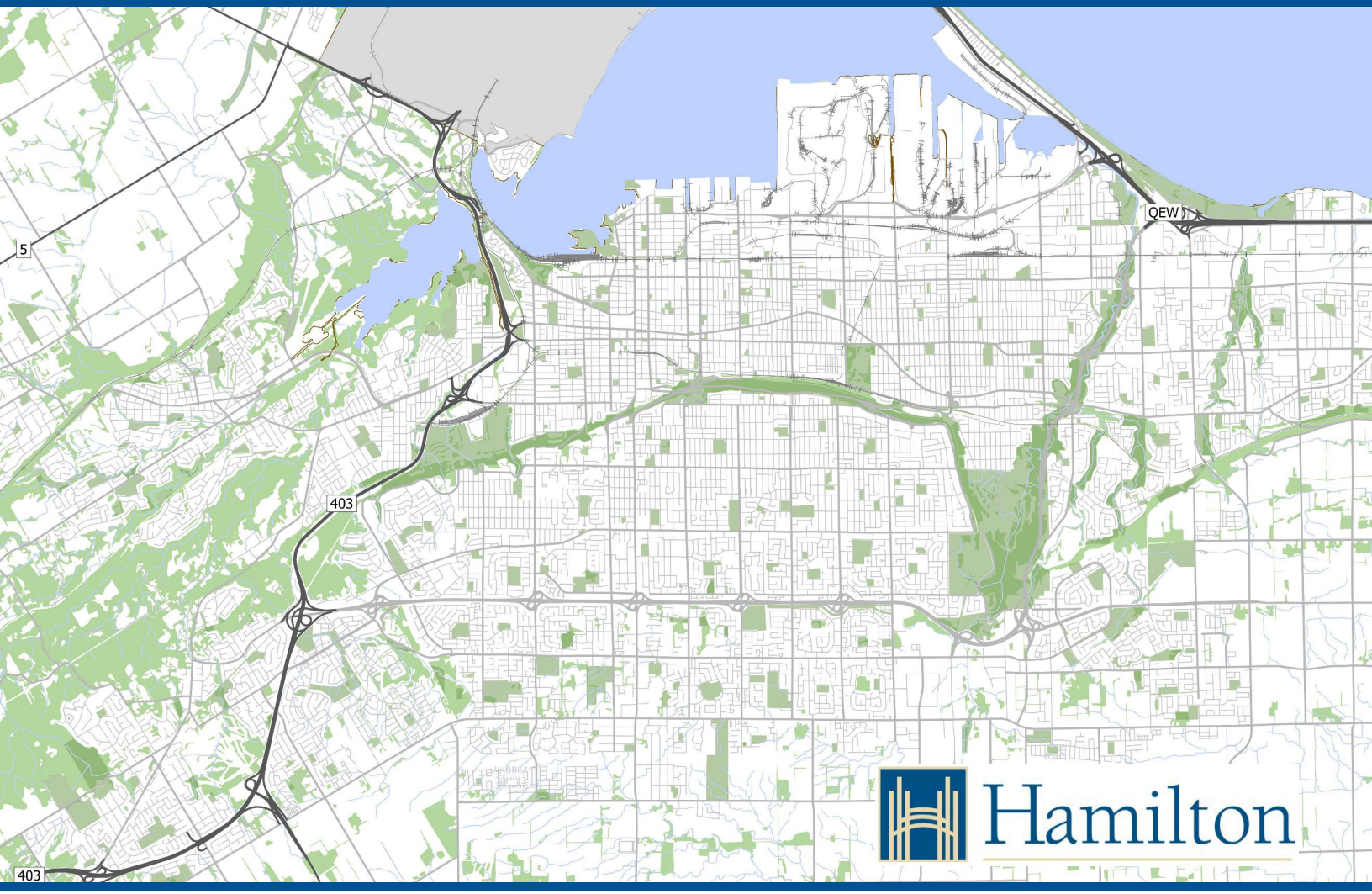

CITY OF HAMILTON

WATER, WASTEWATER, STORMWATER DEVELOPMENT CHARGES

2023 Costing Methodology Update

14 February 2024

GM BluePlan ENGINEERING

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA

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1	26 September 2023	First Draft
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GM BluePlan Signatures

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1.0 Introduction

GM BluePlan Engineering was retained by the City of Hamilton for the 2023 Water and Wastewater Development Charges (DC) Background Study. The project scope included review of the methodology for long-term planning infrastructure cost estimation at a M**aster Plan (MP) level**. Master Plan level costing is typically done with relatively minimal project details available. Basic information such as pipe diameter, pumping station capacity, general alignment/location and in some cases project depths are known, however, specific details about project property acquisition needs, subsurface conditions, construction constraints, potential tunnel shaft locations, utility conflicts, etc. are unknown. The projects are at the conceptual phase and may be subject to several changes prior to design and construction. As such, relatively conservative cost estimates are prepared to account for many unknowns that can present themselves. The Master Plan level project costs are estimated for the purposes of a Master Plan, Development Charges Background Study, or similar type study. The project costs typically have a high range of variability; in the order of +50%/-40%.

This memorandum presents a new proposed Cost Estimation Framework, including updated unit rates, that may be applied to the City of Hamilton's capital projects in the 2023 Water and Wastewater Development Charges Background Study.

The primary objectives of this task are to:

- Review and compare historical costing methodology and Unit Rates for Hamilton and other Ontario Municipalities; and,
- Propose an updated estimation framework and unit costs for the City.

This memorandum will provide an overview analysis of various municipality rates and costing frameworks, which will serve as a basis for recommending a new costing methodology for the City of Hamilton. By comparing Hamilton's existing practices with those of other municipalities we aim to develop an improved costing framework that aligns with the market and caters to the specific needs of the City of Hamilton.

1.1 Construction Costing Indexing (Inflation)

Within this memo, unit rate costs from various historical reference years have been indexed to 2023 dollars in order to provide a fairer comparison. Additionally, the 2023 Development Charges Background Study will require costs to be provided in 2023 dollars.

Based on the Non-Residential Building Construction Consumer Price Index (CPI) data from Statistics Canada, we can derive the inflation rate specific to the construction sector discussed in this report. While **1.1** below presents the quarterly CPI numbers for Toronto, ON, it's important to note that Statistics Canada has not updated their table since Q3 2022. As a result, the CPI figures for Q4 2022 to Q1 2023 are general CPI numbers obtained from the Bank of Canada. These numbers align with the percentage differences observed in previous quarters, providing a reliable basis for analysis.

Table 1-1Yearly Non-residential Building Construction Price Index (NRBCPI) for Toronto, Ontario.

2017 BASE YEAR	2019 INDEX	2019 YR/YR	2020 INDEX	2020 YR/YR	2021 INDEX	2021 YR/YR	2022 INDEX	2022 YR/YR	2023 INDEX	2023 YR/YR
QUARTER		% CHNG		% CHNG		% CHNG		% CHNG		% CHNG
I	107.4	5.20%	110.6	3.00%	114.2	3.30%	134.2	17.50%	150.6	12.20%
II	108.3	4.00%	111.1	2.60%	119.9	7.90%	140.9	17.50%	152.3	8.10%
III	109.2	3.30%	111.9	2.50%	125	11.70%	144.5	15.60%	-	-
IV	109.7	2.90%	112.1	2.20%	129.3	15.30%	148.1	14.50%	-	-
Ann. Avg.	108.7	3.80%	111.4	2.60%	122.1	9.60%	141.9	16.20%	151.5	6.70%

Based on the above analysis, the original linear unit costs of the projects, stated in 2019 dollars, have been inflated by 39% to account for inflation from 2019 to 2023. This adjustment ensured that the costs are represented in 2023 dollars.

2.0 Rates and Methodology Comparison

The objective of this section is to conduct a comparative analysis of costing methodologies and criteria employed by neighboring municipalities, with the aim of aligning the City of Hamilton's costing methodology accordingly. By comparing the approaches utilized by other municipalities, valuable insights can be gained to improve the traceability, accuracy and effectiveness of the City's costing practices. This comparative assessment will enable the City of Hamilton to identify potential areas for adjustment, and ultimately enhance the consistency of its costing methodology in line with industry standards and practices observed in neighboring municipalities.

2.1 Region of Peel – Current Master Plan (2020) Methodology

The Region of Peel applies a relatively simple unit rate methodology to calculate the base infrastructure installation cost: the total length or capacity needs of the required infrastructure is multiplied by a unit rate applicable to the size or capacity and particular construction type (e.g., 5 metre depth open cut sewer, 10 metre depth open cut sewer, open cut watermain, open cut wastewater forcemain, tunneled watermain or sewer). Additional costs are added to account for creek, road, railway or utility crossings, valves, small sections of tunneling requirements, etc., where applicable.

In cases where construction will occur in built up areas, such as intensification areas, a cost escalation factor is applied to the installation cost. This factor provides additional project costs to account for utility coordination / relocation, urban reinstatement, and urban construction impacts.

The sum of the base pipe installation cost, plus additional cost results in the Base Construction Cost.

Soft costs such as geotechnical / hydrogeological, property / easements, engineering and design, contract administration and project contingency allowances are added to the Base Construction Cost to arrive at the Total Project Cost. The Region of Peel approach is shown in **Table 2-1** below.

Table 2-1. Current Project Costing Calculation for Region of Peel.

Construction Cost		
A	Base Construction Cost ($) =	$/m x Length
B	Construction Uplift =	0% Greenfield 10% Suburban 20% Urban
C	Additional Construction Costs =	Between 10% - 20% depending on project complexity (Low, Medium, High) – complexity estimated by consultants during Project definition phase of Master Plan
D	Provisional Allowance =	10%
E	Total Construction Cost =	A + B + C + D
Soft Costs		
F	Geotechnical / Hydrogeological =	Between 0.5% - 2% x E depending on complexity
G	Property / Easements =	Between 1% - 2% x E depending on complexity
H	Engineering / Design (Internal) =	Between 4% - 8% x E depending on total project cost
I	Design / Contract Administration (External) =	Between 10% - 15% x E depending on total project cost
J	Total Soft Costs =	F + G + H + I
Project Contingency		
K	Between 10% - 25% depending on Project Complexity (Low, Moderate, High)	
Total Project Cost = E + J + [K x (E +J)]		

2.2 Region of Halton – Current Master Plan (2022) Methodology

The Region of Halton's costing methodology uses a similar approach to the Region of Peel's approach. Based on the type of project, an applicable unit rate for the size / capacity of the required infrastructure is multiplied by the length / capacity, identified in the project scope, to calculate the installation cost. Though the unit rate differs between water and wastewater for linear projects, there is further divergence between wastewater linear unit rates based on sewer depth (i.e., Shallow 5 metre vs Deep 10 metre sewers).

In cases where construction occurs in built-up areas (sub-urban and urban), a construction uplift is applied and added to the installation cost. To calculate the total construction cost, additional costs are calculated as a percentage dependant on project complexity, and then added along with provisional allowance as a fixed percentage of the base construction cost.

Additional project costs (geotechnical / hydrogeological and property / easements) are then calculated as a percentage of the total construction cost, based on project complexity. Any permit requirements identified are also added to the sub-total base cost.

To arrive at the total project estimate, soft costs (consultant engineering and internal staffing) and project contingency (percentage of total construction cost) are calculated then added to the subtotal base cost. The Region of Halton's approach is shown below.

