B

TOWN OF WHITCHURCH-STOUFFVILLE

WATER AND WASTEWATER MASTER PLAN

APPENDIX B

Cost Estimation Paper

TABLE OF CONTENTS

APPENDICES

Appendix A Cost Estimation Spreadsheet Template
Appendix B Cost Estimate Classes
Appendix C Data Confidence and Availability for Cost Estimate Classes
Appendix D Upload Unit Rates

LIST OF TABLES

LIST OF FIGURES

No table of figures entries found.

1.0 Introduction

The Town of Whitchurch-Stouffville retained GM BluePlan Engineering Limited to complete the Water and Wastewater Master Study which provides a review, evaluation and development of water and wastewater servicing strategies for servicing within the Town. This memorandum presents an update to the Cost Estimation Framework established under the 2018 Master Plan, including updated unit rates, which were applied to the Town's capital projects in the Water and Wastewater Master Plan.

2.0 Cost Estimation Framework

The Cost Estimation Framework for capital projects at the Master Plan level are based on an overall project unit cost approach. In this approach, project costs are generated from unit rates with added contingency and other additional costs.

3.0 Approach and Methodology

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 sewer, 10-metre depth sewer, water main, wastewater force main, tunnelling). Additional costs are added to account for creek, road, railway or utility crossings, valves, 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 cost plus additional cost results in the Base Construction Cost.

Soft costs such as geotechnical/hydrogeological, property/easements, engineering and design, contract administration and contingency allowances, are added to the Base Construction Cost to arrive at the Total Project Cost.

Figure 1 shows the cost estimating process flow diagram. Each of the key components of the diagram is described below, including:

- Project Type,
- Cost Estimate Classification,
- Project Complexity,
- Unit Rates,
- Construction Uplift,
- Additional Costs,
- Construction Provisional Allowance,
- Other Project Costs (Geotechnical, Property, Design, In-house costs, etc.), and
- Project Contingency.

The unit costs and all the above components are contained in excel spreadsheets that include the Town's project sheets and the Water and Wastewater Capital Programs. The spreadsheet is the working tool that brings all the cost components together to create project cost estimates for the capital programs. The template spreadsheet is provided in **Appendix A**.

The following sections describe the methodology for each cost component noted above.

Figure 1 - Cost Estimation Process Flow Diagram

Step 1. Define Project

Project Description
Define basic project details. Description can include: - Project status - new/replacement - Project infrastructure type (sewer, watermain, PS, WWPS, etc) - Geographic location and/or alignment(s) - Diameter or Capacity

Step 2. Define Project Classification

Estimate Class	Estimate Class Description	End Usage/Major Deliverables
Class 5	Conceptual Planning Cost Estimate	Concept ccreening, justification for project funding, minimal information requirements.
Class 4	Infrastructure Planning Cost Estimate	Study to support investment decisions based on sufficient knowledge to identify high-level risk.
Class 3	Conceptual Design Cost Estimate	Basis for budgeting and approvals.
Class 2	Preliminary Design Cost Estimate	Used for project cost control during design; initial design estimate.
Class 1	Detailed Design Cost Estimate	Final cost review in preparation for construction; tender-ready.

Step 3. Define Project Complexity

Project Complexity	Complexity Description
High complexity	Projects with high cost, broad scope of work, multiple alternatives/alignments, etc.
Moderate complexity	Projects with moderate cost, larger scope of work, several alternatives/alignments, etc.
Low complexity	Projects with low cost, defined scope of work, few if any altenatives

Step 4. Define Project Details

Project Detail	Detail Description
Diameter	Nominal diameter of the proposed water main to provide the required level of service.
Length	Approximate length of the proposed pipe based on the alignment (whether assumed or determine through more rigorous analysis).
Construction Methodology	The method by which the pipe will be installed (e.g., open cut, trenchless).
Construction Depth	The depth of excavation required to install the pipe assuming that open cut construction is chosen (e.g., normal, deep).
Construction Environment	The general environment within which the pipe will be constructed (e.g., greenfield, suburban, urban).
Crossings	Identification of the type and number of crossings associated with the pipe installation (e.g., creeks, roads, railways, major utilities).
Appurtenances	Identification of the type and number of appurtenances required for the proposed water main (e.g., valves, chambers, hydrants, etc.).
Capacity	Proposed capacity of vertical infrastructure (e.g. pump stations).

Step 5. Calculate Total Construction Cost

❶ INSTALLATION COST
Basic cost to install linear infrastructure and associated appurtenances calculated using various unit rates for pipe, valve and chamber sizes and type of crossings.

