

SEWPCC Upgrading/Expansion Conceptual Design Report

SECTION 23 - Opinion of Probable Cost

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23.0 Opinion of Probable Cost

23.1 INTRODUCTION

This section presents an opinion of probable cost for the project. It is based on the previous sections of this report as well as discussions and feedback received from the City. Sizing of the treatment process units and layouts are as presented in the preceding sections. This opinion of probable cost is prepared to assist in refining of scope and for budgeting purposes. The objectives of the Opinion of Probable Cost section are:

- Present an opinion of probable cost for the SEWPCC Upgrading / Expansion project that reflects the scope of the project as it is currently known and the existing construction market conditions.
- Document the assumptions that were used in developing the scope of the SEWPCC Upgrading / Expansion project on which the opinion of probable cost is based.
- Identify the optional items, items that can be phased or deferred, and the potential risks associated with phasing of the work.
- Assist with refining the project scope.

23.2 BACKGROUND

The previous sections of this report have reviewed the proposed plant processes and recommended upgrades to achieve the effluent criteria defined in the Environment Act License for the SEWPCC. These sections were previously submitted as Technical Memoranda for review and commented by the City and they form the basis for the scope of work proposed at the SEWPCC. They provide a level of detail in terms of type of construction, sizing, mechanical requirements, and other factors that facilitate the ability to quantify the work so that pricing can be obtained for specific items.

23.2.1 Limitations of Opinion of Probable Cost

The Project Team has agreed to basic design criteria, process and components. However, there are still many unknown details related to the SEWPCC Upgrading / Expansion project that could impact the opinion of probable cost presented in this section. Because the project is in the conceptual state, there will be design decisions made during detailed design that will affect cost. Sufficient work has been undertaken on each of the components of the conceptual design for Stantec to make informed assumptions based on our past experience on similar treatment facilities. This opinion of probable cost includes a contingency allowance of 10 percent and an estimating allowance of 15 percent. These are included to account for changes during

construction and to mitigate the impact of small changes made during detailed design. This opinion of probable cost should be considered to have a level of accuracy ranging from -15 to +30 percent.

The opinion of probable cost is prepared based on the Conceptual Design work completed to date, as outlined in the preceding technical memoranda. It reflects our best judgement at this stage of the project. Stantec has no control of future construction market conditions, which could significantly impact construction costs. An inflation allowance of 15 percent has been included in an effort to mitigate this risk. However, the final cost will be influenced by local market conditions at the time of tender.

23.3 GENERAL COSTING PROCEDURE

23.3.1 Major Project Component Breakdown

Our approach to developing the opinion of probable cost was to break down the project components into facility areas and include some larger general items where pricing is not area specific but project specific. The following 17 items make up the Major Project Components:

- 1.0 General Requirements
- 2.0 Site Works
- 3.0 Effluent Sampling Station
- 4.0 Hauled Liquid Waste Receiving Station
- 5.0 Headworks
- 6.0 Primary Clarifiers
- 7.0 Chemical Feed Systems (Primary Clarifiers and Bioreactors)
- 8.0 Bioreactors, Blower Room and Electrical Room
- 9.0 Secondary Clarifiers
- 10.0 UV Disinfection Systems
- 11.0 Electrical Room and DAF Polymer Feed
- 12.0 Odor Control
- 13.0 Solids Handling DAF
- 14.0 Fermenters and Adjacent Building
- 15.0 Sludge Holding Tanks and Storage Building
- 16.0 Electrical, Control and Instrumentation (General)
- 17.0 Standby Emergency Power Upgrade

18.0 Ancillary Items (Permits)

In addition, a number of optional items that were discussed during the development of this report are included so that the project team has the ability to review their level of importance in comparison to cost for possible inclusion in the project. The optional items are not listed above as they are currently not accounted for in the overall project cost.

In general, the major project components shown above include sub items. These were developed to provide a detailed list for inclusion in the opinion of probable cost and to identify quantities/units and unit prices. The sub items generally identify a specific piece of equipment, type of work, smaller unit process, etc.

23.3.2 Sub-Item Opinion of Probable Cost Approach

For many of the Major Project Components, there are sub-items that are used consistently with a common cost and only varying quantity. The following discussion states the approach taken to determine the unit cost used for these sub-items.

Excavation and Backfill

Taillieu Construction was contacted to determine the price they are currently using for excavation and backfill for building type excavation. They provided a value of \$15 per m³. This was checked against some recently tendered earthworks projects and seems reasonable. Excavation pricing for the SEWPCC Snow Dump ranged from \$5 to \$15. Thus a value of \$15 per m³ is valid and conservative.

The excavation and backfilling value used for this opinion of probable cost is \$15 per m³.

Superstructure

PCL provided a cost range for building construction (not including foundations) of \$1,340 to \$1,875 per square meter, depending on finishes. Because of the industrial nature of the proposed buildings, cost relating to interior finishes should be minimal and exterior finishes will be low cost except for walls facing north. Building costs for recent Stantec projects are: East St. Paul STP (\$1,350/m²); and Gimli WWTP (\$1,500/m²).

The superstructure value used for this opinion of probable cost is \$1,500/m².

Substructure

PCL provided a 2009 cost for major concrete works. They indicated a cost of \$1,080/m³ for concrete (including forming) and \$388 for associated reinforcing. Bird Construction provided a less detailed value of \$2,000/m³ for reinforced concrete. Stantec is working with Parkwest Projects on the 2008 East St. Paul Sewage Treatment Plant upgrade and their tendered value

for concrete works equals \$1,350/m³. The CITY had Hanscombe provide a 2009 value for concrete and he provided a range of \$1,300 to \$1,400/m³.