Table 2-2. Current Project Costing Calculation for Region of Halton.

Construction Cost		
A	Installation Cost	$/m x Length
B	Construction Uplift	0% 20% 30%
C	**Base Construction Cost = A X (1 + B)**	
D	Additional Construction Cost	10% 15% 20%
E	Provisional Allowance	10%
F	**Total Construction Cost = C x (1 + D + E)**	
Additional Project Costs		
G	Geotechnical / Hydrogeological	0.5% 1.0% 2.0%
H	Property Requirements	1.0% 1.5% 2.0%
	Permit / Approvals Requirements	Lump Sum
J	**Sub-Total Base Cost = F x (1 +G +H) + I**	
Soft Costs		
K	**Consultant Engineering**	
	Scoping / Feasibility Study	Lump Sum
	EA Study	2%
	Design	7%
	Contract Admin / Inspection	6%
L	In-House / Staffing Fees (Design & Construction)	10%
M	Project Contingency (% + Tot. Const. Cost)	10%
N	Non-Refundable HST (% x [J+K+M])	1.76%
Total Project Cost = J + K + L + M + N		

2.3 York Region – Current Master Plan Methodology

Master Plan level Cost estimates for York Region are calculated slightly differently than Region of Peel. Installation costs are the sum of the component costs for land, constructions, engineering, program management and contingency. For most projects, cost estimates will be developed by leveraging the Region's infrastructure replacement cost models.

A summary of the calculation steps for the cost estimation method, using the Region's replacement cost models is shown in the table below:

Table 2-3. Current Project Costing Calculation for York Region.

	Components	Calculation
A	Base Construction Cost-Discrete Base Construction Cost-Linear	(Capacity or Unit Rate Length) x Unit Rate + Shaft Costs
B	Soft Cost-Engineering-Planning	% x (A)
C	Soft Cost-Engineering- Design	% x (A)
D	Soft Cost-Engineering-Construction Service	% x (A)
E	Program Management	% x (A)
F	Contingency	% x (A)
G	Additional Costing Factors	% x (A)
H	Land	Area x Unit Cost
I	***Total Project Cost***	***A+B+C+D+E+F+G+H***

2.4 City of Hamilton – 2019 Development Charges – Current Methodology

A simplified unit rate approach was used for the City of Hamilton 2019 Development Charges Bylaw Update. The 2014 DC linear unit costs of the projects, stated in 2014 dollars, were inflated by 12.4% to account for inflation from 2014 to 2019. This adjustment ensured that the costs are represented in 2019 dollars. Unit costs calculation was accomplished on a $/m basis, with additional 25% added to account for engineering and contingency.

Two types of unit cost were used:

- **Greenfield** - The greenfield unit rate assumes infrastructure is installed in new greenfield growth areas and will require less additional costs such as restoration, traffic control, utility re-locates, etc. It is also anticipated that Greenfield projects will be coordinated with adjacent watermain construction, storm sewer construction and potential road widening. As such, it is expected that some cost efficiencies may be achieved for Greenfield projects and the unit rate reflects this assumption.
- **Urban** – the urban unit rate assumes a higher unit cost than Greenfield due to anticipated additional project specific costs. Typically, an Urban type of project is a stand-alone linear water or wastewater project within an already built-up area which may not have efficiencies of other coordinated construction works. The Urban unit rate reflects these assumptions.

Where more up to date cost information was available, such as tender prices, detailed Environmental Assessment project cost estimates or from the City's Budget, these costs were used instead of the typical unit cost calculation.

The costing formula for the City of Hamilton is summarized as follows:

$$\text{Total Project Cost} = [\ \frac{\$}{\text{meters}}(\text{Greenfield or Urban}) \text{ x Length }] \times 1.25$$

2.5 Construction Uplift/Premium

Construction "Uplift" or "Premium" is an additional cost used in the Region of Peel Costing Methodology to account for the potential increased cost of constructing in built-up areas for items such as utility relocation, additional traffic control and other potential site constraints. This factor is calculated as a percentage of the base linear construction cost and is then added to the project cost.

As noted in **Section 1.1**, the Region of Peel applied 0% Uplift/Premium for Rural construction, **10%** for Suburban and **20%** for Urban construction projects, whereas in **Section 2.2** the Region of Halton applied 0%, 20%, and 30% respectively.

The previous City of Hamilton costing methodology accounts for the increase in construction cost within Urban areas by using two separate linear unit rates: Greenfield and Urban. The table below provides a comparison between City of Hamilton Sewer Unit Rates for Greenfield and Urban. This table shows that the historical uplift ranges between 45%-148% depending on pipe diameter. The overall average uplift increase is **88%.**

Table 2-4. Comparison of City of Hamilton Sewer Unit Rates: Greenfield vs. Urban (Historical Uplift Analysis).

Diameter (mm)	2019 Cost Unit Rates $/m (Greenfield)	2019 Cost Unit Rates $/m (Urban)	Percentage Difference
50	404	1,003	148%
300	544	1,042	91%
375	567	1,081	90%
450	583	1,158	99%
525	622	1,275	105%
600	684	1,391	103%
675	855	1,625	90%
750	948	1,780	88%
825	1,057	1,936	83%
900	1,197	2,130	78%
975	1,275	2,285	79%
1050	1,384	2,480	79%
1200	1,788	2,713	52%
1350	2,063	2,988	45%
		Average Difference =	**88%**

2.6 Construction Depth Premium

The Region of Peel and York Region have distinct approaches in terms of their construction depth premium. They apply different rates for shallow and deep sewer construction projects. For the Region of Peel and Region of Halton, shallow projects are defined as installations up to 5 meters deep, while deep projects are those with a depth of 10 meters. On the other hand, York Region classifies shallow projects as installations up to 5 meters deep, but their deep projects are considered to be those with a depth of 8 meters. Furthermore, it is worth noting that the Region of Peel does not differentiate between rural and urban projects when determining their construction depth premium rates. In contrast, York Region takes into account the project's location, categorizing projects into Rural, Urban, and Dense Urban areas, each with its specific rates for shallow and deep open cut sewer installations.

The tables below showcase the average percentage difference between the unit rates for shallow and deep open cut sewer projects.

Table 2-5. Comparison of Region of Peel Sewer Unit Rates: Deep vs. Shallow (Depth Premium Analysis).

Diameter (mm)	Peel 2022 Shallow Cost Unit Rates ($/m)	Peel 2022 Deep Cost Unit Rates ($/m)	Percentage Difference
300	840	3,447	311%
375	898	3,552	296%
450	980	3,686	276%
525	1,057	3,809	260%
600	1,356	4,169	208%
675	1,669	4,606	176%
750	1,857	4,843	161%
825	2,001	5,042	152%
900	2,352	5,524	135%
975	2,537	5,740	126%
1050	2,811	6,156	119%
1200	3,180	6,618	108%
1350	3,603	7,174	99%
1500	4,081	7,679	88%
1800	5,266	9,054	72%
2100	6,570	10,640	62%
2400	8,179	12,440	52%
3000	11,572	16,174	40%
		Average Difference =	**152%**

Table 2-6. Comparison of York Region Rural Unit Rates: Deep vs. Shallow (Depth Premium Analysis).

Diameter (mm)	Rural Shallow Cost Unit Rates ($/m)	Rural Deep Cost Unit Rates ($/m)	Percentage Difference
300	1,466	1,517	3%
375	1,579	1,650	4%
450	1,583	1,699	7%
525	1,672	1,808	8%
600	1,795	1,960	9%
675	2,117	2,359	11%
750	2,278	2,558	12%
825	2,474	2,730	10%
900	2,618	2,971	13%
975	2,762	3,155	14%
1050	2,922	3,349	15%
1200	3,405	3,891	14%
		Average Difference =	**10%**

Table 2-7. Comparison of York Region Urban Unit Rates: Deep vs. Shallow (Depth Premium Analysis).

Diameter (mm)	Urban Shallow Cost Unit Rates ($/m)	Dense Urban Deep Cost Unit Rates ($/m)	Percentage Difference
300	1,784	2,063	14%
375	1,901	2,200	14%
450	1,908	2,252	15%
525	2,001	2,364	15%
600	2,128	2,521	16%
675	2,461	2,932	16%
750	2,626	3,135	16%
825	2,827	3,311	15%
900	2,975	3,556	16%
975	3,123	3,744	17%
1050	3,288	3,942	17%
1200	3,779	4,493	16%
		Average Difference =	**15%**

Table 2-8. Comparison of York Region Dense Urban Unit Rates: Deep vs. Shallow (Depth Premium Analysis).

Diameter (mm)	Dense Urban Shallow Cost Unit Rates ($/m)	Dense Urban Deep Cost Unit Rates ($/m)	Percentage Difference
300	2,142	2,676	20%
375	2,263	2,819	20%
450	2,272	2,873	21%
525	2,371	2,990	21%
600	2,503	3,152	21%
675	2,849	3,575	20%
750	3,018	3,783	20%
825	3,223	3,964	19%
900	3,376	4,214	20%
975	3,530	4,407	20%
1050	3,699	4,609	20%
1200	4,199	5,169	19%
		Average Difference =	**20%**

Based on review of the above, the Region of Peel shows an average difference of 152% between shallow and deep open cut sewer rates. In contrast, York Region applies different rates based on project location, with rural projects having a 10% difference, urban projects 15%, and dense urban projects 20%.

Considering the significant impact of construction depth premiums on open cut sewer projects, it is advisable for the City of Hamilton to adopt a similar approach. Unlike the Region of Peel and York Region, the City of Hamilton currently lacks a construction depth premium in its costing methodology. By incorporating such a premium, the City can effectively account for the variations in project depths and allocate appropriate budgetary considerations. A reasonable starting point for the City of Hamilton could be to consider an average percentage of 20**%** as a construction depth premium.

2.7 Project Contingency

The Region of Peel's Project Contingency percentage is determined based on the project's complexity, which is assessed by engineers during the project estimate development. As the projected complexity of a project rises from low to high, the risk of unforeseen costs also increases. Consequently, adjustments are made to the contingency and additional cost items to account for the varying levels of project complexity. For Peel, Project contingency costs can vary between 10% to 30% depending on complexity (low, medium, high).

The Region of York includes an 'Engineering and Contingency' cost percentage in their base construction cost, aiming to account for items that have not been fully determined during the Master Plan stage. This contingency is essential to address unforeseen events or circumstances that may arise during the project's execution. A standard 'Engineering and Contingency' percentage of 30% is universally applied to all project types, including Linear Water and Wastewater, as well as Discrete (Facilities) Water and Discrete (Facilities) Wastewater projects.

City of Hamilton in their current methodology, consistently applies a 25% 'Engineering and Contingency' percentage to all its projects.

2.8 Unit Cost Comparison Graphs

Further to the overall costing methodology, the base $/m unit rates were also compared.

The following graphs compare the Sewer, Watermain cost unit rates, and Tunneling costs in other municipalities with the City of Hamilton's corresponding rates. Through this analysis, we aim to identify and analyze the variations in order to propose an improved costing model or methodology for the 2023 Hamilton rates.

Note that for the purposes of this comparison, the City of Hamilton Unit Rates shown on the Graphs were indexed from 2019 dollars to 2023 dollars. Further information on cost indexing is shown in **Section 1.1**.