Includes: pipe installation (unit rate x length), crossings (count x unit rate for size and type of crossing), manholes and chambers (included in unit rate).

For vertical infrastructure, includes facility construction (unit rate x capacity).

❷ CONSTRUCTION UPLIFT
Allowance for the increased cost of constructing in built-up areas, applied to the base construction cost.

Construction Environment		
Greenfield	Suburban	Urban
0%	20%	40%

❸ BASE CONSTRUCTION COST
Total cost to construct the actual linear or vertical infrastructure and associated appurtenances, not including tasks such as traffic management, mobilization, inspections, etc.

❸ = ❶ + ❷

❹ ADDITIONAL CONSTRUCTION COSTS
Additional costs associated with construction not covered under the base construction cost or the construction uplift, including mobilization, traffic management, inspections, etc. A percentage is applied to the water main construction cost based on the complexity of the project.

Project Complexity		
Low	Moderate	High
5.0%	7.5%	10.0%

❺ PROVISIONAL ALLOWANCE
Provisional allowance for labour and materials over and above the construction cost, a standard item on construction tenders. A provisional allowance of 10% is applied to all projects.

❻ TOTAL CONSTRUCTION COST
Total cost of constructing the project including all items that make up a construction tender.

❻ = ❸ + ❹ + ❺

Step 6. Calculate Project Contingency

❼ PROJECT CONTINGENCY
An allowance for contingency that recognizes both the complexity of the project and the project classification in terms of the certainty regarding scope of work, alignment, construction methodology, property requirements, geotechnical/hydrogeological issues, etc. The contingency will become smaller as the project moves closer to implementation.

	Project Complexity		
	Low	Moderate	High
Class 4	15%	20%	25%
Class 3	10%	15%	20%
Class 2	5%	10%	15%
Class 1	0%	0%	5%

Step 7. Calculate Soft Costs

a) For new infrastructure (i.e., growth-related)

❾ GEOTECHNICAL/ HYDROGEOLOGICAL
Allowance for geotechnical/hydrogeological investigations during detailed design.

Project Complexity		
Low	Moderate	High
0.5%	1.0%	2.0%

❿ PROPERTY/EASEMENTS
Allowance for temporary and permanent easements and for property acquisition.

Project Complexity		
Low	Moderate	High
1.0%	1.5%	2.0%

⓫ ENGINEERING/DESIGN (INTERNAL)

Total Cost		
<$10m	$10-$50m	>$50m
4%	6%	8%

⓬ DESIGN/CONTRACT ADMINISTRATION (EXTERNAL)

Total Cost		
<$10m	$10-$50m	>$50m
10%	12%	15%

⓭ TOTAL SOFT COSTS (GROWTH)

⓭ = ❾ + ❿ + ⓫ + ⓬

⓮ NON REFUNDABLE HST
Non Refundable HST has been defined as 1.76%

Step 8. Total Project Cost

⓯ TOTAL COST ESTIMATE (2018 Dollars)
Total cost of the project including construction costs, additional project related costs and soft costs.

⓯ = ❻ + ❼ + ⓭ + ⓮

Step 9. Determine Funding Source(s)

Determine the funding source or sources based on the key driver(s) of the project.

3.1 Project Type

New Infrastructure

New infrastructure projects involve construction of new linear or vertical infrastructure that are growth related. The majority of the capital projects identified in the Master Plan fall into this category and their cost were developed using the cost estimation framework.

Replacement

Projects involving replacement, relining and other works on existing infrastructure. These projects are generally fall in the State of Good Repair (SoGR) category.

3.2 Cost Estimate Classification

The cost estimation approach uses a classification system to categorize cost estimate classes. These classes represent different phases of planning and design and, therefore, different methods of cost estimation and levels of accuracy. This framework complements the generic approach developed by the Association of Advancement in Cost Estimating (AACE) International, and also has similarities to the Government of Canada (GOC) approach.

For the purposes of the Water and Wastewater Master Plan, the cost estimates that are derived using this methodology mostly follow a Class 4 estimate. If this methodology is further used through subsequent phases of the project, the Class can be updated to reflect the higher level of confidence in the estimate and the additional effort used to develop the estimate.

Table 1 provides descriptions of the proposed estimate classes and their end usage or deliverables. **Appendix B** includes expanded details on each Class, including the basis for the estimate and the associated accuracy range that can be expected based on the project complexity.

