

Materials Recovery Facility (MRF) Renewal Business Case

Waste Services | City Operations

Infrastructure Planning and Design | Integrated Infrastructure Services

Infrastructure Delivery | Integrated Infrastructure Services

City of Edmonton

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Document Approval

SUBMITTED BY:

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4.0	Ron Tupas - Project Engineer - WS, City Ops		August 28, 2020
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1. Executive Summary

1.1. Materials Recovery Facility (MRF) Renewal

Commissioned in 1999, the Materials Recovery Facility (MRF) receives and processes material collected in the blue bag recycling program. The facility was originally constructed under a Public-Private Partnership (P3) agreement, which included a 15-year operating period and shared-cost capital renewals every five years. It has undergone two renewal projects in 2003 and 2008 to address recyclable packaging and collection program changes. It is overdue for another renewal as a number of pieces of equipment are near or are now at the end of their life cycle, and some equipment is no longer effective with the current mix of recyclable materials collected against the increasingly challenging commodities market. Since 2014, a third-party contractor has operated and maintained the Materials Recovery Facility.

In March 2019, Waste Services presented City Operations report CR_6866 to Utility Committee along with February 26, 2019 strategic business case, which recommended to execute a phased retrofit to the MRF. The phased retrofit proposes a partial upgrade to address the most critical equipment and facility issues by 2021, followed by a complete retrofit in 2027. The MRF Renewal project focuses on the first phase of the MRF retrofit addressing the replacement of end-of-life-cycle equipment and facility issues. In addition to this recommendation, Waste Services requested that the fibre (paper/cardboard) line in the MRF also be included in this project. The addition of the paper/cardboard line is meant to address the existing process limitations resulting in the system being above maximum capacity and a landfill diversion rate ranging from 21% to 36% in recent years. Approval of the full scope of work, with an expected completion date in 2022, will achieve operating efficiencies and contribute to the City's goal of a 90% diversion rate.

Waste Services Leadership team approved the Project Condensed Business Case on July 22, 2019 based on the approval of the preliminary planning and design work prior to the Delivery Budget Request and approval at Checkpoint #3. The Infrastructure Planning and Design Branch in the IIS Department completed the planning and design work (Concept Design and Development Design). The project has appropriate information incorporated into the budget and schedule to support Waste Services Leadership Team's investment decisions regarding the delivery of the project.

Waste Services and Infrastructure Planning and Design have collaborated to develop this Business Case for the project to be submitted for review and approval. It is recommended by the team that this Business Case Alternative 2 be approved and authorized for Capital Expenditure (Funding Approval) of \$15.7 million. Upon approval, project delivery will commence in 2021/2022.

2. Profile Background

2.1. Problem / Opportunity

Problem

As identified in the February 26, 2019 strategic business case, a number of factors have decreased the MRF's efficiency:

- Due to the postponed renewals, the majority of processing equipment in the plant is nearing or past the end of its life, as mentioned in the 2017 building and equipment condition assessment reports, causing frequent downtime, unplanned maintenance, and unnecessary process bottlenecks.
- Quality standards for end-product marketability have become higher due to the imposition of China's Green Fence policy and improved technology of MRF operations across the industry.
- Composition of recyclables in the waste stream has changed with a downward trend in the old newsprint (ONP) quantities, an upward trend in the quantity of old corrugated cardboard (OCC) and glass and metal containers are being replaced by multi-layer plastic containers, which cannot be easily recycled using available technology.
- Current facility throughput is inadequate for the volume of recycling generated by the Edmonton program and for the required end-product quality resulting in a reduced landfill diversion rate.

Opportunity

Completing the identified end-of-life equipment replacements and optimizing the efficiency of the paper/cardboard line at the MRF provides an opportunity to align with City's long-term strategic goals as well as:

- Improve efficiency and waste diversion through the enhanced recovery of recyclables;
- Reduce operating and maintenance costs through the introduction of new technologies and replacement of old and obsolete technology, increased processing capacity, improved cost efficiency and enhanced revenue generation;
- Increase the capacity to process recyclables quantities projected for the next 20 years and have the ability to process increased quantities of recyclables should the City plan to develop this as a regional facility. With the citywide Cart Rollout starting in 2021, the quantity of material collected in blue bags is expected to increase as garbage will be collected every two weeks. The 2015 Waste Characterization study highlighted that there was a significant level of recyclables in the garbage stream;
- Improve end-product commodity quality to ensure marketability, improve market competitiveness, and reduce the risk of market rejection.

2.2. Current Situation

Despite partial upgrades to the MRF throughout the last 20 years, several pieces of process equipment are at their end of useful life and require replacement including:

- Angle (finishing) screen;
- Eddy current separator; and
- Air classifier fan.