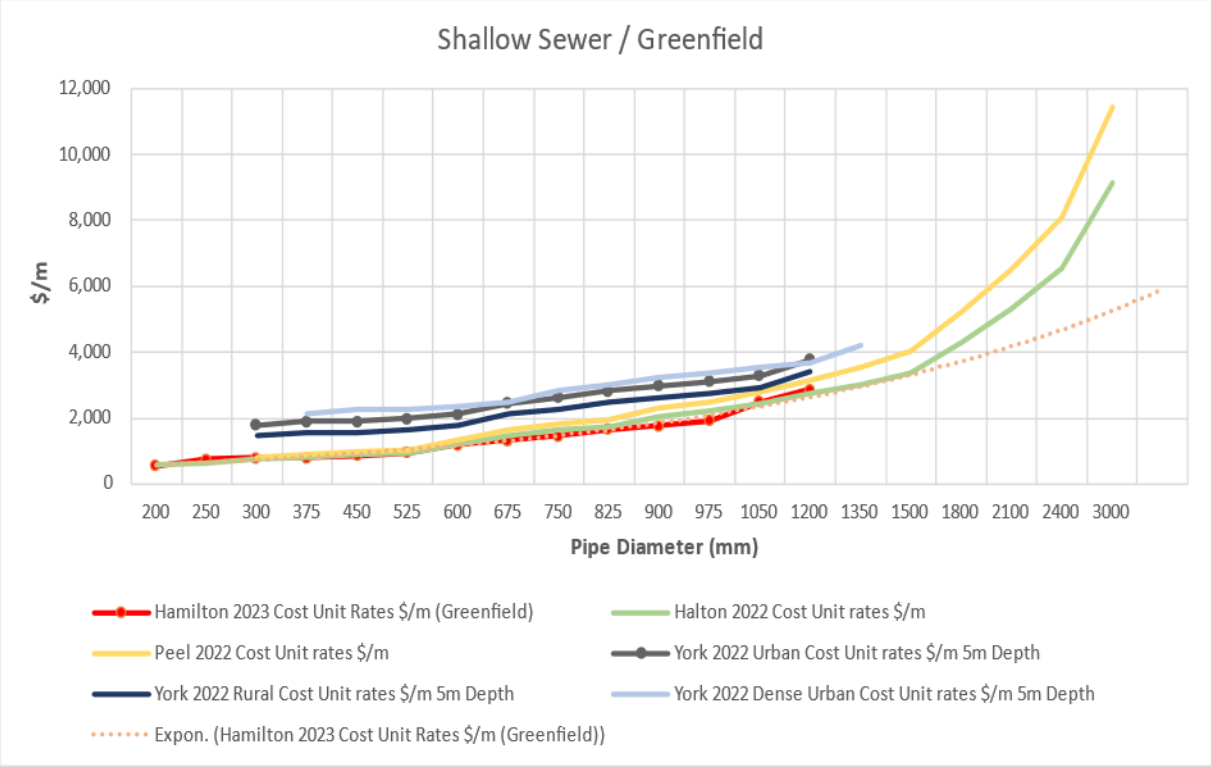


Figure 2-1. 5m Depth Sewer (Shallow) Cost Unit Rates in Other Municipalities vs. Hamilton Greenfield Rates.

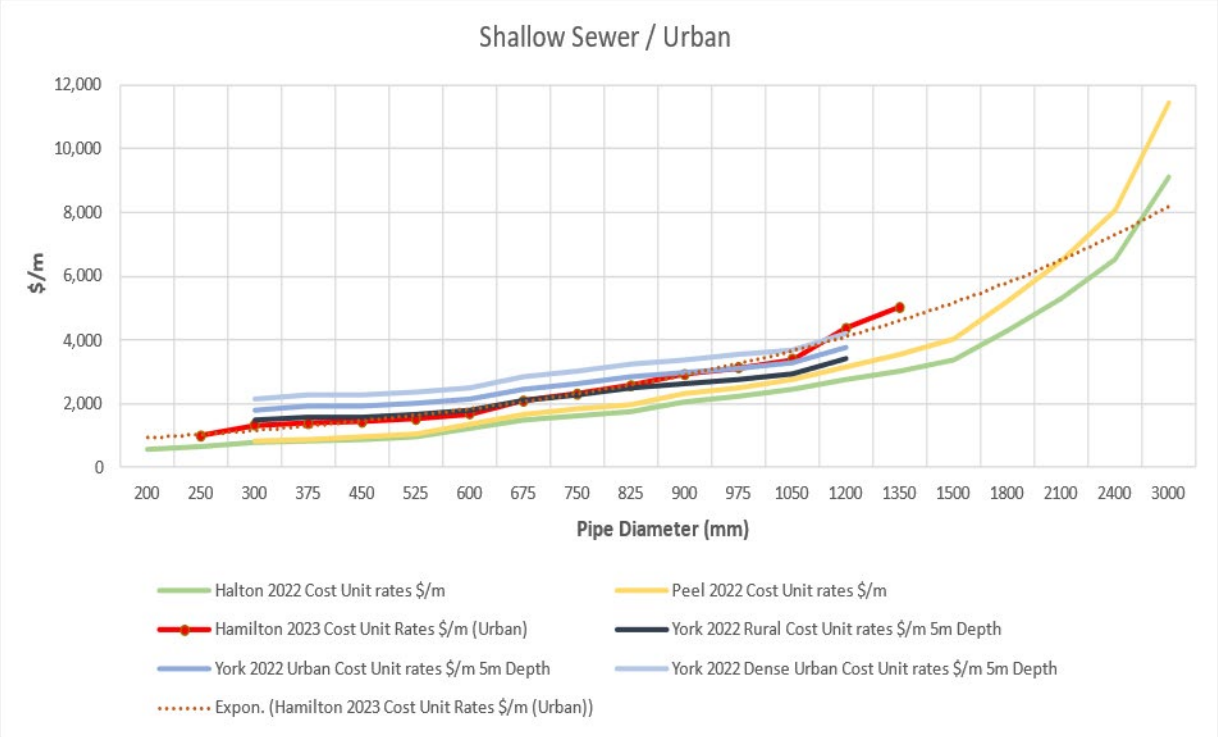


Figure 2-2. 5m Depth Sewer (Shallow) Cost Unit Rates in Other Municipalities vs. Hamilton Urban Rates.

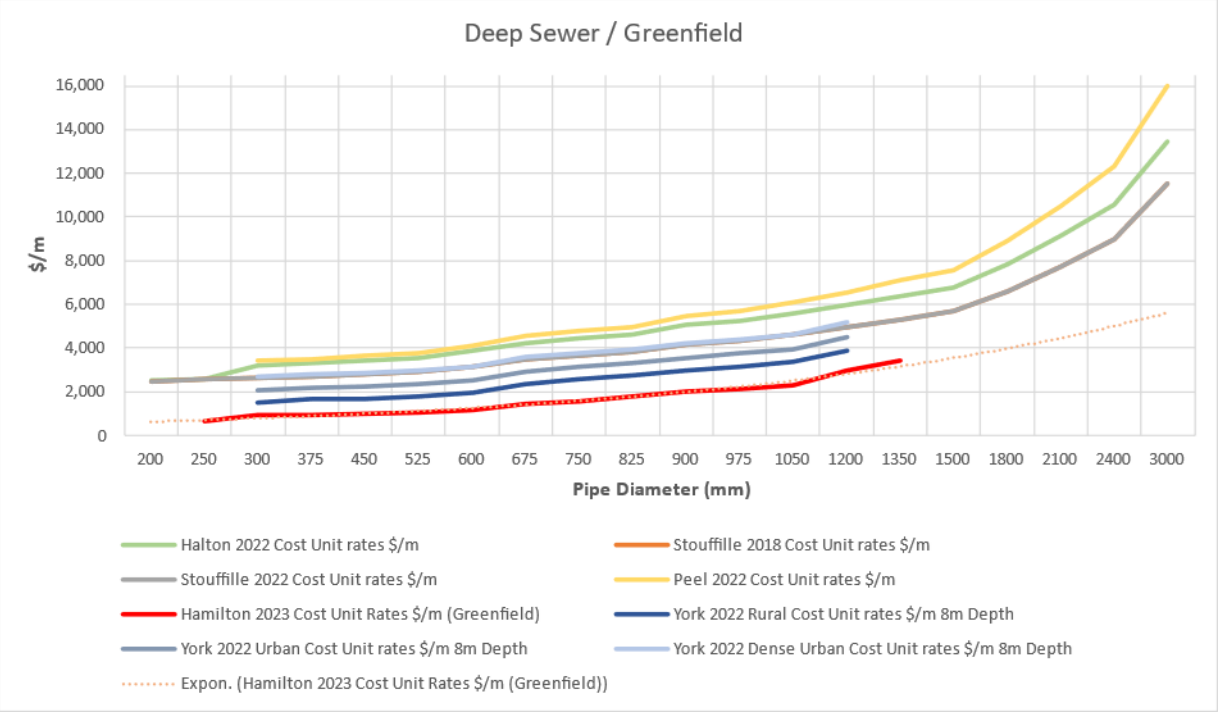


Figure 2-3. 10m Depth Sewer (Deep) Cost Unit Rates in Other Municipalities vs. Hamilton Greenfield Rates.

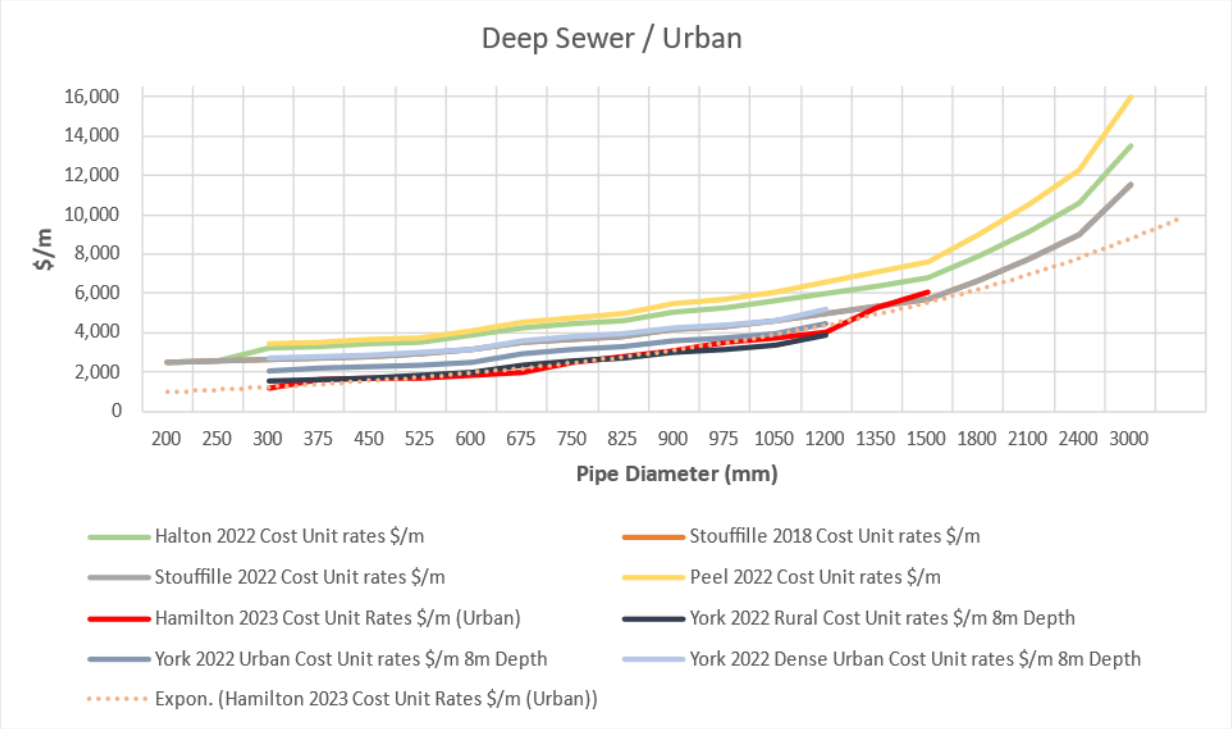


Figure 2-4. 10m Depth Sewer (Deep) Cost Unit Rates in Other Municipalities vs. Hamilton Urban Rates.