Table 1: Cost Estimation Classes

Estimate Class	Estimate Class Description	End Usage / Major Deliverables
Class 5	Order of Magnitude Estimate	Limited or no available information used in the cost estimate. Used at an early stage in absence of better information.
Class 4	Infrastructure Planning Cost Estimate	Infrastructure Planning / Master Planning. Justification for project funding. Limited available information used in the cost estimate.
Class 3	Conceptual Design Cost Estimate	Basis for budgeting and approvals.
Class 2	Preliminary Design Cost Estimate	Used for project cost control during design. Initial detailed estimate.
Class 1	Detailed Design Cost Estimate	Final cost review in preparation for construction; tender ready.

3.3 Project Complexity

A Master Plan level project can vary widely in scope. When developing the cost estimate within a Master Plan context, it should be recognized that not all project costs have the same level of complexity. As part of the cost estimating framework, the project complexity is estimated during development of the project cost estimate. As the anticipated complexity of a project increases from low to high there is a greater risk of unforeseen costs. As such, the contingency and additional cost items are adjusted to reflect the project complexity.

Table 2 provides general definitions of project complexity – high, medium and low – as used in the Water and Wastewater Master Plan. An estimate of the complexity is made after reviewing the project details that are available at the Master Planning stage. The definitions of high, medium and low complexity are provided to maximize the consistency in complexity selection on a given project and to minimize the subjectivity of the estimate.

The complexity estimate is intended to represent the best assumption of the overall complexity of the project with details available at the time.

Table 2: Project Complexity Descriptions

Level	Complexity Description

High Complexity	• Large in scale, scope and, ultimately, cost.
	• Uncommon project, not frequently constructed.
	• Complex project details that, in general, have high uncertainty and may potentially change in later stages of the project (EA, scoping study, design, construction)
	• Multiple options and project details for design and construction (alignment, dimensions, facility layout, construction methodology) that are not yet confirmed.
	• Other anticipated project details that can contribute to consideration as a High Complexity project:
	  ○ Existing utility and linear infrastructure conflicts, that may not be known at the Master Planning Stage
	  ○ Unknown subsurface conditions – Soil, rock, groundwater
	  ○ Significant restoration requirements
	  ○ Environmental features that may require additional approvals and/or mitigation during construction.
	  ○ Potentially long construction duration
	  ○ Linear – Deep sewer/water main, force main.
	  ○ Linear – Large Diameter
	  ○ Facility – Deep Wet Well
	  ○ Facility – Large Capacity (Reservoir, Elevated Tank, Pumping Station)
	The nature of the project details in a high complexity project (e.g. many unknowns, utility conflicts, large diameter, high base construction costs, etc.) necessitate the inclusion of further additional costs to account for the risk of construction cost increases.

Medium Complx	• Moderate in scale, scope and. ultimately, cost. • Medium complexity projects where most project details generally fall in between high and low complexity. • Medium complexity projects may have some elements that fit the High Complexity category, while some elements falling within Low complexity category. (e.g., short section of small diameter water main constructed within a built-up area with several utility conflicts).

Low Complexity	• Smaller in scale, scope and, ultimately, cost.
	• Common project, frequently constructed.
	• Straightforward project details that, in general have low uncertainty and are not likely to change in later stages of the project (EA, scoping study, design, construction).
	• Most options and project details for design and construction (alignment, dimensions, facility layout, construction methodology) are generally confirmed at this stage.
	• Other anticipated project details that can contribute to consideration as a Low Complexity project.
	  ○ Few existing utility and linear infrastructure conflicts – generally associated with greenfield/rural construction.
	  ○ Subsurface conditions are known or assumed with high level of certainty.
	  ○ Minimal restoration required or restoration primarily to be coordinated with road construction/widening.
	  ○ Little to no environmental features within project construction area
	  ○ Short anticipated construction duration.
	  ○ Linear – Shallow sewer, water main, force main.
	  ○ Linear – Small diameter.
	  ○ Facility – Shallow wet well.
	  ○ Facility – Small Capacity (Reservoir, Elevated Tank, Pumping Station).

3.4 Unit Rates

Unit rates require periodic updating to ensure they are consistent with current market conditions. The 2018 Master Plan established units rates and under this 2022 Update, GM BluePlan has benchmarked recent tenders for linear and facility projects within the GTA to provide guidance to the update of unit rates and reviewed inflation indexes. Using Statistics Canada Building Construction price indexes for non-residential buildings the 2018 units rates have been inflated by 41% to establish rates in 2023$. Unit rates are estimated to be high level cost for construction, which is assumed to include General Contractor profit.