The substructure value used for this opinion of probable cost is \$1,400/m³ for slabs and \$1,500/m³ for walls.

Structural Piles

Stantec is currently undertaking a parking garage project for the Winnipeg Regional Health Authority where the tendered piling cost is \$2,600 per pile based on 400mm diameter hex piles 9 to 12 meters deep. The highest cost Stantec has seen for piling in Manitoba is \$3,500 in a rural setting under busy industry conditions last year. Subterranean was contacted and thought that a price of \$3,000 per pile seemed reasonable for the immediate future. Additionally, PCL provided a 2009 estimating cost for piling of \$2,200 per pile.

Based on the pricing received from the various sources, the piling value used for this opinion of probable cost is \$3,000 per pile.

Void Form

Void form is a small cost in relation to the other items but a large quantity will be required and thus the overall value is significant. Void form is not normally shown on a tender form so it is difficult to determine a Tendered value. Through discussion with Parkwest Projects (who are working on Stantec's most recent WWTP project) and some smaller construction firms, a price of \$15/m² was determined.

The void form value used for this opinion of probable cost is \$15/m².

Miscellaneous Metals

Miscellaneous metals are more difficult to quantify as the type and value will be determined during detailed design. Stantec has quotations for hatches and some other items from a project Tendered in 2008 and this was used as the basis for miscellaneous metal pricing. For stairwells, the RS Means book was used. It identifies a Winnipeg price of \$320 per rise for supply and installation of the stairwell, handrails and landing. For the SEWPCC all stairwells were assumed to be 6 meters in vertical height.

The miscellaneous metal cost relating to hatches used for this opinion of probable cost is \$1,200 per hatch.

The miscellaneous metal cost relating to stairwells used for this opinion of probable cost is \$10,500 per stairwell.

Demolition

There are various types of demolition required as part of the SEWPCC project ranging from simple building demolition such as the existing storage building to demolition of concrete walls and existing mechanical systems as required for the HPO reactor. In order to determine demolition costs, discussions were undertaken with Rakowski Cartage for the structural components and Doerksen Mechanical (DMS) for the mechanical components. Due to the varying scope of this work, each demolition item was analyzed and priced separately.

Mechanical Piping and Valves

Two approaches were undertaken to price out the mechanical pipe and valve portion of the work. The first approach was to provide a very rough takeoff to local mechanical suppliers for pricing. The second was to price out the valve and pipe materials and determine an installed cost.

Mechanical contractors were relied on to provide pricing for 80 to 90 percent of the mechanical systems. There was difficulty getting local mechanical contractors to provide pricing due to the busy state of the industry. The mechanical contractors would not determine pricing without a quantity takeoff being provided to them. Thus quantity takeoffs were developed. Because the project is in the conceptual stage, quantity takeoffs were based on likely pipe sizes and routings, and valve quantities.

DMS, Westwood Mechanical, Dontech, and Arnason Industries all provided pricing for various components of the pipe and valve installation. All mechanical contractors were asked to base pricing on average quality valves as specific requirements were not available. For piping, DMS based their pricing on Sch 10 stainless steel, while Westwood used epoxy coated carbon steel. Chemical system piping was based solely on PVC.

Only 10 to 20 percent of the mechanical pipe and valve systems were priced by Stantec personnel using pipe and valve costs. This was primarily done for piping requiring custom fabrication. Local fabricators were contacted directly.

In general, the mechanical pipe and valve price used for this opinion of probable cost was determined through information provided by local mechanical contractors and pricing is specific to each area.

Major Mechanical Equipment

Each part of the proposed facility includes various types of mechanical process equipment. This includes items such as pumps, blowers, vortex grit units, screens, classifiers, clarifier and fermenter mechanisms, UV systems, DAF units and other equipment. Pricing for these items was obtained directly from suppliers. Suppliers contacted include Power and Mine, Nothart,

Flygt, Mequipco, EDA Mechanical, National Process Group, Sapphire Group, Westron, Welco, Hydro International, Teledyne, Temcor and others. Quotes for supply were obtained for nearly all of the major pieces of equipment.

The standard practice for pricing of installation is to budget for 50 percent of the supply cost for installation. Through discussion with mechanical contractors in Winnipeg, they confirmed that this was a reasonable method based on the level of detailing available. For some of the larger pieces of equipment with supply cost greater than \$250,000, installation values used were sometimes less than 50 percent of the supply cost due to the reduced scope due to work completed during fabrication.

Cranes

Cranes will be required for operation and maintenance procedures throughout the plant. Stantec reviewed tendered pricing from recent projects where cranes were used and the cost has ranged from \$25,000 to \$55,000. Sizing for cranes at the SEWPCC is difficult at this conceptual stage so a determination was made on whether a large or small crane was required. The approach for pricing of the required cranes was to use a price range of \$25,000 to \$75,000 and use a judgment to determine where in this range the likely cost would fall.

The crane value used for this opinion of probable cost ranges from \$25,000 to \$75,000 per crane.

Odor Control and Related Ventilation

Bowker and Associates provided an analysis of the upgraded facility to determine how odor would be controlled and handled. Additionally, they provided an opinion of probable cost for the odor control related works. Pricing was based on unit prices Stantec provided for the building and site services work. This has been included in the various corresponding items in this opinion of probable cost, but is primarily shown in the Odor Control item.