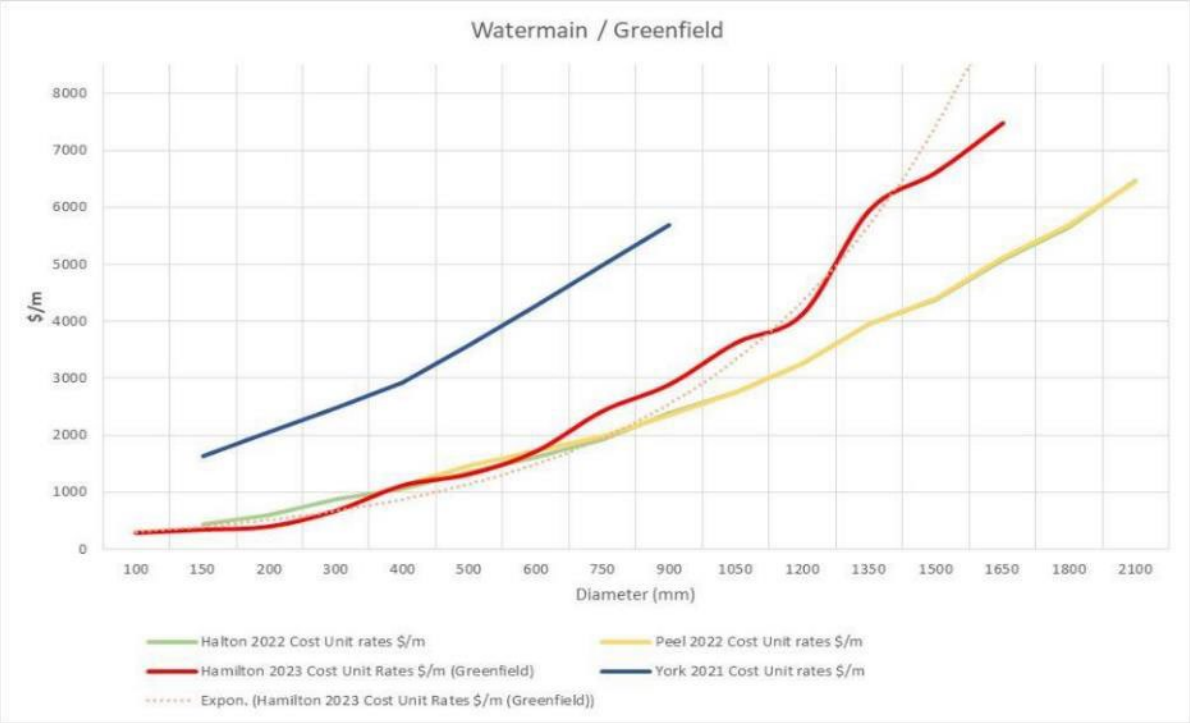


Figure 2-5 Watermain Cost Unit Rates in Other Municipalities vs. Hamilton Greenfield Rates

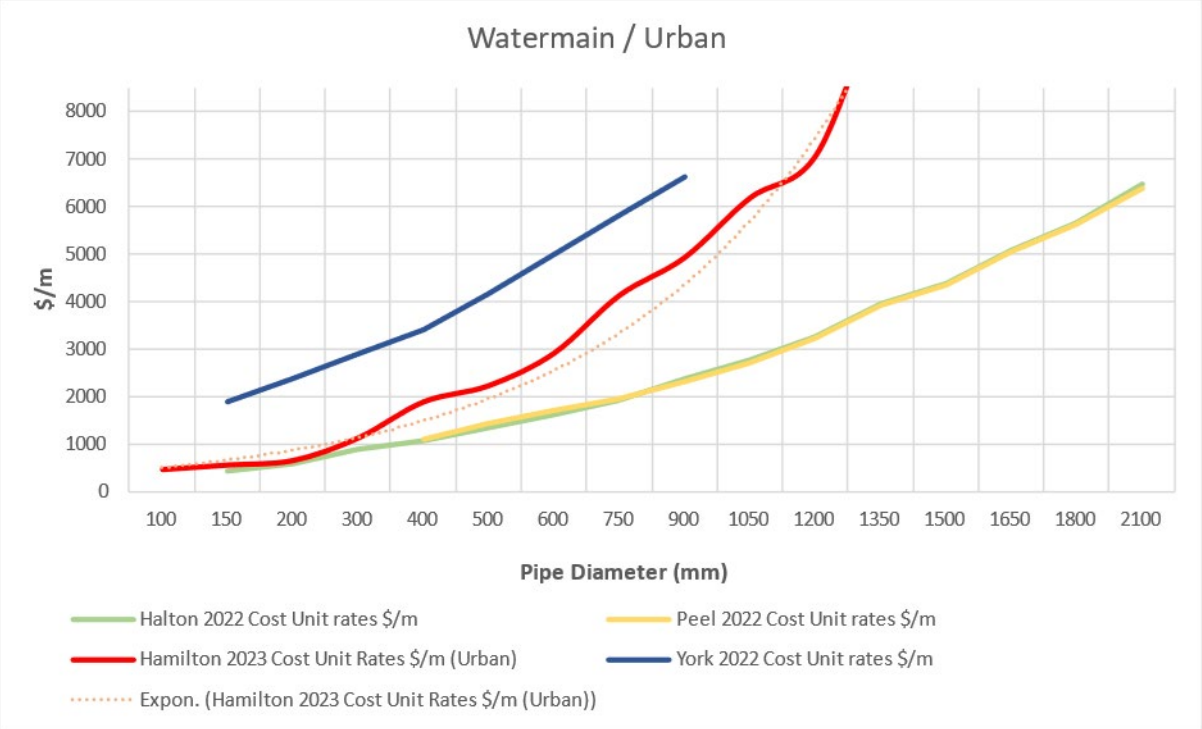


Figure 2-6. Watermain Cost Unit Rates in Other Municipalities vs. Hamilton Urban Rates

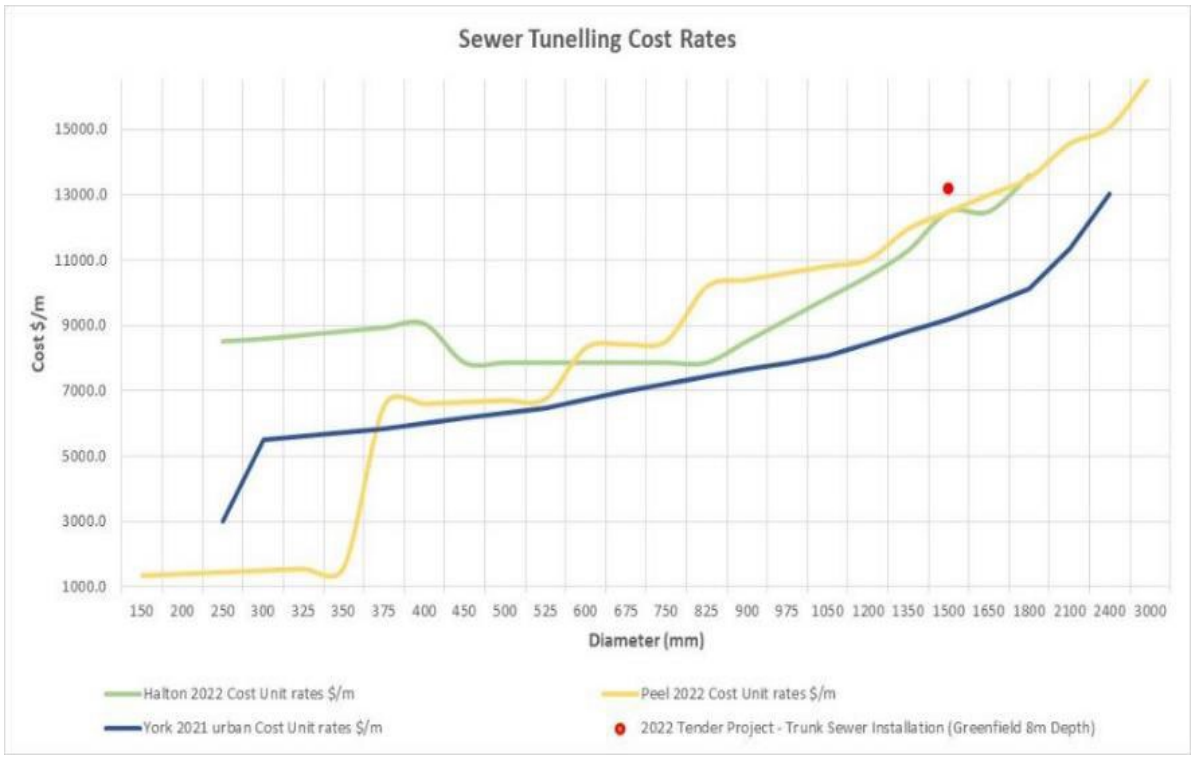


Figure 2-7Sewer Tunnelling Cost Unit Rates in Other Municipalities vs. Hamilton Urban Rates

