Dufferin. The table below summarizes the costs per property impacted for each of the three areas for the five design storms.

Top 3 Modelled Flood Zones Cost Per Property Affected (\$2017)					
Flood Zone/ Rain Event Risk	2 YR	5 YR	10 YR	25 YR	100 YR
Ruth-Cairns	\$ 373,696	\$ 185,749	\$ 80,255	\$ 72,245	\$ 53,347
1st - Dufferin	\$ 345,718	\$ 150,358	\$ 106,857	\$ 276,671	\$ 261,671
Cascade-Dufferin	\$ 300,056	\$ 154,844	\$ 265,394	\$ 283,349	\$ 405,551
Average Cost Per Property (Not in Millions)	\$ 326,234	\$ 161,248	\$ 146,012	\$ 186,011	\$ 201,759

All numbers may change based on more detailed designs and costs, and refined modelling assumptions based on the survey results clarifying the number of houses impacted by rain events.