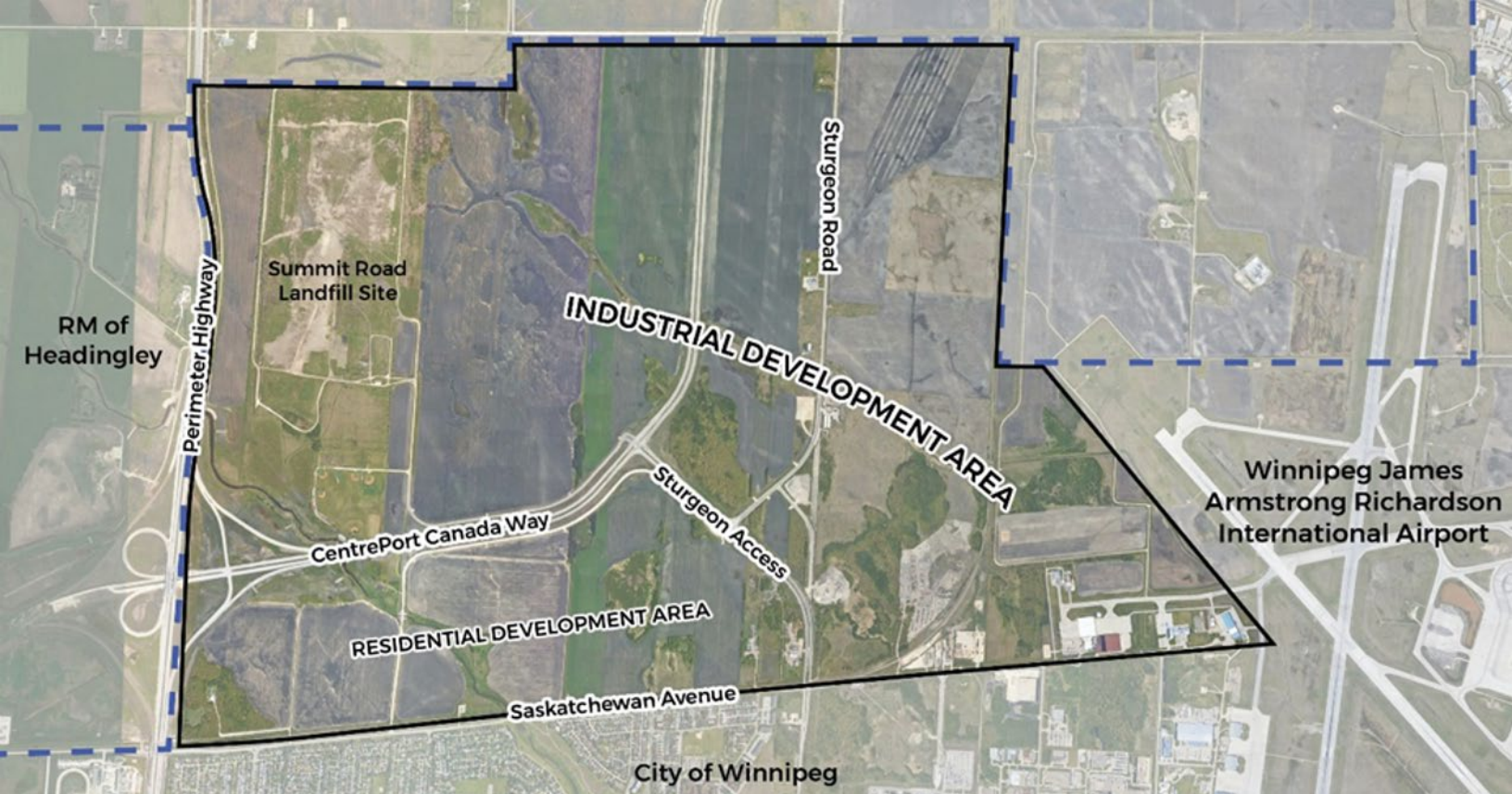




CITY OF WINNIPEG

Airport Area West Regional Water and Wastewater Servicing Preliminary Engineering – Executive Summary

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EXECUTIVE SUMMARY

This study presents the Class 3 cost estimate and supporting information for the future design and construction of regional water and wastewater servicing of the Airport Area West (AAW) lands, the study area.