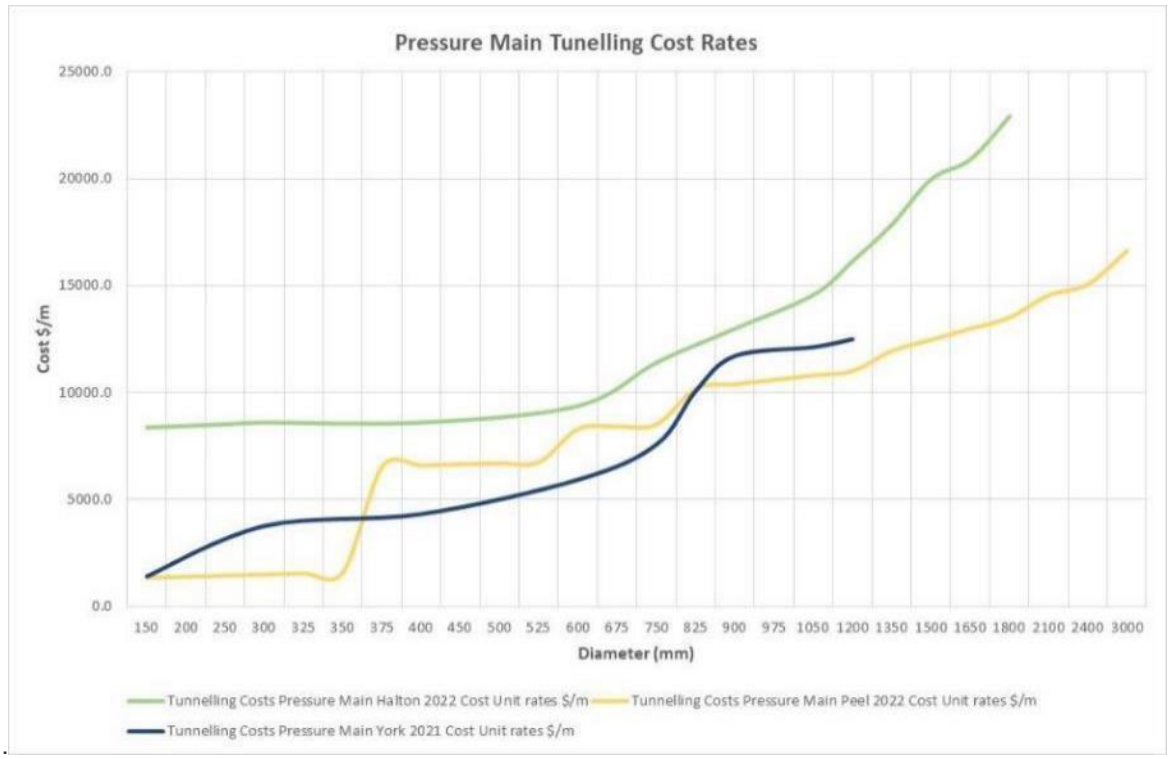


Figure 2-8 Pressure Main Tunnelling Cost Unit Rates in Other Municipalities

The City of Hamilton does not have a Tunnelling Unit Rate for use with Master Plan Level cost estimating. However, the City did provide a recent tender analysis for the Dickenson Road Trunk Sewer, which is represented as a single point in **Figure 2-7**. This approach allowed us to incorporate Hamilton's tunneling costs into our analysis, despite the lack of official unit rates from the City. No Watermain tunnelling tender cost estimate was available at this time for a similar comparison to wastewater, however, the graph is shown for reference.

Note that at the Master Plan / Development Charges stage for costing of tunnelled projects, it is not common to have full understanding of shaft sites, number of shafts, depth, pipe material/construction tunnelling methodology, etc. As such a general “all-in” tunnelling unit rate, inclusive of shafts, manholes and pipes is typically used.

At this stage, we are not recommending a separate tunnelling rate, however, this could be reviewed in the future for the upcoming Master Plan.

2.9 Total Cost Comparison – 100m Project

This memo has compared the overall costing methodology including the various percentage adjustments (uplift / premium, depth, contingency) as well as the base unit rates. However, in order to provide an overall project cost comparison which incorporates unit rates as well as percentage adjustments, sample project cost estimates were required.

These estimates were calculated for sample 100 metre sewer and watermain projects in Hamilton and neighbouring Regions (York, Halton, and Peel), to compare Hamilton's estimates using inflated unit rates and with the proposed methodology. The following figures show trendlines of estimates using the former, Hamilton's current methodology with inflated unit rates, alongside estimates for each Region.

Analyzing cost trends and regional differences can help the City of Hamilton evaluate the effectiveness of their existing policies and regulations related to infrastructure planning. Comparing the cost of linear installation projects in different regions helps the City of Hamilton assess whether their projected cost estimates are reasonable and competitive. If their projected cost is significantly lower than the regional averages, an adjustment to the unit rates and/or methodology can offer a potential solution to address this matter.

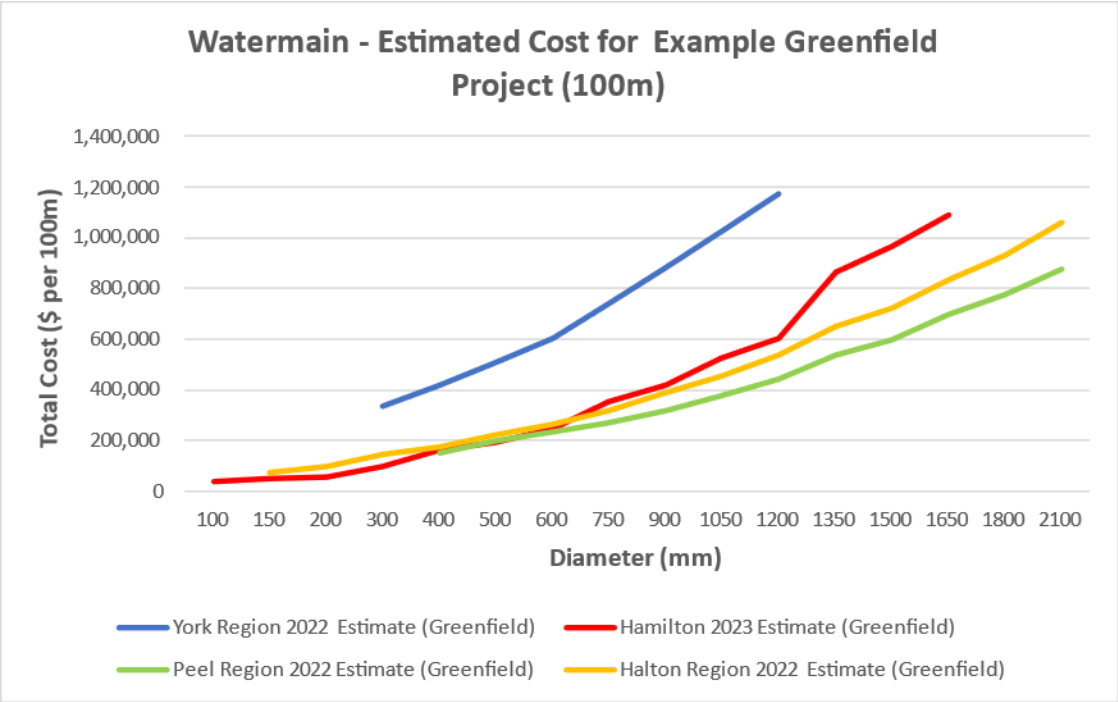


Figure 2-9 Estimate Project Costs for Example Greenfield Watermain (100m Length)

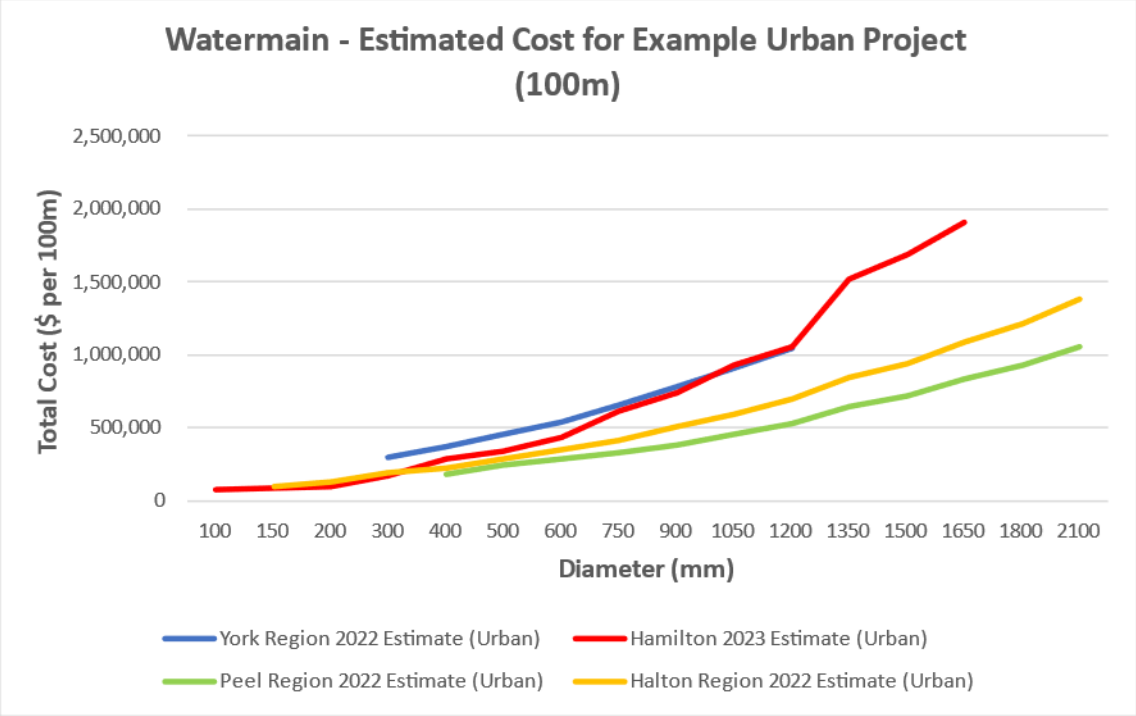


Figure 2-10 Estimate Project Costs for Urban Watermain (100m Length).

Figure 2-11 Estimate Project Costs for Greenfield Shallow Sewer (100m Length).

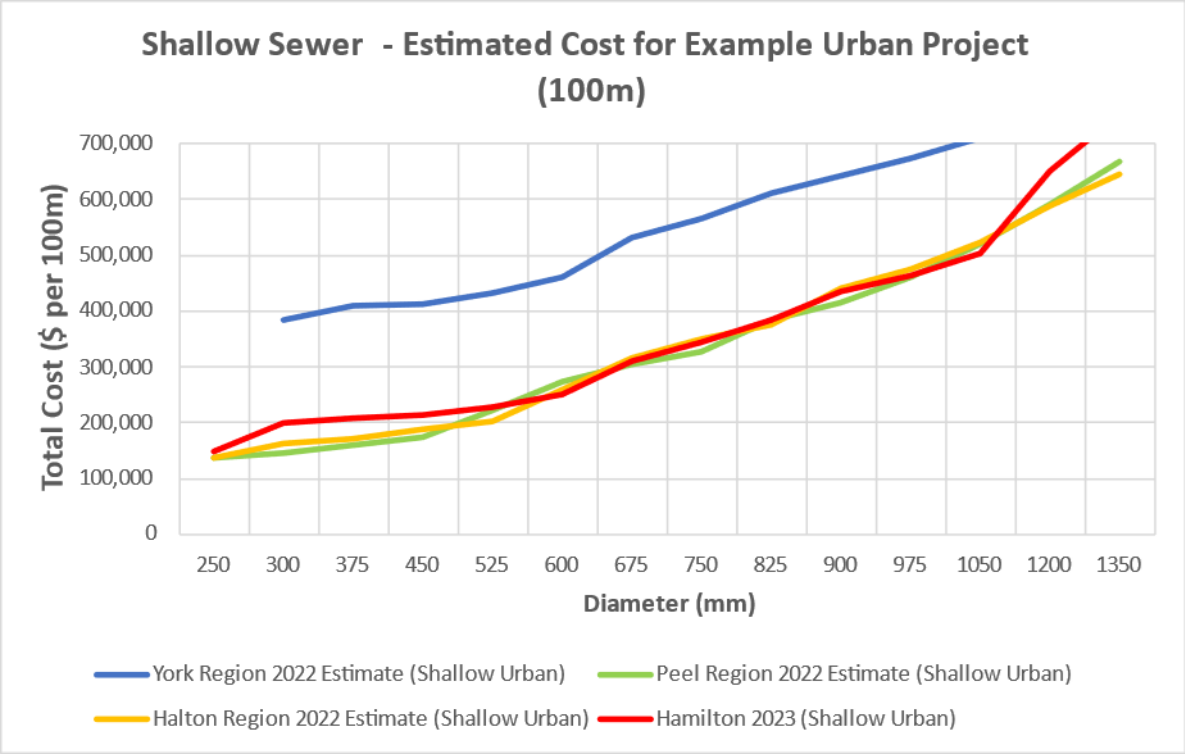


Figure 2-12 Estimate Project Costs for Urban Shallow Sewer (100m Length).