The linear unit rate for a given pipe diameter is made up of the following components:

- Excavation ($/m3)
- Bedding ($/m3)
- Pipe Supply ($/m)
- Pipe Install ($/m)
- Backfill ($/m3)
- Restoration ($/m)
- Manhole Allowance ($/m)
- Valve Allowance ($/m)

Each component was broken down to a $/m linear unit rate to generate the total base construction cost for a given diameter of pipe. Unit rates for facilities are not broken down to the same level of detail as linear projects. Facility unit rates are based on $/L/s or $/ML.

The Master Plan unit rates are provided in **Appendix D**. They are based on a combination of supplier material costs, tender analysis and historic project costs from multiple municipalities across southern Ontario. In this approach, the unit rates are the starting point or base for a cost estimate. Many other factors and criteria are applied to the unit rates..

Creeks, roads, railways and utility corridor crossings are also identified during the cost estimating process. The costs associated with these crossings, where applicable, are part of the installation cost. The costs of crossings are calculated as follows:

- Major Creek / Major Road → 150 m x Trenchless Unit Rate
- Minor Road / Utilities Corridor → 60 m x Trenchless Unit Rate
- Minor Creek → 20 m x Trenchless Unit Rate

Cost for crossings are considered a premium over and above the installation cost for the project and, as such, the total length of the water main or sanitary sewer is not adjusted to remove the length of the crossing.

3.5 Construction Uplift

Construction uplift introduces an allowance for the increased cost of constructing in built-up areas and is applied to the installation cost. This uplift accounts for additional costs related to restoration, utility conflicts, traffic management and additional restoration that are often encountered in an urban or suburban area as opposed to greenfield construction.

Table 3 provides a definition and the construction uplift percentages applicable for the different area conditions in the Water and Wastewater Master Plan.

Table 3. Construction Uplift Descriptions

Construction Environment	Environment Description	Construction Cost Uplift %
Greenfield	Greenfield construction with limited environmental constraints.	0%
Suburban	Developed built-up environment.	20%
Urban	Heavily developed built-up environment (e.g., downtown area).	30%

3.6 Additional Construction Costs

Additional construction costs account for costs that are incurred but not included in the base construction cost. These costs generally include mobilization and demobilization, pipe inter-connections, inspection, hydrants, signage, traffic management, bonding, insurance, etc.

Additional construction costs are adjusted based on assumed project complexity, as follows:

- Low Complexity → Additional Construction Costs = 10%
- Medium Complexity → Additional Construction Costs = 15%
- High Complexity → Additional Construction Costs = 20%

3.7 Construction Provisional Allowance

A provisional allowance is applied to the base construction cost in the event of increased construction labour or material costs. The provisional allowance remains separate from the primary project cost but must be accounted for budgeting purposes. Regardless of estimate class or project complexity it is recommended that 10% of the base construction cost is applied as a Provisional Allowance.

3.8 Other Project Costs

Other costs that can be included within a project in addition to the base construction costs are listed in **Table 4.** If available, actual quoted costs should be used. In the absence of this information, percentages are applied to the base construction costs. Some of these costs are related to project complexity. **Table 4** shows the percentages to be applied for high, medium and low complexity projects.

Table 4: Additional Cost Components

Cost Components	% of Construction Cost		
Geotechnical / Hydrogeological / Materials	High: 2.0 %	Medium: 1.5%	Low: 0.5%
Property / Easements – (applicable to all projects)	High: 2.0 %	Medium: 1.5%	Low: 1.0%
Engineering / Design (Internal)	Total Cost < $10M: 8%	Total Cost = $10M-$50M: 6%	Total Cost > $50M: 4%
Design / Contract Administration (External)	Total Cost < $10M: 15%	Total Cost = $10M-$50M: 12%	Total Cost > $50M: 10%
Project Contingency	See Section 2.10		
Non Refundable HST	1.76% of (construction cost + geotechnical/hydrogeological/materials + property requirements + consultant engineering + project contingency)		

3.9 Project Contingency

The associated risk and uncertainty of a project cost estimate is minimized with the addition of a contingency. Contingencies are allowances for risks that are known or anticipated at early stages of the project definition. That is, they represent probable events that are “known unknowns” and, experience has shown, are likely to occur. They cannot be attributed to specific items in the base cost estimate but need to be considered in addition to the base cost. A project contingency does not cover major changes in scope, which would require a re-assessment and re-costing of a project. Project Contingency is applied to all projects that are costed using this methodology.