HVAC

HVAC had previously been priced as an overall lump sum. For this opinion of probable cost, HVAC has been included as a sub item for each major item, where applicable. HVAC includes standard heating and ventilating and is not intended to have any relation to odor control. There has been no allowance for cooling included but a sum has been included for air treatment where applicable. Pricing for ventilation was primarily obtained from Trane Canada who indicated that the cost of the equipment normally totaled \$3 per cfm with an installation cost of 100 percent of the supply cost. Stantec undertook a preliminary analysis of required air flow rates for the new construction and thus the cost per cfm can be applied. For air treatment, information was obtained from Calgon and Unisorb but it was difficult to obtain good accuracy due to the preliminary nature of the project.

The HVAC value used for this opinion of probable cost was \$6/cfm (supplied and installed). The cost for air treatment is included and varied between \$15,000 and \$75,000 depending on the room size.

Dewatering

An allowance for dewatering excavations was included. There is currently insufficient information on the site and design to determine a specific dewatering cost for the project. However, there is adequate information to determine a likely allowance that should be carried for this work. Friesen Drillers provided a likely cost for dewatering based on the information provided from previous geotechnical reports and on conversations with Stantec.

The dewatering allowance used for this opinion of probable cost is \$750,000.

23.3.3 Items Priced on a Percentage Basis

General Requirements

General Requirements is an item that is a function of the overall project cost and for estimating purposes is usually based on a percentage of the total work value. General Requirements includes items such as bonding, insurance, mobilization, demobilization, construction facilities, overhead, profit, and other project setup and site costs. This is difficult to quantify and thus the percentage used is based on information provided by PCL.

For General Requirements, a percentage of 9 percent was used, providing an opinion of probable cost of \$10,430,000.

Plant Electrical

Plant Electrical is another item that has been generally carried as a percentage of the other work. There was some refining of the plant electrical and control systems completed for this opinion of probable cost but there are still many unknowns related to the electrical systems. Where specific costs were known, they are shown and priced separately. For all other electrical, a percentage value has been carried and is based on past experience related to other Stantec projects. Stantec's experience is that electrical costs normally range between 15 percent and 18 percent of the overall project cost.

For Plant Electrical, a percentage of 18 percent was used, providing an opinion of probable cost of \$17,520,000.

23.3.4 Financial

The key financial considerations on which the opinion of probable cost for the SEWPCC Upgrading / Expansion project has been developed are summarized as follows:

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June 1, 2009

- Construction will start in 2009 and be completed by mid 2012.
- Detailed unit prices and labour rates shown in the estimate are 2nd quarter, 2008 dollars.
- Average construction cost escalation rate of 15 percent between 2nd quarter 2008 and mid construction stream.
- Updated engineering cost reflects additional engineering associated with the increased scope of work.
- Assumed the Contractor will have unrestricted access to the site and will complete work during normal construction hours. There is no allowance for premium time included in the cost.
- Equipment costs are based on vendor supplied price quotations.
- Bulk material costs used are typical for the Winnipeg area.
- Substructure construction is assumed to be concrete.
- Building construction is assumed to be concrete block and metal cladding or block and Tindal Stone on building north faces.
- PST is included in the cost. GST is **not** included.
- A contingency allowance of 10 percent of construction is included for items that will be unknown at the time of tender.
- An estimating allowance of 15 percent of construction is a separate line item to allow for further development of the design between the date of this report and the tender date.
- No allowance is included for additional City Operations costs (project labour, electricity, diesel, natural gas, consumables, laboratory and start up costs) the City may incur during construction.
- No allowance is included for interim financing or legal costs.
- The opinion of probable cost is prepared based on the conceptual design information available at this time. It reflects our best judgement at this stage of the project. Stantec has no control of future construction market conditions, which could significantly impact construction costs. The final cost will be influenced by local market conditions at the time of tender.

23.4 SEWPCC OPINION OF PROBABLE COST

23.4.1 General

The opinion of probable capital cost for the SEWPCC Upgrading / Expansion project was developed based on the cost for each of the major components identified in Section 23.3.1. Each major component is discussed below with some comments as to assumption, quantity determinations, and quantity costs. The overall cost summary is presented in Table 23.1. A detailed cost breakdown of each major component and the overall breakdown are provided in Appendix R.

The opinion of probable cost for each item is indicated below. Note that these do not include the factors for contingency, engineering, estimating allowance, and inflation, which are discussed later in this document. For discussion purposes, these factors combined increase each item price by approximately 68 percent.

23.4.2 Item 1.0 – General Requirements

General requirements includes items such as bonding, insurance, mobilization, demobilization, construction facilities, overhead, profit, and other project setup and site costs. This is difficult to quantify and thus an allowance based on information provided by PCL was used.

- For General Requirements, a percentage of 9 percent was used, providing an opinion of probable cost of \$10,430,000.

23.4.3 Item 2.0 – Site Works

Site works carries a variety of items including storage building demolition, roads, sidewalks, outfall, plant bypass piping, bypass flow splitting chamber, and site dewatering. For the road, sidewalk and general grading works, pricing from the snow dump tender as well as other recent projects was used to determine cost. For the outfall and bypass piping, pricing from recent City projects was used. Dewatering has been a significant cost to other City projects so Friesen Drillers were contacted. They provided probable dewatering costs as well as advice that pricing is likely to be better if dewatering is tendered separately from the rest of the contracts.

Work directly related to the snow dump that is paid by Public Works is no longer included in the opinion of probable cost. Some work in the snow dump tender, such as a portion of the roadwork and the flood protection berm work, is included in this item as they are funded by Water and Waste as a part of this project.

- Our opinion of probable cost for this item is \$7,930,000.