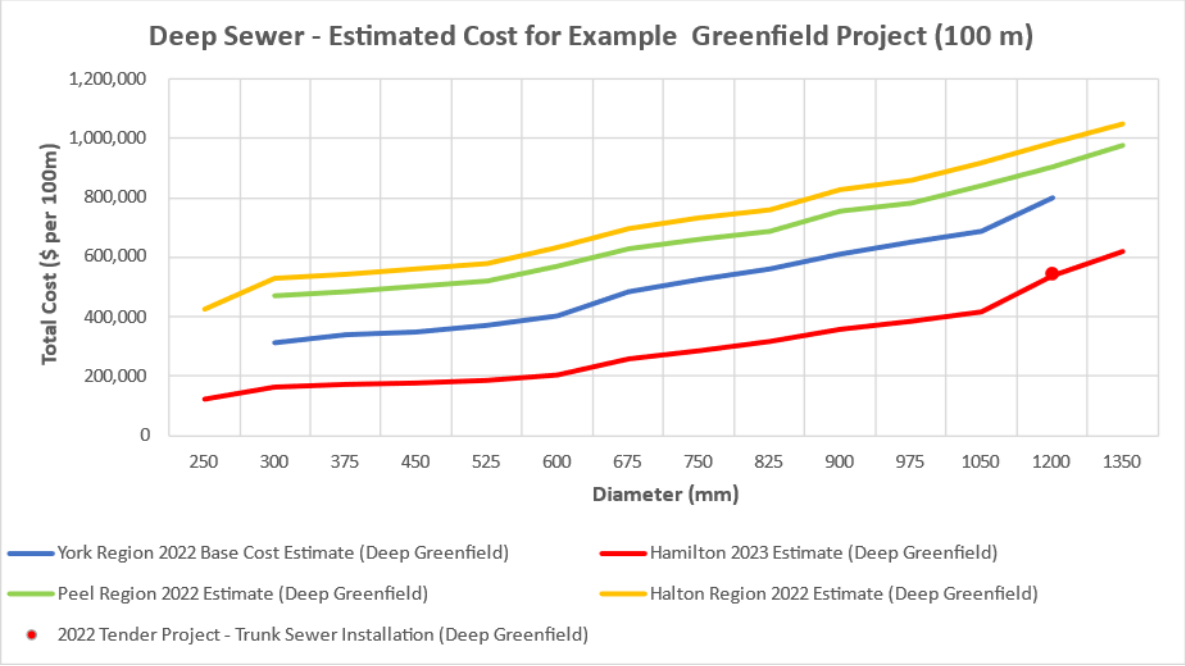


Figure 2-13 Estimate Project Costs for Greenfield Deep Sewer (100m Length).

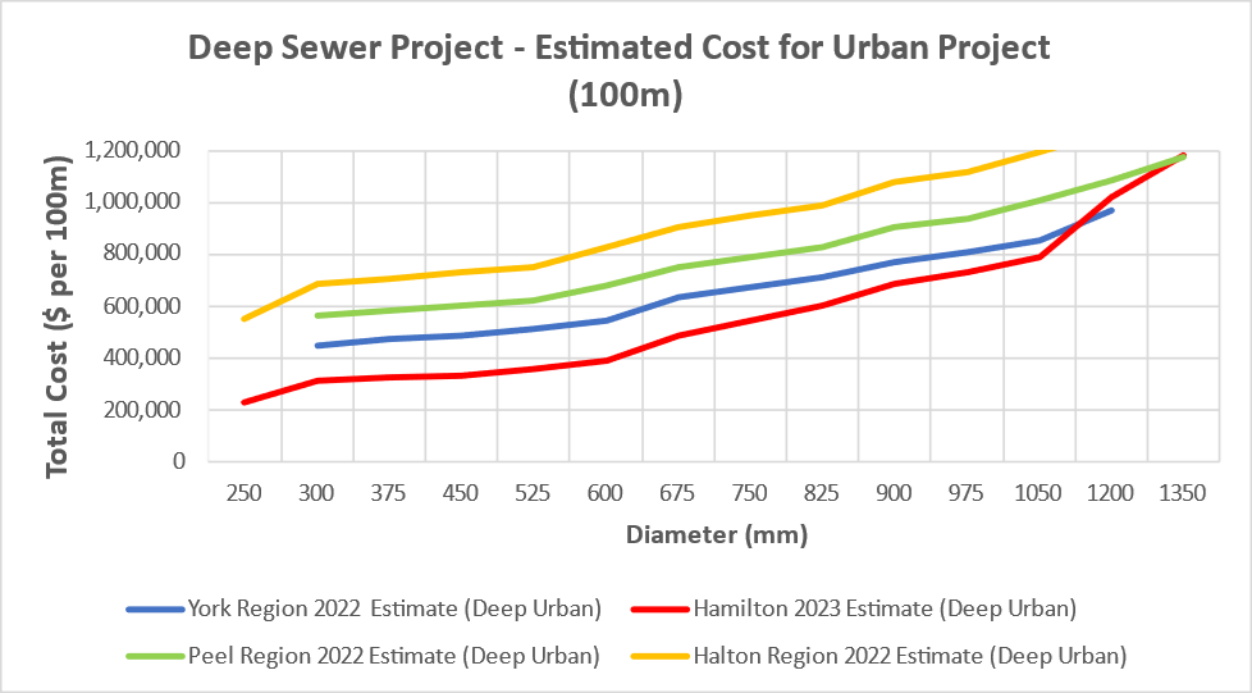


Figure 2-14 Estimate Project Costs for Urban Deep Sewer (100m Length).

It is important to note that unit rates for deep sewers were unavailable for Hamilton, resulting in the difference seen in Figure 2-13 and Figure 2-14 above. Despite this, Hamilton's estimates using the current methodology appear lower on average, mainly for sewer projects.

The analysis conducted reveals several key findings. Firstly, it is evident that the current costing methodology and/or unit rates employed by Hamilton is resulting in low-cost estimates, which highlights the need for a re-evaluation of the costing methodology to ensure greater accuracy in future estimations.

Additionally, the current Hamilton costing methodology results in lower total costs that of neighboring municipalities, exemplified by the above graphs. This discrepancy emphasizes the importance of aligning Hamilton's costing methodology with industry standards to enhance cost-effectiveness and maintain competitive pricing.

2.10 City of Hamilton Tender Cost Example

Cost unit rates were also reviewed and updated based on recent tender data for pipe installation of different size and type that are constructed via open cut and trenchless methodologies. We conducted analysis using a past project, obtaining our data from the 'Unit Prices' list provided by the City of Hamilton.

We conducted an analysis of a past project from 2022, specifically the open cut portion of the "C15-11-22(HSW) Dickenson Road East Sanitary Sewer and Watermain" project, implemented by the City of Hamilton. Our focus was on a crucial component of the project, namely the open cut trunk sewer installation between MH2A and MH20A, which served as the basis for our calculations. The tender cost sheet indicated a unit cost of $5,464.51 per linear meter for this installation. Considering the pipe diameter of 1200 mm and the open-cut method employed, the total distance covered was 2529 meters, incurring a total cost of $13,819,745.79. To provide a meaningful comparison, we utilized this unit cost as an example and plotted it against the "8m Depth Sewer - Average Project Cost (100 m)" graph. Furthermore, we created a comparative table to illustrate the cost differences for an average rural project of 100 meters. The table showcases the projected expenses for York if they were to undertake a similar project, the estimated cost for Hamilton if they were to execute the same undertaking, and the actual cost incurred by Hamilton in 2022 for a similar project (C15-11-22(HSW) – trunk sewer installation section).

Table 2-9. Project unit rate comparison between York Region and City of Hamilton.

	York Region	City of Hamilton	Actual Cost
Unit Rate	$ 3,891	$ 2,934	**$546, 451**
Project Cost	$ 396,788 (Using existing York Region methodology)	$ 317,816 (Using existing unit rate, inflated to 2023 and existing methodology)	

Notes: The project costs for the mentioned municipalities were derived using their current unit rates for rural construction and utilizing their existing costing methodologies

3.0 Conclusions and Proposed Costing Criteria

For the 2023 Development Charges Bylaw Update, the cost unit rates are proposed to be updated based on the following factors:

Considering the above analysis, we recommend utilizing a single unit rate for each of Water and Wastewater as opposed to an "Urban" and "Greenfield" unit rate. The 2019 Greenfield Unit Rates with shallow depth will be used as the baseline for the base construction costs, increased by **39%** to inflate the values from 2019 dollars to 2023 dollars. Furthermore, to better align with the total project costs of the other municipalities, we also propose the following percentages to calculate the Total Project Costs:

- For projects in Urban environments, an additional 75% Urban Construction Premium added to the cost. This generally aligns with the range of cost premiums observed between 2019 Greenfield and Urban rates.
- For deeper construction (>5 metres) and typically for Wastewater projects, 20% depth premium added to the cost.
- Applying 15% Soft Costs for Engineering and other potential studies / costs.
- Applying 30% Overall Project Contingency to the sum of the total construction costs plus soft costs.

The following table summarizes the proposed methodology.

Table 3-1. Proposed Costing Methodology for City of Hamilton.

Construction Cost		
A	Base Construction Cost ($) =	$/m x Length (Inflated 2019 Greenfield Unit Rate) x Length
B	Urban Construction Premium =	0% Greenfield 75% Urban
C	Construction Depth Premium =	0% Shallow 20% Deep
D	**Total Construction Cost =**	**A + (B x A) + (C x A)**
Soft Costs		
E	Geotechnical / Hydrogeological / Engineering Design and Contract Administration	15%
Contingency		
F	Project Construction Contingency	30%
Total Project Cost = D + (E x D) x (1 + F)		

3.1 Updated Project Projected Costs

Utilizing the new proposed costing methodology, we generated average projected project cost graphs for water and wastewater linear projects of various construction depths and areas (rural and urban). As evident from the graphs presented below, the updated methodology for costing has narrowed the trend lines for the City of Hamilton, bringing them closer to those of other regions. This improvement signifies a more aligned and comparable cost estimation approach. We recognize that in the case of watermain projects with diameters exceeding 750 mm, Hamilton's anticipated project costs surpass those of the Region of Peel and Halton Region. This discrepancy can be attributed to Hamilton's elevated unit rates for watermains compared to those of Halton and Peel.

Further review of recent tenders, if available, can provide an opportunity to make adjustments to the rates / methodology in the future.