The AAW study area includes 1,457 hectares of unserviced land in the northwest corner of Winnipeg. The study area boundaries include the RM of Rosser to the north, the Winnipeg James Armstrong Richardson International Airport to the east, Saskatchewan Avenue to the south and the Perimeter Highway to the west. This area, referred to as Airport Area West within the City of Winnipeg, represents the southern portion of CenterPort Canada, a tri-modal port shared with the RM of Rosser.

Regional water and wastewater infrastructure are required to facilitate future development of these lands. This study team considered the land use planning and anticipated water and wastewater flows to develop local and regional water and wastewater infrastructure that could support the development of the AAW lands from early stages through to complete buildout. The regional components of the infrastructure were advanced to preliminary design and considered the challenging geotechnical conditions that exist in the area, the anticipated phasing of the development, land acquisition needs, and other unique project constraints. A Class 3 cost estimate, with accuracy of -20% to +30%, was prepared based on the anticipated phasing of the proposed work.

Land Use Planning and Phasing

The study began with an analysis of the potential land uses to gain an understanding on the rate of development, the phasing of the potential development, the possible land use servicing classifications, and the resulting water demands and wastewater generation.

A shadow plan including anticipated future roads, parceling of land, and land development types was prepared for this study as the basis to the land use planning. The shadow plan was based in part on information from two independent draft secondary plans being prepared by the property owners, and on input received through engagement with the key stakeholders. The two draft secondary plans (land use plans) were under review by the City during the course of this study. The complete documents could not be shared; however, the general layout of roadways and anticipated land uses was shared with the project design team and steering committee. The draft plans represent two distinct zones that make up the overall study area. A residential development plan located south of Centerport Canada Way (CCW) and west of the Sturgeon Access, and an industrial development plan that covers the remaining portion of the study area. The residential land is anticipated to be developed as a lower-density residential neighborhood with a portion dedicated to mixed-use and higher-density residential development. The Industrial lands are anticipated to include a variety of industries as well as commercial development nodes at key locations throughout.

A conceptual phasing plan was then developed to determine the spatial and temporal impacts on the anticipated water demands and wastewater flows at varying stages of development. The following key assumptions form the conceptual phasing plan used in estimating when the future infrastructure would need to be in service:

- **General**

- Development of the southern portion of the study area is generally expected to be constructed within the first 20 years of development, with full buildout estimated at 50 years.

- **Residential Development**

- To be fully developed in the first 20 years of the 50-year buildout
- Estimated to be constructed as three general developments covering the west, central and east portions of the land (based on land ownership)
- Estimated to begin construction along the south border of the study area and trending northward.

- **Industrial Development**

- Annual development for the industrial lands is estimated at approximately 12 net hectares/year
- Airport Area 8 (belonging to the James Richardson International Airport) located in the southeast corner of the study area is estimated to be fully developed in the first 20 years of development.
- The remaining portions of the industrial area are assumed to begin development in the southern portion of the study area and phasing northward.

The development phasing plan was split into sub-phases as presented below to address key spatial and flow impacts on the proposed regional infrastructure. Two general phases (Phase One and Phase Two) primarily cover the southern and northern portions, respectively. Phase One was divided into subphases in five-year increments over the first 20 years to capture the low flow conditions expected in the early years of development. These low flow conditions can have detrimental impacts on larger regional infrastructure designed for the full buildout. Phase Two was divided into 10-year increments over the remaining 30 years to get to the full buildout condition

Servicing Classification	Phase 1A 1-5 Years (ha)	Phase 1B 6-10 Years (ha)	Phase 1C 11-15 Years (ha)	Phase 1D 16-20 Years (ha)	Phase 2A 21-30 Years (ha)	Phase 2B 31-40 Years (ha)	Phase 2C 41-50 Years (ha)	Total Net Area (ha)
Total Net Area	117.97	127.07	122.91	125.47	86.37	86.37	86.37	752.53