TABLE 23.1 - SEWPCC

Opinion of Probable Cost for Plant Expansion - IFAS Option

Date: October 30, 2208

Item	Description	Cost
1.0	General Requirements	\$10,430,000
2.0	Siteworks	\$7,930,000
3.0	Effluent Sampling Station	\$590,000
4.0	Hauled Liquid Waste Receiving Station (Under Separate Contract)	\$0
5.0	Headworks	\$7,221,000
6.0	Primary Clarifiers	\$660,000
7.0	Chemical Feed Systems (Primary Clarifiers and Bioreactors)	\$1,580,000
8.0	Bioreactors, Blower Room and Electrical Room	\$32,500,000
9.0	Secondary Clarifiers	\$20,315,000
10.0	UV Disinfection Systems	\$3,090,000
11.0	Electrical Room and DAF Polymer Feed Room	\$1,680,000
12.0	Odor Control	\$3,860,000
13.0	Solids Handling (DAF)	\$4,960,000
14.0	Fermenters and Adjacent Building	\$4,970,000
15.0	Sludge Holding Tanks and Storage Building	\$4,850,000
16.0	Electrical, Control, Instrumentation	\$18,520,000
17.0	Standby Emergency Power Upgrade	\$2,370,000
18.0	Ancillary Items (Permits)	\$760,000
	Subtotal	\$126,290,000
	Contingencies (10% of Subtotal)	\$12,629,000
	Engineering (15% of Subtotal & Contingencies)	\$20,838,000
	Estimating Allowance (15% of Subtotal, Cont. & Eng.)	\$23,964,000
	Inflation Allowance for 2009 -2012 Construction Period (15% Above)	\$27,558,000
	Total	\$211,279,000

Note 5

Item	Description	Cost
5.0	Headworks - Admin Bldg. Renovation Only (Possible Deferral or Deletion)	\$1,033,000
5.0	Headworks - Raw Water Pump Upgrades and Wet Well Grit Pump Upgrades	\$1,693,000
9.0	Secondary Clarifiers - Cost saving if FST-5 Construction Is Deferred	\$19,986,000

Note 5

Item	Description	Cost
Secondary Clarifier Cost Provided Construction of FST-4 and FST-5 Is Phased		
9.0	Secondary Clarifiers - Price To Construct FST-4 (Including FST-1, 2 & 3 Rerofts) With FST-5 Deferred	\$23,727,000
9.0	Secondary Clarifiers - Price To Construct FST-5 Not In Conjunction With FST-4 (At Some Later Time)	\$23,081,000

Note 5

Item	Description	Cost
Items That Could Be Deleted (Included In Overall Cost Opinion)		
8.0	Bioreactors - Bioreactor Covers	\$2,862,000

Note 5

Item	Description	Cost
Optional Items (Not Included In Overall Cost Opinion)		
6.0	Primary Clarifiers - Modify PC#1 and 2 Scum Collection	\$1,158,000
19.0	Connect UV to Secondary Clarifiers Underground Walkway	\$1,056,000
20.0	Miscellaneous Items - PSA Salvage, Fall Arrest, Confined Space Equipment	\$1,109,000

¹ The cost basis is August, 2008.
² The Opinion of Probable Costs Table was updated September 6, 2008 to bring the Inflation Allowance in line with current predictions.
³ Costs are in 2008 Canadian Dollars.
⁴ Construction costs will vary depending on market conditions at the time of tender. Stantec has no control over those conditions.
⁵ For possible deferred, deleted or optional work, the numbers shown include the contingency, engineering, estimating and inflation allowances. Depending on when items are deferred or deleted, some allowance for engineering may be applicable.

23.4.4 Item 3.0 – Effluent Sampling Station

An effluent sampling station is required for the use of both the SEWPCC staff and MB Conservation. Associated with this work is inclusion of two mixing chambers, building superstructure, foundation, hatches, building mechanical and process mechanical / instrumentation.

- Our opinion of probable cost for this item is \$590,000.

23.4.5 Item 4.0 – Hauled Liquid Waste Receiving Station

Work on the hauled liquid waste receiving station is being done as an alternate project using other funding sources. Thus, it has been deleted from the overall opinion of probable cost. The odor control section identifies an opinion of probable cost to address odor control at the station. All related costs for odor control are considered to be carried under the alternate project. Bowker and Associates provided odor control pricing based on similar projects.

- Our opinion of probable cost for this item is \$0.

23.4.6 Item 5.0 – Headworks

The headworks item includes the cost of renovating the administration building, providing one new raw wastewater pump, wet well grit pumping, grit channel baffles, vortex grit removal equipment, screenings equipment, grit classifiers, conveyor extension, grit pumping, and associated mechanical. New concrete tanks and a pipe gallery extension would be required as well as a building addition. Pricing for the heavy civil works and buildings was as discussed in Section 23.3.2. For the major pieces of equipment (vortex grit, screening equipment, and classifiers), pumps and valves, supplier pricing was obtained. A cost for installation equaling 50 percent of the equipment supply cost was used, except for the vortex grit equipment where a factor of 35 percent of the supply price was used for installation. This was based on discussions with local mechanical contractors and Stantec's experience.

- Our opinion of probable cost for this item is \$7,221,000.

23.4.7 Item 6.0 – Primary Clarifiers

The primary clarifier work includes new channel mixers and flocculators, new hatches in the existing channels for access, in-channel flow measurement and replacement of the sludge pump VFD drives. The greatest costs are related to the flocculators and channel mixers for which supplier pricing was obtained. A cost for installation equaling 50 percent of the equipment supply cost was used.

- Our opinion of probable cost for this item is \$660,000.