The Project Contingency for this methodology is adjusted based on the cost estimate classification and project complexity as follow:

Table 5: Project Contingency

Class	Low Complexity	Moderate Complexity	High Complexity
Class 5	30%	30%	30%
Class 4	10%	15%	25%
Class 3	10%	15%	20%
Class 2	10%	10%	15%
Class 1	10%	10%	10%

TOWN OF WHITCHURCH-STOUFFVILLE

WATER AND WASTEWATER MASTER PLAN

APPENDIX B1

Cost Estimation Spreadsheet Template

TOWN OF WHITCHURCH-STOUFFVILLE
WATER AND WASTEWATER MASTER PLAN
PROJECT TRACKING AND COSTING SHEET

Class Estimate Type:	Class 4	Class adjusts Construction Contingency and expected accuracy
Project Complexity	Low	Complexity adjusts Construction Contingency, and expected accuracy
Accuracy Range:	30%	
Area Condition:	Rural	Area Condition uplifts unit cost and restoration

	= Field has drop down
	= Field must be manually populated
	= Field auto-filled based on project details

PROPOSED DIAMETER:		
TOTAL LENGTH:		
Tunnelled		#DIV/0!
Open Cut		#DIV/0!

CLASS EA REQUIREMENTS:	A+
CONSTRUCTION ASSUMPTION:	Sewer 5m

COST ESTIMATION SPREADSHEET

COMPONENT	RATE (%)	RATE ($)	UNIT	ESTIMATED QUANTITY	COST PER UNIT	SUB-TOTAL	COMMENTS
Construction Cost							
Pipe Construction - Open Cut			m	0 m	#N/A	#N/A	Existing road ROW
Pipe Construction - Tunneling			m	0 m	#N/A	#N/A	
Pipe Construction Uplift (Based on Area Conditions)	0%					#N/A	
Minor Creek Crossings			ea.	0	#N/A	#N/A	
Major Creek Crossings			ea.	0	#N/A	#N/A	
Road Crossings			ea.	0	#N/A	#N/A	
Major Road Crossings (Highway)			ea.	0	#N/A	#N/A	
Utility Crossings			ea.	0	#N/A	#N/A	
Additional Construction Costs	10%		ea.			#N/A	Includes Mod/Demob,connections, inspection, hydrants, signage, traffic management, bonding, insurance
Provisional & Allowance	10%		ea.			#N/A	Provisional Labour and Materials in addition to base construction cost
Sub-Total Construction Base Costs						**#N/A**	
Geotechnical / Hydrogeological / Materials	0.5%					#N/A	
Geotechnical Sub-Total Cost						**#N/A**	
Property Requirements	1.0%					#N/A	
Property Requirements Sub-Total						**#N/A**	
Consultant Engineering/Design	#N/A					#N/A	includes planning, pre-design, detailed design, training, CA, commissioning
Engineering/Design Sub-Total						**#N/A**	
In House Labour/Engineering/Wages/CA	#N/A					#N/A	
In-house Labour/Wages Sub-Total						**#N/A**	
Project Contingency	10%					#N/A	Construction Contingency is dependent on Cost Estimate Class and Project Complexity
Project Contingency Sub-Total						**#N/A**	
Non-Refundable HST	1.76%					#N/A	
Non-Refundable HST Sub-Total						**#N/A**	
Total (2018 Dollars)						**#N/A**	Rounded to nearest $1,000
Other Estimate							
Chosen Estimate						**#N/A**	**2018 Estimate**

TOWN OF WHITCHURCH-STOUFFVILLE

WATER AND WASTEWATER MASTER PLAN

APPENDIX B2

Cost Estimation Classes

Linear Projects

General Project Data	Class 5	Class 4	Class 3	Class 2	Class 1
Location	Assumed	Assumed	Preliminary	Defined	Defined
Project Complexity	Assumed	Assumed	Preliminary	Defined	Defined
Area Condition	Assumed	Assumed	Preliminary	Defined	Defined
Diameter/Capacity	Assumed	Preliminary	Defined	Defined	Defined
Length	Assumed	Preliminary	Defined	Defined	Defined
Tunnelled / Open Cut	Assumed	Assumed	Preliminary	Defined	Defined
Construction Assumption (water main, 5m sewer, 10m sewer, force main, tunnel)	Assumed	Preliminary	Preliminary	Defined	Defined
Crossings (Road, Creek, Utilities)	Assumed	Preliminary	Defined	Defined	Defined
Hydraulic Requirements (Valves, Chambers)	Assumed	Preliminary	Preliminary	Defined	Defined
Hydrogeological, Geotechnical	Assumed	Assumed	Preliminary	Defined	Defined
Property Requirements	Assumed	Assumed	Defined	Defined	Defined
Approval Requirements	Assumed	Assumed	Preliminary	Defined	Defined