Some form of regional water and wastewater infrastructure will need to be in-service to support the water and wastewater flows at the end of the first year of development. For the purpose of this report, the year that City of Winnipeg regional infrastructure is brought into service is referred to as Year Zero. This in-service year (Year Zero) is required for capital planning. The City of Winnipeg Basis of Estimate (BOE) template, used for the development of the Class 3 cost estimate, includes this in-service date to refer to the year that the asset will be available for use, and to determine when operations and maintenance budgets are to be applied to the estimate. For this project various regional infrastructure assets will come on-line at subsequent years to Year Zero to address the increasing water demands and wastewater generation in later development phases.

The shadow plan and conceptual phasing plan for this study was presented with other relevant information to the Key Stakeholders at an engagement event on November 5, 2019. During this event, our team presented key project assumptions associated with the rate and phasing of the development as well as the

land uses, to ensure that the project assumptions were validated prior to moving forward with further analysis.

Water and wastewater flows were developed based on our conceptual phasing plan and shadow plan to identify the water demand and sewage production over the course of the development of the study area. The land use information was translated to correspond with the servicing classifications used in the City of Winnipeg's Water Demand and Wastewater Flow Estimation Guidelines. These values were applied against anticipated densities to provide water and wastewater flows used in the design of the sewer and water systems

Wastewater Infrastructure

The preliminary design of the wastewater infrastructure includes a single Wastewater Lift Station (in conformance with the project intent) to collect the future gravity wastewater flows and direct them to the existing 1350 mm Inkster interceptor sewer which is terminated at the intersection of Inkster Boulevard and Brookside Boulevard. The preliminary design includes additional regional wastewater infrastructure including segments of gravity interceptor and intake sewer piping upstream of the wastewater lift station, and Force Mains between the lift station and the Inkster Interceptor Sewer.

A conceptual pipe network representing the future local gravity sewers was developed as part of this study in order to determine the capacity and location of the regional wastewater infrastructure. The local sewers were assumed to follow the future road alignment on our shadow plan. Pipe depths were developed from the existing ground elevations (based on a Lidar survey) using assumed depths for the different development types. A depth of 3.0 m below the upstream manholes was used for single family residential areas (to allow a sewer service line for typical basement depths). A depth of 4.0 m was used at the high-end manholes for the industrial areas to account for longer anticipated service lines in the large industrial parcels. Minimum pipe slopes were then applied along each pipe segment, as per City standards. The various local pipe network branches were then used to optimize the location of the wastewater lift station focusing on a central location with the shallowest invert elevation. The lift station location also considered other key project constraints including the variable geotechnical conditions, constructability, site access, land acquisition and adjacent land uses.

The selected regional infrastructure design includes two interceptor sewers collecting flows from the east and west sides of the study area that direct flows to a central lift station located just east of the intersection of Centerport Canada Way and the Sturgeon Access. Two Force Mains (600 mm and 750 mm) are used to convey the pumped flows from the lift station to the Inkster Interceptor.

A considerable amount of risk exists in constructing a single lift station for a development of this size without a guarantee that the wastewater flows would be achieved. Under the lower wastewater flows in the early years of development a lift station sized for full buildout would be oversized and the pumps would be operating outside of optimum levels. Furthermore, a significant capital investment would be required at Year Zero to support flows that might not be realized until years after construction. To mitigate these risks, the lift station was broken down into three separate contracts to support the various stages of development.

Contract	Support Development Year	Description
1A	1-5	By-pass Lift Station
1B	6-10	Lift Station sub/superstructure and associated mechanical and electrical to support development for years 6-10
1C	11-50	Lift Station Mechanical upgrades to support development for years 11 - 50

Contract 1A is for the development of a smaller lift station using the by-pass components of the future full-buildout lift station. The station would also include a small heated and insulated structure to support the mechanical, electrical and instrumentation needs throughout the operation of phase 1A.