23.4.8 Item 7.0 – Chemical Feed Systems (Primary Clarifiers and Bioreactors)

The primary clarifiers and bioreactors will require a building addition to be constructed on the north side of the facility for storage and feeding of alum and polymer. The components included are the building and foundation, storage tanks, chemical pumps, chemical piping and valves, miscellaneous metals, crane, and HVAC. Pricing for the heavy civil works and buildings are calculated as discussed in Section 23.3.2. For the chemical feed systems and storage tanks, supplier pricing was obtained. A cost for installation equaling 50 percent of the equipment supply cost was used for the chemical feed systems and storage tanks. For the pipe and valve work, pricing was obtained from Dontech.

- Our opinion of probable cost for this item is \$1,580,000.

23.4.9 Item 8.0 – Bioreactors, Blower Room and Electrical Room

The bioreactors require new process tanks as well as adjacent blower and electrical rooms. The main components include new building space and foundations for the blower and electrical rooms, concrete bioreactor tanks, blowers, MLSS pumps, scum pumps, submersible mixers, IFAS media, piping and valves, miscellaneous metals, cranes, and HVAC. Pricing for the heavy civil works and buildings is as discussed in Section 23.3.2. Additionally, pricing for the pre-cast components of the bioreactor tank roof was obtained from both ConForce and Lafarge. DMS provided pricing for demolition of the PSA equipment and Rakowski Cartage provided pricing for the concrete demolition in the HPO tanks. Pricing for miscellaneous metal work was based on the number of hatches and stairwells required as described in Section 23.3.2. Pump and mixer pricing was obtained from local suppliers and a cost for installation equaling 50 percent of the equipment supply cost was used. For the pipe and valve work, pricing was obtained from DMS based on stainless steel piping. Pricing for the IFAS media was obtained from Anox Kaldness with an installation value of 10 percent of the supply price used. This supplier would not break down their price and indicated that some of the cost was to pay for R&D on their IFAS system. This made it difficult to determine the installation cost but items such as the IFAS media have a negligible installation value. The odor control cost is based on pricing provided by Bowker and Associates for venting through the stack.

- Our opinion of probable cost for this item is \$32,500,000.

23.4.10 Item 9.0 – Secondary Clarifiers

Two secondary clarifiers are proposed to be constructed on the north side of the facility and be connected to the existing facility through extension of the pipe gallery and a main floor corridor. Dome covers have been proposed to cover the clarifier tanks. Components of this work include concrete tanks and construction of a new below grade mechanical area to house the new RAS and scum pumps. Also included are dome covers, retrofitting of the existing clarifier mechanisms, piping and valves, scum tanks, cranes and HVAC. Pricing for the heavy civil works and buildings was as discussed in Section 23.3.2. For the new clarifier mechanisms and

retrofitting of the existing clarifier mechanisms, pricing was obtained from both EIMCO and WesTec. Pricing for the domes was obtained from both an FRP supplier and an aluminum dome supplier, both of which were insulated domes with dual access. Power and Mine provided pricing for the scum and RAS pumping. A cost for installation of the domes and new clarifier mechanisms equaling 40 percent of the equipment supply cost was used due to the high capital cost of the equipment. For the retrofitted clarifier mechanisms, pumps, and scum equipment, 50 percent of the equipment supply cost was used as the installation cost. For the pipe and valve work, pricing was obtained from Westwood Mechanical based on epoxy coated steel pipelines. Costs for HVAC were determined as described in Section 23.3.2.

- Our opinion of probable cost for this item is \$20,315,000.

23.4.11 Item 10.0 – UV Disinfection Systems

Expansion of the existing UV building is proposed to the south of the existing facility. The work requires construction of a new foundation, concrete channels, building expansion, UV equipment, flow control gates, and modifications to the existing outfall channel. Pricing for the heavy civil works and buildings was as discussed in Section 23.3.2. For the new UV equipment, Trojan provided equipment supply pricing. The cost for the flow control gates was obtained from Power and Mine. A cost for installation of the UV equipment equaling 40 percent of the equipment supply cost was used due to the high capital cost of the equipment and packed mechanical and electrical, and an installation cost of 50 percent of the equipment supply cost was used for the control gates. The costs for HVAC were determined as described in Section 23.3.2.

- Our opinion of probable cost for this item is \$3,090,000.
- Stantec was asked to comment on the difference between the values of the UV work for the SEWPCC(\$3,090,000) versus that of the WEWPCC (\$7,229,800). The WEWPCC UV facility cost cannot be directly compared because it includes allowances for gas service, general requirements, fees and contingency, which are included in the overall SEWPCC opinion of probable cost but not broken down specifically for the UV item. According to the Hanscomb estimate, the construction value before allowances and factors is \$6,035,900. A large portion of this relates to site servicing, pipelines, dewatering, etc., which is included in other items for the SEWPCC opinion of probable cost. Thus a true comparison of the two facilities should only include the foundations, substructures, superstructures and internals. The probable construction cost for the SEWPCC UV facility is \$3,090,000 while the WEWPCC UV facility is \$3,749,700. The cost difference can be attributed to the nature of construction (expansion for SEWPCC and all new for WEWPCC), the size of each (160m² SEWPCC; 255m² WEWPCC) and inclusion of electrical items for the WEWPCC. After a detailed analysis, the opinion of probable cost shown for the SEWPCC is greater per square meter and more conservative.

23.4.12 Item 11.0 – Electrical Room and DAF Polymer Feed Room

The solids handling process requires a room for electrical equipment and a room for chemical storage and pumping equipment to feed polymer to the DAF units. These will be located in a new part of the facility located to the south east. These rooms require construction of new foundation works, concrete slabs, building superstructure, polymer feed system, piping, valves, and chemical handling crane. Pricing for the heavy civil works (excavation, piling, concrete) and buildings was determined as discussed in Section 23.3.2. For the polymer feed system, Mequipco provided equipment supply pricing. The cost for supply and installation of chemical piping and valves was obtained from Westwood mechanical. Costs for HVAC were determined as described in Section 23.3.2.