Vertical Projects

General Project Data	Class 5	Class 4	Class 3	Class 2	Class 1
Location	Assumed	Assumed	Preliminary	Defined	Defined
Hydrogeological, Geotechnical	Assumed	Assumed	Preliminary	Defined	Defined
Building/Structural Type and Requirements	Assumed	Assumed	Preliminary	Defined	Defined
Hydraulic Requirements, Equipment Selection	Assumed	Preliminary	Preliminary	Defined	Defined
Technology	Assumed	Assumed	Preliminary	Defined	Defined
Building Schematics	Assumed	Assumed	Preliminary	Defined	Defined
Property Requirements	Assumed	Assumed	Preliminary	Defined	Defined
Approval Requirements	Assumed	Assumed	Preliminary	Defined	Defined

TOWN OF WHITCHURCH-STOUFFVILLE

WATER AND WASTEWATER MASTER PLAN

APPENDIX B3

Data Confidence and Availability for Cost Estimate Classes

CLASS 5 ESTIMATE: Order of Magnitude Estimate

Description: Includes high level cost estimate with a long-term project horizon. Desktop level analysis based on previous similar projects and engineer's informed approximation formed on limited available information. **Example of Typical Study/Design Level:** Master Plan, Infrastructure Plan, Capital Budgeting **End Usage:** Concept screening and feasibility; used at an early stage in absence of better information.	**Estimating Methods Used:** Experience and judgement, historical values, rules of thumb, factor estimating base on similar projects, among other basic calculations. **Expected Accuracy Range:** Low Complexity → High Complexity +/- 40% → +/- 70%

CLASS 4 ESTIMATE: Planning Cost Estimate

Description: Includes high level cost estimate with a long-term project horizon. Desktop level analysis based on preliminary investigations, anticipated project needs, and engineer's best judgement based on limited available information. **Example of Typical Study/Design Level:** Master Plan, Infrastructure Plan, Capital Budgeting **End Usage:** Concept screening; justification for project planning funding. Useful for planning purposes in preparation for project pre-design. Shall be included in Capital Projects List.	**Estimating Methods Used:** An approximate method of estimating using an inclusive "all in" unit rates, typically based on historic data. (e.g. sewer cost per meter) **Expected Accuracy Range:** Low Complexity → High Complexity +/- 20% → +/- 40%

CLASS 3 ESTIMATE: Concept Design Cost Estimate

Description: Includes detailed costing for budgeting purposes. Includes more detailed knowledge of specific criteria to generate more component related costing. **Example of Typical Study/Design Level:** 5-Year Business Plan Conceptual Design **End Usage:** Basis for budgeting and approvals.	**Estimating Methods Used:** Uses features from both the unit rate method (for low risk items) and first principles method (for high risk items). **Expected Accuracy Range:** Low Complexity → High Complexity +/- 15% → +/- 20%

CLASS 2 ESTIMATE: Preliminary Design Cost Estimate

Description: The cost estimate generated from this class can be used as a basis for fund appropriation. Uses more detailed knowledge and more costing components including more field investigations and preliminary design reports. **Example of Typical Study/Design Level:** Preliminary Design **End Usage:** Used for project cost control during design. Initial detailed estimate.	**Estimating Methods Used:** Uses features from both the unit rate method (for low risk items) and first principles method (for high risk items). **Expected Accuracy Range:** Low Complexity +/- 10% ⟹ High Complexity +/- 15%

CLASS 1 ESTIMATE: Detailed Design Cost Estimate

Description: This class will generate a cost estimate representing the Engineer's final estimate based on completed plans. The estimated cost will reflect current market conditions in the constructing community. The goal of this cost estimate is to match the median bid received during the bidding process. **Example of Typical Study/Design Level:** Detailed Design **End Usage:** Final cost review in preparation for construction; tender ready	**Estimating Methods Used:** Project specific costs based on detailed study of work methods, resources and materials. For example, material costs based on current supplier quotes. All project components costed individually. **Expected Accuracy Range:** Low Complexity +/- 5% ⟹ High Complexity +/- 10%