At a later date, when the actual development rates are approaching the anticipated rates estimated for Phase 1B (year 5), construction of the primary lift station can occur. This design provides the flexibility to avoid expending capital for the lift station until the flows are actually required. If development slows after year 1 due to unforeseen economic drivers, the by-pass lift station will be able to support the wastewater flows until development resumes.

A third contract (1C) includes mechanical upgrades to support the final stages of development from years 11-50. This contract was established to defer capital costs for components that are not required until the flows warrant their installation.

The Force Main (FCM) was also sized to address design constraints associated with the various wastewater flows at different stages of development. A 600 mm FCM is required for development years 0-10 (Phases 1A and 1B). A 750 mm FCM is required to support flows for phases 1C and 1D in development years 11-20. In year 21 at phase 2 both Force Mains will need to operate concurrently to support the wastewater flows.

Water Infrastructure

The preliminary design of the water infrastructure includes a primary Feeder Main (FDM), a secondary supply main and various smaller connections to the existing water system south of Saskatchewan Avenue. Water modelling was used to design a FDM to provide required pressures and flows to a future local distribution system under maximum day plus fire flow and under peak hour conditions. Connections to the existing City water system south of Saskatchewan Avenue were included to address early development phasing needs, to provide circulation and supplement the local grid. And a secondary supply main was modeled to provide some level of redundancy in the event of a loss of the FDM.

A conceptual local distribution grid was designed along the road right-of-ways on our shadow plan to represent the future water infrastructure in our model. Modelling was run using the EPANET water distribution modelling software. The analysis consisted of investigating a variety of system configurations under three conditions:

- Maximum Day Demand plus Fire Flow, to determine maximum available fire flows while maintaining minimum residual pressures within the distribution system.
- Peak Hour Demand, to determine minimum pressures in distribution mains and FDMs in non-fire conditions.

- Average Day Demand, to determine the age of water within the distribution system during periods of low flow.

The above analyses were applied to a range of pipe configuration scenarios including the anticipated flows for the various development phases, the full buildout scenario, as well as various secondary water supply main options to identify the optimal solution.

The optimal solution for the FDM was a 750 mm extension of the Silver Avenue FDM from Moray Street to Sturgeon Road and then an extension north along Sturgeon into the AAW lands. The FDM includes offtake structures to the local distribution system.

A 400 mm secondary water supply line was selected extending from the Rouge Road FDM north from Hamilton Avenue to the intersection of Saskatchewan Avenue and Cavalier Drive. The secondary supply main does not have to equal the performance of the 750 mm FDM but rather is designed to provide sufficient water to meet residential needs and to maintain peak hour pressures in industrial areas to ensure that essential machinery requiring water pressure can operate. Portions of the local domestic pipe network will need to be upsized by the developers from 300 mm to 400 mm to meet the selected design outcomes. The regional components have been progressed through to preliminary design and are included in the Class 3 cost estimate.

Connections to the local domestic distribution system are also required to supplement the local distribution grid. These connections are all to existing 300 mm mains and are located at:

- Saskatchewan Avenue and Buchanan Boulevard.
- Saskatchewan Avenue and Cavalier Drive.
- Saskatchewan Avenue and Hamilton Avenue.
- Saskatchewan Avenue and Sturgeon Road.
- Saskatchewan Avenue and Moray Street.

The complete water distribution system is not required to be in service in Year Zero, but instead has been designed to be constructed as required to meet the development phasing of the project. The regional water distribution system was divided into three general contracts.

The first contract (described as 4A within the report) is for the installation of the 750 mm FDM from Silver Avenue to offtake structure 3. Contract 4A is required to be in service for the start of Phase 1A (Year Zero) to support any development in the industrial zone. Development within the residential subdivision can initially begin without a connection to the FDM by using the connections to the existing system south of Saskatchewan Avenue. As development progresses within the residential development zone the connection to the FDM will be required.

The second contract for the secondary supply main (termed contract 5) is required to be in service for phase 1C at the end of development year 10.