- Our opinion of probable cost for this item is \$1,680,000.

23.4.13 Item 12.0 – Odor Control

The solids handling process generates significant odor and thus space is required for odor control infrastructure. A biofilter system is proposed and would be housed in concrete covered tanks and include the biofilter media, humidification, irrigation and control panels. This item requires construction of new foundation works, concrete slabs and tanks, piping, valves, and control panels. Pricing for the heavy civil works (excavation, piling, concrete) and buildings was determined as discussed in section 2.2. For the biofilter media, humidification equipment, irrigation equipment, piping, valves and control panels, supply pricing was provided by Biorem. Bowker and Associates determined that labor would be 50 percent of the equipment supply price.

- Our opinion of probable cost for this item is \$3,860,000.

23.4.14 Item 13.0 – Solids Handling DAF

The DAF is part of the solids handling philosophy and a building expansion to house the DAF equipment will be constructed to the south of the odor control room. This item requires construction of new foundation works, concrete slab, building superstructure, DAF Units, piping, valves, WAS and TWAS pumps, subnatant pumps and HVAC. Pricing for the heavy civil works (excavation, piling, concrete) and building was determined as discussed in Section 23.3.2. Supply pricing for the DAF equipment was obtained from 3 suppliers and a cost equal to 40 percent of the equipment supply price was used for installation. Supply pricing for the pumps was obtained from two suppliers and an installation cost of 50 percent of the equipment supply cost was used. DMS provided pricing for the pipe and valve supply and installation associated with them. Costs for HVAC were determined as described in Section 23.3.2.

- Our opinion of probable cost for this item is \$4,960,000.

23.4.15 Item 14.0 – Fermenters and Adjacent Building

The fermenters will be constructed south of the DAF building and will have an adjacent structure to house the associated mechanical components. The fermenters will be constructed partly below grade and partly above grade and will be fitted with low profile covers. The scope of work for the fermenters and adjacent building includes foundation works, circular concrete tanks, fermenter mechanisms, covers, piping, valves, supernatant and sludge pumps and HVAC. Pricing for the heavy civil works (excavation, piling, concrete) was determined as discussed in Section 23.3.2. Supply pricing for the fermenter equipment was obtained from EIMCO and WesTech and a cost equal to 50 percent of the equipment supply cost was used for installation. For the fermenter tank covers, pricing was only obtained for uninsulated covers. Supply pricing for the pumps was obtained from two suppliers and an installation cost of 50 percent of the equipment supply cost was used. Westwood Mechanical provided pricing for the pipe and valve supply and associated installation. Costs for HVAC were determined as described in section 23.3.2.

- Our opinion of probable cost for this item is \$4,970,000.

23.4.16 Item 15.0 – Sludge Holding Tanks and Storage Building

The sludge holding tanks will be constructed south of the existing maintenance garage and emergency generator building, but north of the DAF building expansion. The tanks will be constructed partly below grade and partly above grade with a below grade pump room/pipe gallery and main floor truck loading bay. The scope of work for the sludge holding tanks and storage building includes foundation works, concrete slabs and rectangular sludge holding tanks, piping, valves, sludge pumps and HVAC. Pricing for the heavy civil works (excavation, piling, concrete) was determined as discussed in Section 23.3.2. Supply pricing for the progressive cavity sludge pumps was obtained from two suppliers and an installation cost of 50 percent of the equipment supply cost was used. Westwood Mechanical provided pricing for the pipe and valve supply and installation. Costs for HVAC were determined as described in Section 23.3.2. The cost for odor control is included in Item 11.0.

- Our opinion of probable cost for this item is \$4,970,000.

23.4.17 Item 16.0 – Electrical, Control and Instrumentation

The previous opinion of probable cost used a percentage of overall projected construction cost to determine the value of the electrical work. The previous percentage was 20 percent. Some of the electrical work has been refined through this report. This includes the emergency power upgrades as well as the primary power feed upgrades. Decisions have not been finalized regarding the plant control upgrades so definitive pricing is not possible. The use of a percentage calculation is the only feasible option at this stage of the electrical concept development.

For this opinion of probable cost, the electrical work has still primarily been estimated and is 18 percent of the overall construction cost. This number has been reduced to reflect refinement of the primary power feed upgrade (included in this item) and the emergency power upgrade (shown in item 16.0). Information from other Stantec projects of a similar size have traditionally shown electrical to account for between 15 percent and 18 percent of the overall project cost. A Stantec designed \$40M upgrade at the Kelowna WWTP that closed in September 2008 had a range of 17 percent to 21 percent for electrical depending on the bid. Thus, the use of an 18 percent estimate is reasonable when you consider that another 2 percent is carried but in a broken out and refined state.

Note that all electrical room building costs are carried elsewhere.

The primary power feed upgrade includes new transformers, switchgear, cost for the Hydro service replacement work, and miscellaneous equipment wiring and terminations.

- Our opinion of probable cost for this item is \$18,520,000.

23.4.18 Item 17.0 – Standby Emergency Power Upgrade

The standby emergency power upgrade will involve installation of an additional facility generator in a new building constructed to the north of the existing standby power building. It will include an above ground enclosed access way to the existing emergency power building for ease of maintenance. The work items required for the Emergency Power Upgrade includes foundation works, concrete slab, new building construction, gas feed mechanical, exhaust system mechanical, HVAC, 1000kW generator, electrical switchgear, and related electrical panels. Pricing for the heavy civil works (excavation, piling, concrete) was determined as discussed in section 23.3.2. Supply pricing for the generator was obtained from two suppliers and an installation cost of 50 percent of the equipment supply cost was used. Westwood Mechanical provided pricing for the pipe and valve supply for all of the various mechanical systems. HVAC requirements were estimated by Stantec based on past experience. The cost for electrical panels was determined through conversation with two local suppliers. Decommissioning of the existing 85kW generator has been included.