TOWN OF WHITCHURCH-STOUFFVILLE

WATER AND WASTEWATER MASTER PLAN

APPENDIX B4

Updated Unit Rates

Water and Wastewater Master Plan - Unit Rates for Watermains and Forcemains

Open Cut

Watermain and Forcemain unit rates for open cut construction

Diameter	Unit Cost		
	Urban	Suburban	Rural
(mm)	(2023 $/m)	(2023 $/m)	(2023 $/m)
100	$837	$773	$644
150	$837	$773	$644
200	$962	$888	$740
250	$1,102	$1,017	$848
300	$1,235	$1,140	$950
350	$1,433	$1,323	$1,102
400	$1,548	$1,429	$1,190
450	$1,755	$1,620	$1,350
500	$2,069	$1,910	$1,592
600	$2,431	$2,244	$1,870
750	$2,787	$2,573	$2,144
900	$3,314	$3,059	$2,549
1050	$3,896	$3,597	$2,997
1200	$4,601	$4,247	$3,539
1350	$5,598	$5,167	$4,306
1500	$6,215	$5,737	$4,781
1650	$7,223	$6,667	$5,556
1800	$8,049	$7,430	$6,192
1950	$8,580	$7,920	$6,600
2100	$9,111	$8,411	$7,009

Tunnelling

Watermain and Forcemain unit rates for tunelling construction

Diameter	Unit Cost
(mm)	(2023 $/m)
100	$1,837
150	$1,837
200	$1,837
250	$1,837
300	$1,837
350	$1,837
400	$8,900
450	$8,900
500	$8,900
600	$8,900
750	$8,900
900	$13,845
1050	$13,845
1200	$13,845
1350	$18,366
1500	$18,366
1650	$18,366
1800	$18,366
1950	$18,366
2100	$18,366

Trenchless Crossings

Minor Creeks

Length =	20 m
Diameter	Unit Cost
(mm)	(2023 $/m)
100	$40,970
150	$40,970
200	$42,383
250	$42,383
300	$52,272
350	$64,987
400	$276,901
450	$291,028
500	$305,156
600	$333,411
750	$418,176
900	$531,197
1050	$587,707
1200	$672,473
1350	$791,144
1500	$861,782
1650	$932,420
1800	$1,003,058
1950	$1,038,377
2100	$1,073,696

Roads and Utility (Rail and Hydro)

Length =	60 m
Diameter	Unit Cost
(mm)	(2023 $/m)
100	$500,000
150	$500,000
200	$500,000
250	$500,000
300	$500,000
350	$500,000
400	$1,000,000
450	$1,000,000
500	$1,000,000
600	$1,000,000
750	$1,000,000
900	$1,084,998
1050	$1,141,508
1200	$1,226,274
1350	$1,525,779
1500	$1,596,417
1650	$1,667,054
1800	$1,737,692
1950	$1,773,011
2100	$1,808,330

Major Creeks and Highways

Length =	150 m
Diameter	Unit Cost
(mm)	(2023 $/m)
100	$500,000
150	$500,000
200	$500,000
250	$500,000
300	$500,000
350	$500,000
400	$1,433,949
450	$1,448,077
500	$1,462,205
600	$1,490,460
750	$1,575,225
900	$2,331,051
1050	$2,387,561
1200	$2,472,326
1350	$3,178,705
1500	$3,249,343
1650	$3,319,981
1800	$3,390,619
1950	$3,425,938
2100	$3,461,257

Valve Costs

Valve Unit Costs

Diameter	Unit Cost
(mm)	(2023 $/m)
100	$2,260
150	$2,260
200	$2,826
250	$3,108
300	$7,770
350	$14,128
400	$49,447
450	$56,510
500	$63,574
600	$77,702
750	$120,084
900	$127,148
1050	$155,403
1200	$197,786
1350	$211,914
1500	$247,233
1650	$282,552
1800	$317,871
1950	$335,530
2100	$353,189