Lastly, the extension of the FDM from offtake structure 3 to offtake structure 4 is required to facilitate the development of the northern half of the industrial zone in Phase 2 at the end of development year 20.

Geotechnical Investigation

Geotechnical investigations were completed along the proposed infrastructure route to gain a better understanding of the stratigraphy and groundwater conditions for the purpose of developing cost estimates and assessing the geotechnical risks at the preliminary design phase.

The geotechnical investigations included a combination of sonic drilling, seismic refraction surveys and conventional drilling and instrumentation. Complex ground conditions including shallow bedrock and till and irregular changes in ground conditions were found to exist throughout the AAW lands. The geotechnical information was used in part to select optimal locations for the infrastructure, and also to determine the probable methods of installation of the various components of the regional infrastructure. Installation of pipelines in rock, till or mixed soil conditions appears unavoidable through portions of the study area. To demonstrate this, the variable rock and till profiles are shown on the preliminary design for each component of the sewer and water infrastructure. Appropriate construction equipment was selected for the various components, or portions of the regional infrastructure including horizontal directional drilling and tunneling equipment. Costs for these techniques were then included within the class 3 cost estimate to increase the accuracy of the estimate.

Schedule and Cost

The cost estimate was developed using the City's BOE template and provides the capital, engineering, and operations and maintenance costs to complete water and sewer regional servicing program. The estimate is based on a series of independent contracts that are phased to be in service to support the anticipated flows for the respective year of development.

The proposed regional infrastructure has been broken down into discrete contracts to phase the work as presented in this report. For consistency, specific numbers were provided to each asset as listed below, and then letters were used to identify the phasing of the particular asset.

- Contract 1 – Lift Station.
- Contract 2 – Force Main.
- Contract 3 – Interceptor and Intake Sewer.
- Contract 4 - Feeder Main.
- Contract 5 – Secondary Supply Main.
- Contract 6 – Upgrades to City Interceptor Sewer.

The below table demonstrates the breakdown of the work and the associated in-service year

The estimated capital cost of the proposed program excluding inflation is \$112,574,000 in \$2020.

Stage/Phase (In-service year)	Contract	Description	Construction Contract Value (\$2020)	Engineering	Utility	Other	Contingencies	City PM Salary	Administrative Charges	TOTAL
Phase 1A (in-service year 0)	1A	By-pass Lift Station	\$3,042,100	\$6,649,987	\$310,000	\$389,000	\$6,627,820	\$396,000	\$1,274,121	\$59,980,171
	2A	600 mm Force Main	\$14,872,812							
	3	Interceptor and Intake Sewers	\$16,409,530							
	4A	750 mm Feeder Main (Silver to OS3)	\$10,008,800							
Phase 1B (in-service year 5)	1B	Lift Station sub/superstructure and associated mechanical and electrical to support development for years 6-10	\$9,071,955	\$1,841,155	\$0	\$0	\$1,835,018	\$660,000	\$332,211	\$16,942,753
	5	400 mm Secondary Supply Main	\$3,202,414							
Phase 1C (in-service year 10)	1C	Lift Station Mechanical upgrades to support development for years 11 – 50	\$1,503,837	\$2,420,664	\$0	\$0	\$2,412,595	\$660,000	\$432,620	\$22,063,642
	2B	750 mm Force Main	\$14,633,924							
Phase 2 (in-service year 20)	4B	750 mm Feeder Main (from OS3 to OS4)	\$3,564,058	\$534,609	\$0	\$0	\$532,827	\$0	\$92,630	\$4,724,124
Phase 3 (in-service year 30)	6	Wastewater upgrades to the Interceptor Sewer	\$6,686,569	\$1,002,985	\$0	\$0	\$999,642	\$0	\$173,784	\$8,862,980
Combined Sub-Total (Class 3)			\$82,996,001	\$12,449,400	\$310,000	\$389,000	\$12,407,902	\$1,716,000	\$2,305,366	\$112,573,670
Total (Class 3) \$2020 (Excluding Inflation)										\$112,574,000