- Our opinion of probable cost for this item is \$2,370,000.

23.4.19 Item 18.0 – Ancillary Items (Permits)

Ancillary items previously included allowances for leachate treatment, asbestos abatement and re-insulation after asbestos removal. Leachate treatment has been deleted from the scope of work while asbestos abatement and re-insulation measures are no longer shown because funding for these will come from a separate project. An allowance is now included for permit application and approval fees. It is uncertain if these fees will apply to the project because the work is being undertaken by the City, but they could be significant so an allowance is carried.

The allowance is based on Stantec's past experience. No fees related to Manitoba Conservation Licensing are anticipated.

- Our opinion of probable cost for this item is \$760,000.

23.5 PROJECT ALLOWANCES

23.5.1 Contingency

Contingency is recommended to be carried for all projects to cover unknown issues that arise during undertaking of the work. The standard percentage recommended at this stage of the design is 10 percent of the project construction cost. This equates to a value of \$12,629,000.

23.5.2 Engineering

Engineering fees are a non-construction cost that would not normally be shown in a construction cost opinion. However, since engineering is included in the CITY available budget, an allowance for it is included in this opinion of probable cost.

Stantec previously submitted a proposal for engineering services of \$19,800,000. This was based on a scope of work that has changed and increased as the project has progressed. Revised engineering fees have not been calculated but for the purposes of this proposal a percentage equaling 15 percent of the construction has been used. This equates to a value of \$20,838,000.

23.5.3 Estimating Allowance

As the opinion of probable cost is based on the conceptual level of detail, it can be anticipated that costs will vary during the detailed design stage. For much of the costing process, suppliers were presented as much information as possible on which to provide budgetary pricing, but it must be recognized that supplier pricing is likely to vary as the design is refined. Suppliers were instructed to base pricing on average quality equipment. If higher quality equipment is required and special coatings are used, pricing will increase.

For these reasons, an estimating allowance has been carried. The estimating allowance is 15 percent of the project cost which equates to a value of \$23,964,000. This should be adequate to account for the current level of detail and price fluctuation between different equipment manufacturer's products. The project team must be careful during the design stage when specifying equipment so that cost/benefit consideration is given because this is a major risk item that could result in the budget being exceeded if not managed properly.

23.5.4 Inflation Allowance

Construction inflation has been discussed at length and poses a significant risk to the project. The inflation allowance needs to account for inflation to the middle of the project. This

allowance is then applied to all project components, some of which are completed before and some that are completed after mid project. Based on discussions with several contractors in the Winnipeg area, 2008 construction inflation was predicted at close to 1 percent per month. There is general agreement in the industry that construction inflation in the Winnipeg market is decreasing. The City discussed inflation with other groups having large projects being constructed in the next 10 years such as MB Hydro, and an inflation range of 8 percent to 10 percent was predicted. The recent economic downturn may further reduce construction inflation. Stantec has used a construction inflation value of 7.5 percent for each of the next two years. The inflation value is applied to all previous allowances. This equates to a value of \$27,558,000.

23.6 OPINION OF PROBABLE COST OVERVIEW AND OPTIONS

23.6.1 General

The opinion of probable cost for the SEWPCC as defined in the Conceptual Design is \$211,279,000. This is above the existing project budget of \$203,000,000. The opinion of probable cost includes allowances such as an estimating allowance and an inflation allowance. Depending on the actual inflation and the adequacy of the estimating allowance, the project could still be completed within budget. However, if these allowances are equal to or greater than predicted, the project will continue to exceed the available budget. The City has a number of options available in order to advance the project. These include securing additional funding, reducing the scope of work, deferring a portion of the work or a combination of increased funding and reduced / deferred scope.

In this section, components of the work that could be either deferred or deleted from the scope of work are identified and discussed. Discretionary items that could provide process or operational benefit to the facility are also identified and discussed.

23.6.2 Deferrable Items

Deferrable items are those that potentially are not needed immediately but will be required beyond 10 years of facility operation. Any items need either immediately or within 10 years are included in the overall cost and not identified here. Three work items have been identified that could be deferred to reduce the initial project cost. The deferred work options are shown below and the cost savings include the associated contingencies, inflation and engineering.

1. Defer administration building interior renovation. City operators indicate that the current administration building facilities result in lost operational time as they do not accommodate enough staff. Deferring this item results in increased operational cost. \$ 1,033,000
2. Defer upgrading of the Raw Water Pump and associated mechanical. \$ 1,693,000
The current pumping capacity is near 385 MLD. This would mean that

the facility would not meet the 415 MLD design criteria and during on extreme wet weather event could potentially result in basement flooding if the Red River is high.

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|--|---------------|
| 3. Defer construction of the additional secondary clarifier until 2021 when it is required based on the population growth. | \$ 19,986,000 |
|--|---------------|

Subtotal of Potential Cost Reduction Measures	\$ 22,712,000
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23.6.3 Discretionary Items (Included in the Opinion of Probable Construction Cost Total)

During presentation of the various components of this report, some items were identified as beneficial but not essential. It was decided to include these discretionary items in the overall project cost but to provide a separate price in case deletion was later required as part of a cost cutting exercise. After much discussion, only one item remains and the other items in question have been identified as optional. The bioreactor tank covers are included in the overall opinion of probable cost but a price is given for possible deletion.