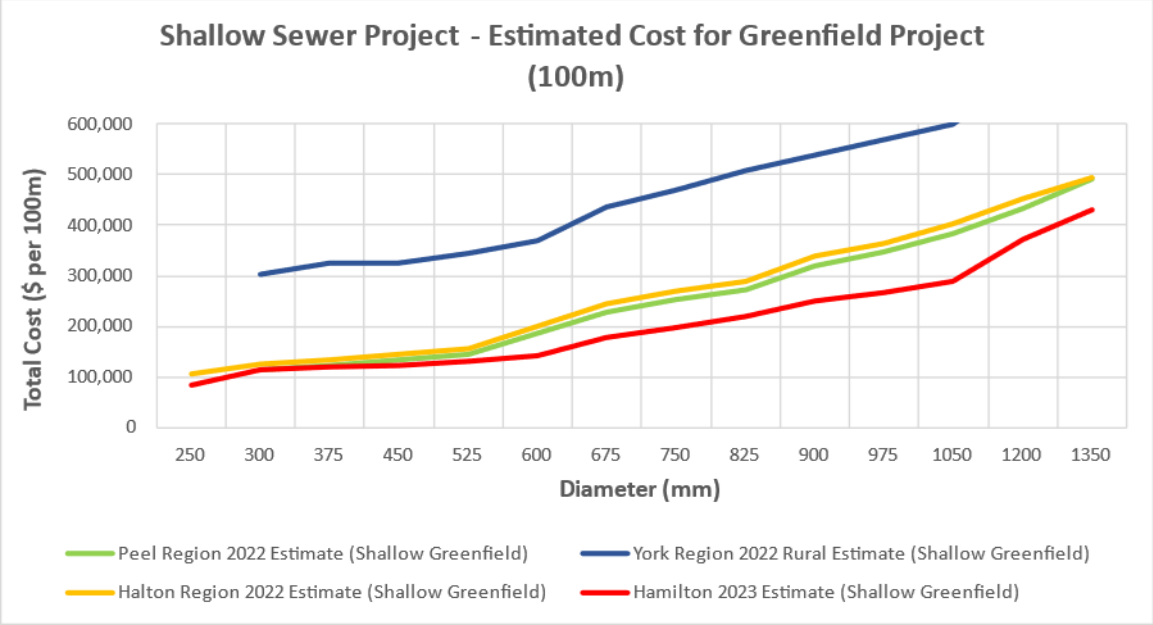


Figure-3-1. Estimated Cost Shallow Greenfield (100m) Sewer Project.

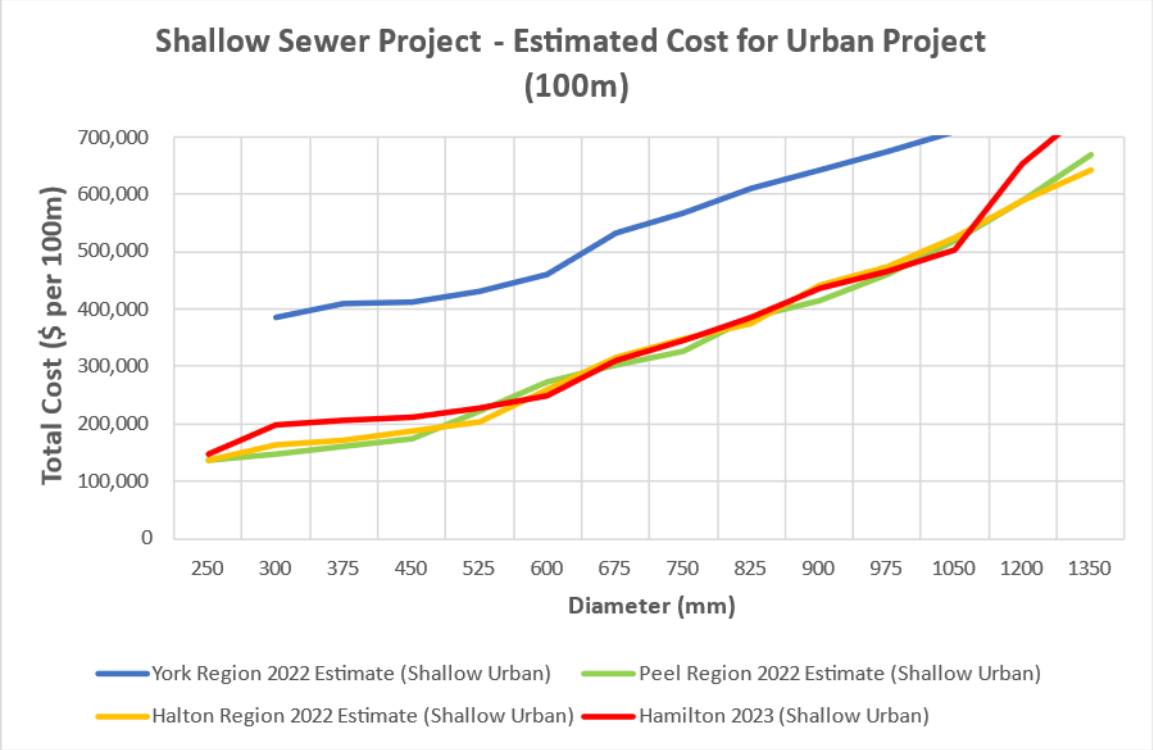


Figure 3-2. Estimate Cost for Shallow Urban (100m) Sewer Project.

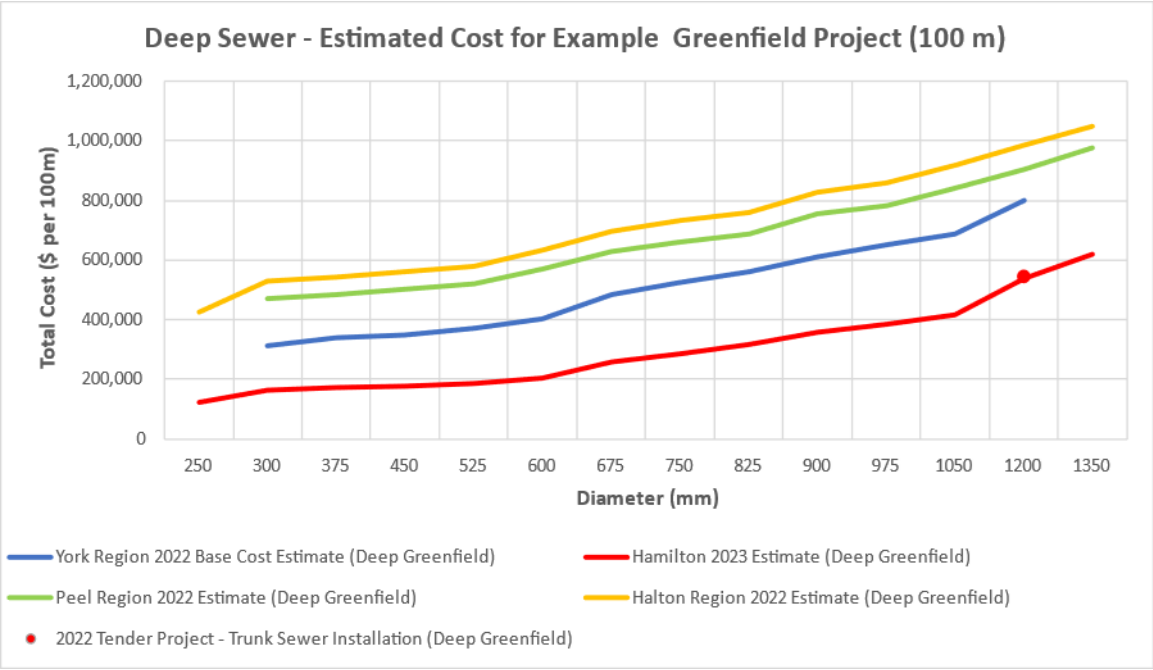


Figure 3-3. Estimated Cost for Deep Greenfield (100m) Sewer Project.

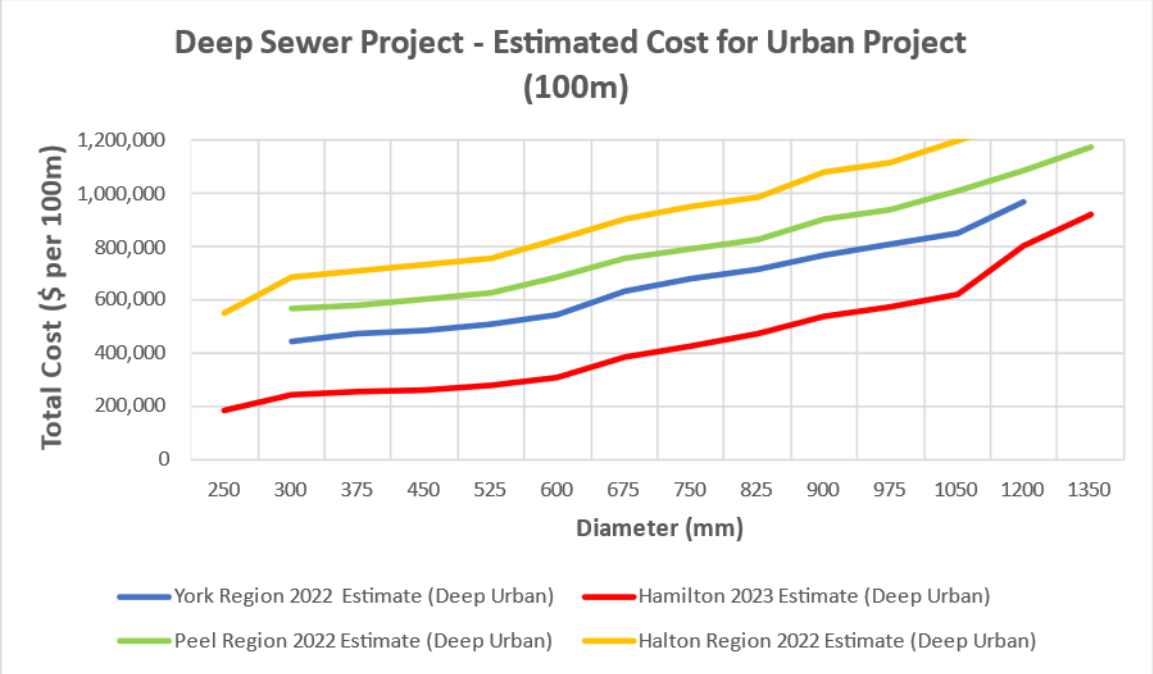


Figure 3-4. Estimated Cost for Deep Urban(100m) Sewer Project.