Minor Roadways

Length =	60 m
Diameter	Unit Cost
(mm)	(2023 $/m)
All	$52,111

Water and Wastewater Master Plan - Unit Rates for Sanitary Sewers

Open Cut

Sanitary sewer unit rates for 5-metre deep open cut construction

Diameter	Unit Cost		
	Urban	Suburban	Rural
(mm)	(2023 $/m)	(2023 $/m)	(2023 $/m)
150	$1,041	$961	$800
200	$1,041	$961	$800
250	$1,119	$1,033	$861
300	$1,155	$1,066	$889
375	$1,232	$1,137	$948
450	$1,339	$1,236	$1,030
525	$1,441	$1,330	$1,108
600	$1,850	$1,708	$1,423
675	$2,262	$2,088	$1,740
750	$2,498	$2,306	$1,922
825	$2,682	$2,476	$2,063
900	$3,153	$2,910	$2,425
975	$3,388	$3,128	$2,606
1050	$3,748	$3,460	$2,883
1200	$4,215	$3,891	$3,242
1350	$4,734	$4,370	$3,641
1500	$5,329	$4,919	$4,099
1650	$6,070	$5,603	$4,669
1800	$6,810	$6,286	$5,239
1950	$7,629	$7,042	$5,869
2100	$8,448	$7,799	$6,499
2250	$9,449	$8,722	$7,268
2400	$10,449	$9,645	$8,038
2700	$12,552	$11,587	$9,656
3000	$14,655	$13,528	$11,273

Sanitary sewer unit rates for 10-metre deep open cut

Diameter	Unit Cost		
	Urban	Suburban	Rural
(mm)	(2023 $/m)	(2023 $/m)	(2023 $/m)
150	$4,563	$4,212	$3,510
200	$4,563	$4,212	$3,510
250	$4,720	$4,357	$3,630
300	$4,834	$4,462	$3,718
375	$4,976	$4,593	$3,828
450	$5,157	$4,760	$3,967
525	$5,322	$4,913	$4,094
600	$5,820	$5,372	$4,477
675	$6,405	$5,913	$4,927
750	$6,712	$6,196	$5,163
825	$6,974	$6,437	$5,364
900	$7,630	$7,043	$5,870
975	$7,911	$7,302	$6,085
1050	$8,472	$7,820	$6,517
1200	$9,070	$8,372	$6,977
1350	$9,777	$9,025	$7,521
1500	$10,411	$9,610	$8,009
1650	$11,286	$10,418	$8,682
1800	$12,161	$11,226	$9,355
1950	$13,180	$12,166	$10,138
2100	$14,199	$13,107	$10,922
2250	$15,334	$14,154	$11,795
2400	$16,468	$15,201	$12,668
2700	$18,813	$17,366	$14,471
3000	$21,157	$19,530	$16,275

Tunnelling

Sanitary sewer unit rates for tunelling construction

Diameter	Unit Cost
(mm)	(2023 $/m)
150	$1,837
200	$1,837
250	$1,837
300	$1,837
375	$8,900
450	$8,900
525	$8,900
600	$8,900
675	$8,900
750	$8,900
825	$13,845
900	$13,845
975	$13,845
1050	$13,845
1200	$13,845
1350	$18,366
1500	$18,366
1650	$18,366
1800	$18,366
1950	$18,366
2100	$18,366
2250	$18,366
2400	$18,366
2700	$18,366
3000	$18,366

Trenchless Crossings

Minor Creeks

Length =	20 m
Diameter	Unit Cost
(mm)	(2023 $/m)
150	$93,242
200	$93,242
250	$93,242
300	$93,242
375	$234,518
450	$276,901
525	$276,901
600	$276,901
675	$347,538
750	$347,538
825	$446,432
900	$517,069
975	$517,069
1050	$587,707
1200	$587,707
1350	$678,124
1500	$678,124
1650	$678,124
1800	
1950	
2100	
2250	
2400	
2700	
3000	

Roads and Utility (Rail and Hydro)

Length =	60 m
Diameter	Unit Cost
(mm)	(2023 $/m)
150	$750,000
200	$750,000
250	$750,000
300	$1,000,000
375	$1,000,000
450	$1,000,000
525	$1,000,000
600	$1,000,000
675	$1,000,000
750	$1,000,000
825	$1,000,000
900	$1,070,871
975	$1,070,871
1050	$1,141,508
1200	$1,141,508
1350	$1,412,758
1500	$1,412,758
1650	$1,412,758
1800	
1950	
2100	
2250	
2400	
2700	
3000	

Major Creeks and Highways

Length =	150 m
Diameter	Unit Cost
(mm)	(2023 $/m)
150	$1,000,000
200	$1,000,000
250	$1,000,000
300	$1,000,000
375	$1,391,567
450	$1,433,949
525	$1,433,949
600	$1,433,949
675	$1,504,587
750	$1,504,587
825	$2,246,285
900	$2,316,923
975	$2,316,923
1050	$2,387,561
1200	$2,387,561
1350	$3,065,685
1500	$3,065,685
1650	$3,065,685
1800	
1950	
2100	
2250	
2400	
2700	
3000	