- Bioreactor Tank Covers – The bioreactor tanks could be left as open tanks. Many other jurisdictions, including those in Canada, do not cover their bioreactor tanks and in the case of the SEWPCC this could represent a significant cost saving measure. The following factors should be considered when determining if the covers should be included or omitted:
 - Operators would be exposed to the elements when servicing the bioreactors whether covered or not. Only a superstructure would alleviate weather concerns and this has previously been ruled out.
 - From a safety perspective, covered tanks eliminate the chance of falling into an open tank, except when hatches are open. If the tanks were not covered, railings would be provided to prevent personnel from falling into the tanks.
 - With open tanks, gratings that stay relatively clean in winter could be used. Covered tanks would increase the slipping hazard and would require more frequent cleaning.
 - Bioreactors are generally low maintenance. The pumps and associated mechanical equipment would be accessible from the pipe gallery. Only the mixers would need to be maintained from above the tanks. Covered tanks would make this easier as four sides of the access hatches would be accessible. For uncovered tanks, the mixers would be located adjacent to the walkways to simplify removal for maintenance.
 - For observing the process, open tanks permit easy monitoring of scum collection and proper aeration operation. Covered tanks would make observation of the bioreactor process difficult.

- Covered tanks require air handling for odor generated by the bioreactors. This would not be required for open tanks and would also result in stack capacity being available for other purposes.
- Uncovered tanks release odor directly to the atmosphere at a lower level than if discharged through the stack, potentially impacting area odor complaints. Covered tanks would result in odor discharge at a higher elevation, potentially resulting in fewer complaints.
- There is a significant cost related to covered tanks. Open tanks would still incur cost to set up walkways but this cost is approximately 10 percent of the tank cover cost.

The preceding is intended to facilitate the discussion of whether or not this item should be included in the detailed design scope of work. The opinion of probable cost is provided below. It should be noted that the costs shown include the cost of contingencies, engineering, estimating allowance and inflation allowance.

1. Bioreactor Tank Covers	\$ 2,862,000
Subtotal of Optional Items	\$ 2,862,000

23.6.4 Discretionary Items (Not Included in the Opinion of Probable Construction Cost Total)

During presentation of the components of this report, the City indicated a desire to consider several additional discretionary items related to various systems. These are items that are considered to be beneficial to the operation of the facility but not essential and are not included in the current opinion of probable cost. For the purpose of this opinion of probable cost, the discretionary items are as follows:

- Modify Primary Clarifier 1 and 2 Scum Collection – Grease builds up in the scum lines over time and is removed by contracting a high pressure steam company to clean the lines once per year. There is also discussion that scum collection is not efficient in primary clarifiers 1 and 2 and this could affect the new BNR process. A scope of work was developed to change the scum collection mechanism for primary clarifiers 1 and 2 to counter-current (the same as primary clarifier 3), build new scum storage tanks, and provide the required mechanical and electrical equipment.

The cost to change the scum collection mechanism, build new scum storage tanks and provide the required mechanical and electrical equipment is \$1,158,000. The cost of cleaning the scum lines is \$5,000 per year. The pipe cleaning method is more economically viable.

**SEWPCC UPGRADING/EXPANSION
CONCEPTUAL DESIGN REPORT**

Opinion of Probable Cost

June 1, 2009

Recent discussion with SEWPCC operations staff has resulted in differing opinions of the scum collection efficiency. Some operations staff indicated that the concurrent scum collection mechanism used in primary clarifiers 1 and 2 is more efficient than the counter-current scum collection method used in primary clarifier 3. Stantec has not investigated this further as the removal of fats, oils and grease (FOG) is efficient enough that the BNR suppliers are not concerned with fouling of their screens. The new operating strategy for the primary clarifiers will be to operate with no sludge blanket. This will permit the scum collection mechanism to run more frequently and improve FOG removal efficiency. Additional testing is recommended to determine the current FOG removal efficiency and the FOG content following primary clarification.

It is recommended that no work be undertaken to change the scum collection mechanisms. The efficiency of the current mechanisms appears adequate for the proposed BNR system but further FOG testing is recommended to confirm this.

- Connecting tunnel between the secondary clarifiers and UV building – Operation of the UV disinfection system involves regular operational inspections. The harsh winter climate experienced in Winnipeg makes traveling between the main treatment facility (most components connected by tunnels) and the UV building (not connected) unpleasant. An enclosed access way would improve the operation and maintenance environment and reduce the time required to undertake these tasks, but would increase the project cost. A separate cost to connect the UV facility to the rest of the facility through an enclosed access way is shown. This cost is predicated on construction of secondary clarifier FST-5. The cost would be significantly higher if FST-5 is not constructed as part of the access way extension is completed through the construction of FST-5.
- Miscellaneous Items – A cost to salvage the PSA equipment was requested by the City and has been provided. This would permit reuse of the equipment and possible resale. A price to obtain fall arrest and confined space entry equipment has also been included and would be very beneficial for operation and maintenance. However, it may be possible to obtain the fall arrest and confined space entry equipment through other sources not tied to the project.

To facilitate the discussion of whether or not these items should be included in the Detailed Design scope of work, opinions of probable cost are provided below for each. It should be noted that the costs shown include the cost of contingencies, engineering, estimating allowance and inflation allowance.

1. Primary Clarifier Scum Collection Reconfigure	\$ 1,158,000
2. Connect UV and Secondary Clarifiers	\$ 1,056,000
3. Salvage PSA Equipment	\$ 754,000
4. Fall Arrest Equipment	\$ 162,000
5. Confined Space Entry Equipment	\$ 194,000
Subtotal of Optional Items	\$ 3,324,000