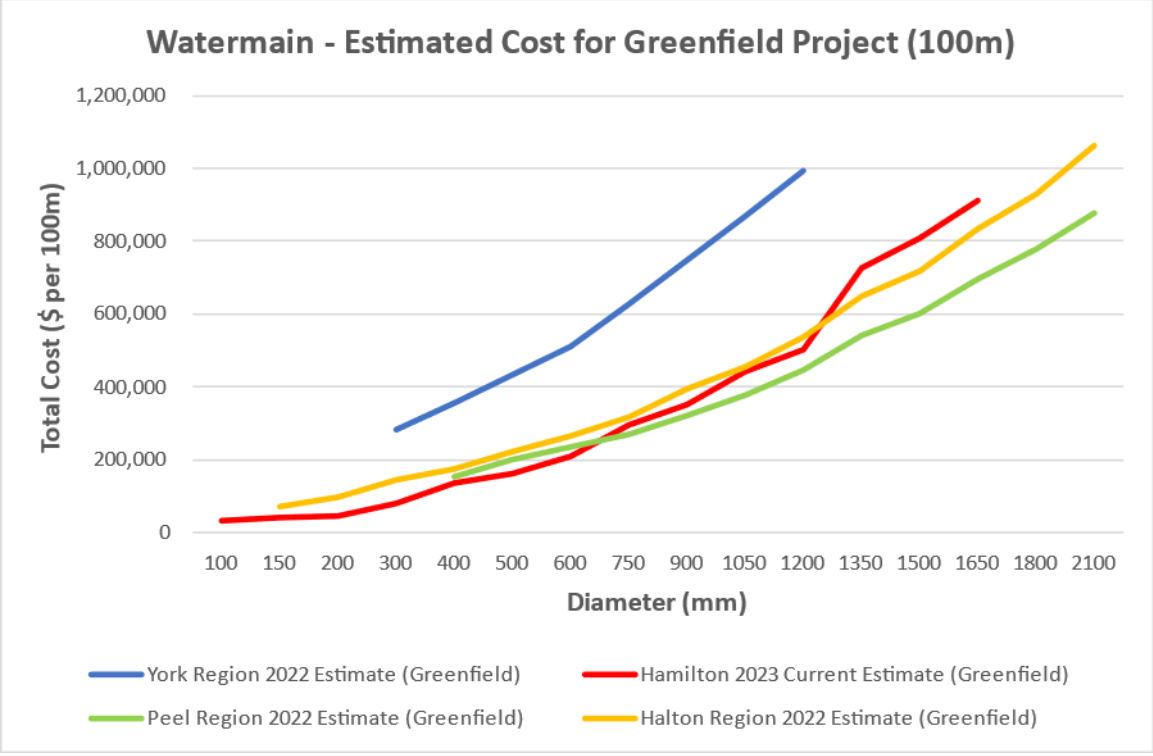


Figure 3-5. Estimated Cost for Greenfield (100m) Watermain Project.

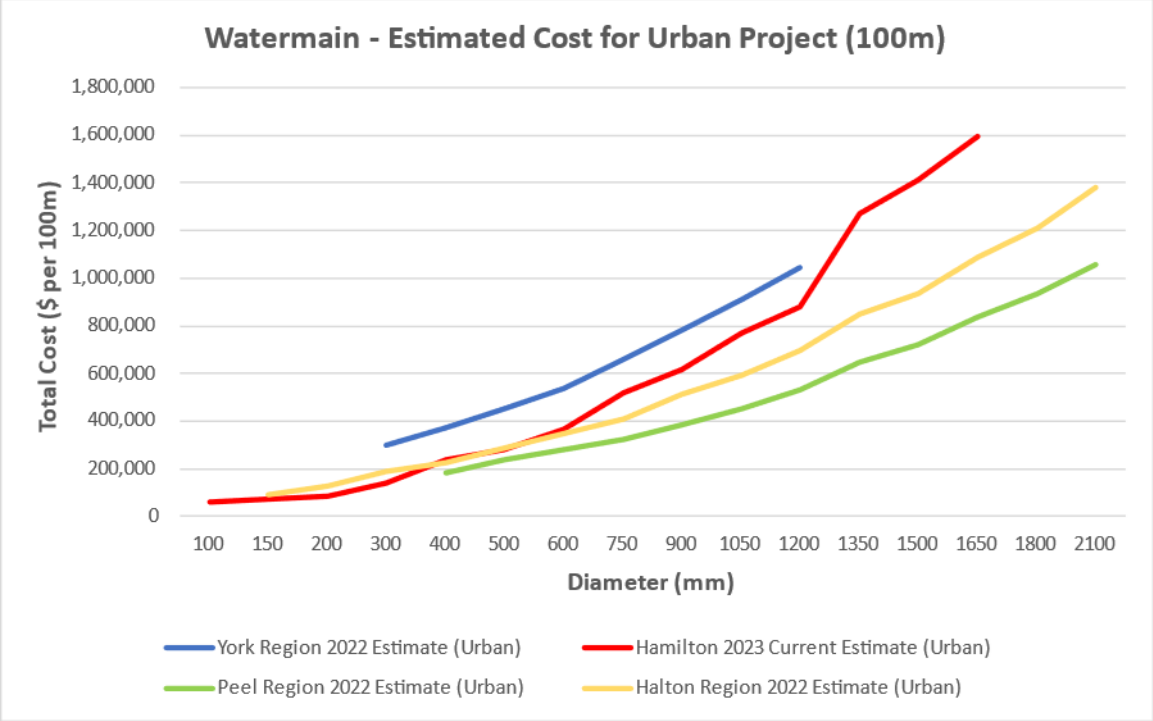
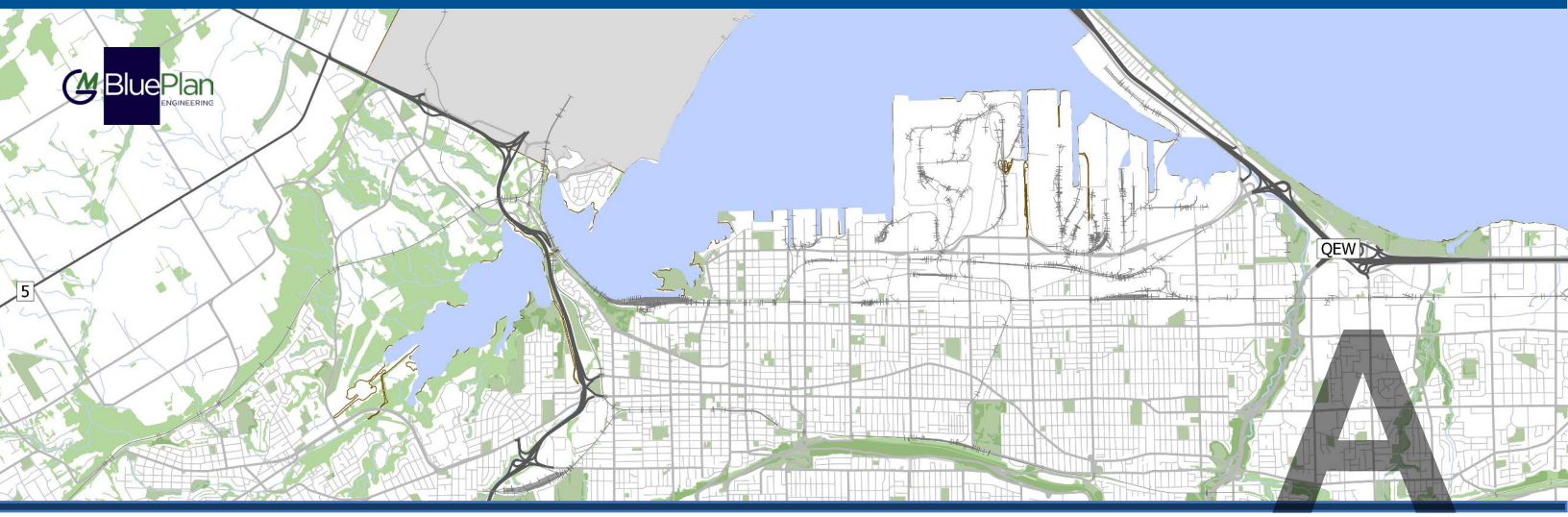


Figure 3-6. Estimated Cost for Urban (100m) Watermain Project.



CITY OF HAMILTON

WATER, WASTEWATER, STORMWATER MASTER PLAN

APPENDIX A

City of Hamilton Unit Rates

Sanitary Sewer (Updated Methodology)					
Sewer Size	**$2019/m**	$2023 /m			
		Shallow		**Deep (>5m)**	
(mm)	**Greenfield**	Greenfield	Urban	Greenfield	Urban
250	**$ 404**	$ 563	$ 986	$ 676	$ 1,183
300	**$ 544**	$ 758	$ 1,327	$ 910	$ 1,593
375	**$ 567**	$ 791	$ 1,384	$ 949	$ 1,661
450	**$ 583**	$ 813	$ 1,422	$ 975	$ 1,707
525	**$ 622**	$ 867	$ 1,517	$ 1,040	$ 1,820
600	**$ 684**	$ 954	$ 1,669	$ 1,144	$ 2,002
675	**$ 855**	$ 1,192	$ 2,086	$ 1,430	$ 2,503
750	**$ 948**	$ 1,322	$ 2,313	$ 1,586	$ 2,776
825	**$ 1,057**	$ 1,474	$ 2,579	$ 1,768	$ 3,095
900	**$ 1,197**	$ 1,669	$ 2,920	$ 2,002	$ 3,504
975	**$ 1,275**	$ 1,777	$ 3,110	$ 2,132	$ 3,732
1050	**$ 1,384**	$ 1,929	$ 3,375	$ 2,314	$ 4,050
1200	**$ 1,788**	$ 2,492	$ 4,361	$ 2,991	$ 5,234
1350	**$ 2,063**	$ 2,876	$ 5,032	$ 3,451	$ 6,039

Sanitary Forcemains (Updated Methodology)					
Diameter	**2019$/m**	**2023$/m (Shallow)**		**2023$/m (Deep)**	
(mm)	**Greenfield**	Greenfield	Urban	Greenfield	Urban
150	**$ 380**	$ 530	$ 928	$ 636	$ 1,113
200	**$ 508**	$ 708	$ 1,239	$ 850	$ 1,487
250	**$ 634**	$ 884	$ 1,547	$ 1,061	$ 1,857
300	**$ 762**	$ 1,062	$ 1,859	$ 1,275	$ 2,231
350	**$ 930**	$ 1,296	$ 2,268	$ 1,555	$ 2,721
400	**$ 1,098**	$ 1,531	$ 2,680	$ 1,837	$ 3,216
450	**$ 1,229**	$ 1,713	$ 2,998	$ 2,056	$ 3,597
500	**$ 1,280**	$ 1,784	$ 3,122	$ 2,141	$ 3,746
600	**$ 1,548**	$ 2,157	$ 3,775	$ 2,588	$ 4,530
750	**$ 1,984**	$ 2,766	$ 4,840	$ 3,319	$ 5,808
900	**$ 2,333**	$ 3,252	$ 5,691	$ 3,902	$ 6,829
1050	**$ 2,827**	$ 3,941	$ 6,897	$ 4,729	$ 8,276

Watermain Unit Rates (Updated Methodology)					
Pipe Size	**$2019 /m**	**$2023 /m**			
		Shallow		**Deep (>5m)**	
(mm)	Greenfield	Greenfield	Urban	Greenfield	Urban
100	$ 194	$ 271	$ 474	$ 325	$ 569
150	$ 233	$ 325	$ 569	$ 390	$ 683
200	$ 272	$ 379	$ 664	$ 455	$ 796
300	$ 466	$ 650	$ 1,138	$ 780	$ 1,365
400	$ 777	$ 1,084	$ 1,896	$ 1,300	$ 2,275
450	$ -	$ -	$ -	$ -	$ -
500	$ 917	$ 1,279	$ 2,238	$ 1,534	$ 2,685
600	$ 1,197	$ 1,669	$ 2,920	$ 2,002	$ 3,504
750	$ 1,695	$ 2,362	$ 4,134	$ 2,835	$ 4,961
900	$ 2,021	$ 2,817	$ 4,930	$ 3,381	$ 5,916
1050	$ 2,534	$ 3,532	$ 6,182	$ 4,239	$ 7,418
1200	$ 2,892	$ 4,031	$ 7,054	$ 4,837	$ 8,465
1350	$ 4,167	$ 5,808	$ 10,164	$ 6,969	$ 12,197
1500	$ 4,633	$ 6,458	$ 11,302	$ 7,750	$ 13,562
1650	$ 5,239	$ 7,303	$ 12,781	$ 8,764	$ 15,337