The age and condition of the equipment mentioned above, among other equipment currently being replaced causes increased facility disruptions. The related facility shutdown and emergency repairs result in diversion rate losses and additional cost. Upon approval of this business case, this list of equipment will immediately be replaced, resulting in increased plant availability and increased overall production.

The building condition assessment report identified various building equipment and structures needing short-term or immediate replacement and/or repair. This includes, but is not limited to, building components within:

- Building structure: concrete pad repairs;
- Building envelope: replace damaged exterior panels, doors, frames, hardware;
- Building interior: replace the flooring, tile wall finishes, washroom vanities/countertops; and
- Building mechanical systems: replace wall mounted exhaust fans, decommission plumbing in the old washroom.

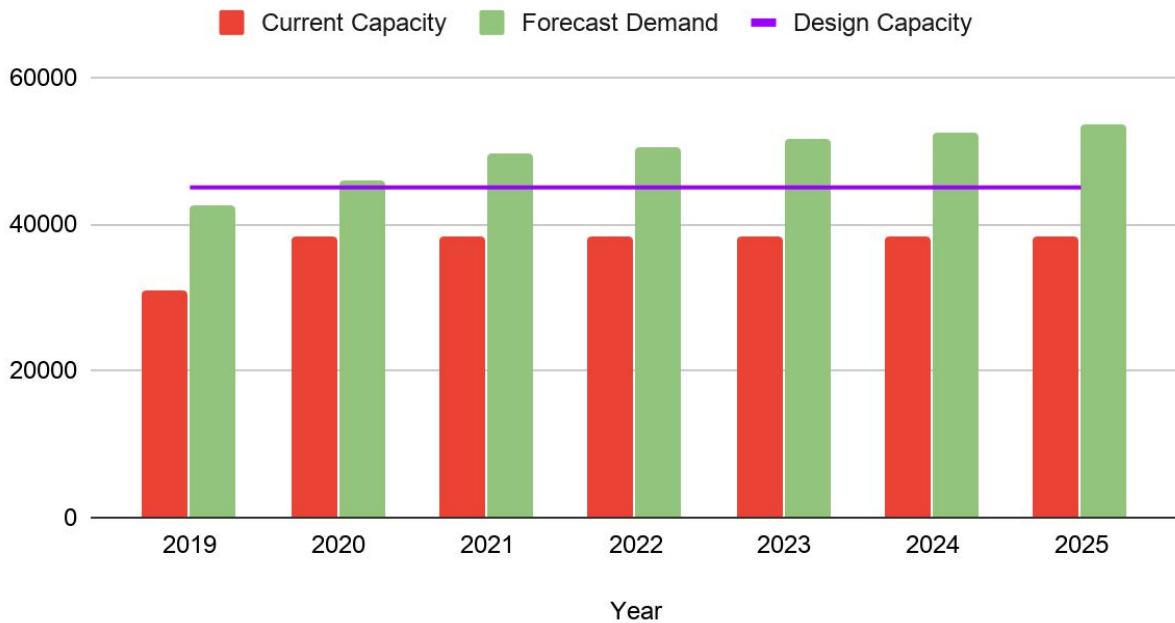
To improve the overall plant capacity and remain competitive in the end-product commodities market, it is crucial to replace the facility's equipment and optimize the paper/cardboard line. In order to maintain sufficient commodity quality, plant production has been significantly slowed down at the expense of plant capacity, which is now lower than the initial design capacity and below the capacity required to process all inbound material. The plant capacity is approximately 38,000 tonnes per year or 15% under capacity compared to the 45,000 tonnes per year being collected. This capacity gap will continue to worsen as the amount of blue bag material collected is projected to grow by 2% each year as the cart system is rolled out city-wide. Paper and cardboard account for 75-80% of the incoming feedstock, making the upgrades to this line even more important since these upgrades are expected to increase plant capacity and quality of a key commodity. The City's overall waste diversion goal will be adversely affected if the capacity gap is not addressed.

The following chart¹ demonstrates the projected gap between the current capacity, design

¹ Figure 1: Gap analysis of recycling growth vs current capacities.
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capacity and forecast demand. Actual capacity in 2019 was lower than expected due to unplanned maintenance related to equipment failures.

Projected Recycling Growth vs Facility Capacity & Constraint



The equipment replacement scope has been prioritized based on facility needs and market circumstances and is summarized below.

Finishing Line Improvement

- Ballistic separator (replaces finishing/angle screen)
- Optical sorter for Mixed Fibre line

Air Classifier (Alternate Technology)

- Optical sorter to replace existing air classifier for container line

Eddy Current Separator

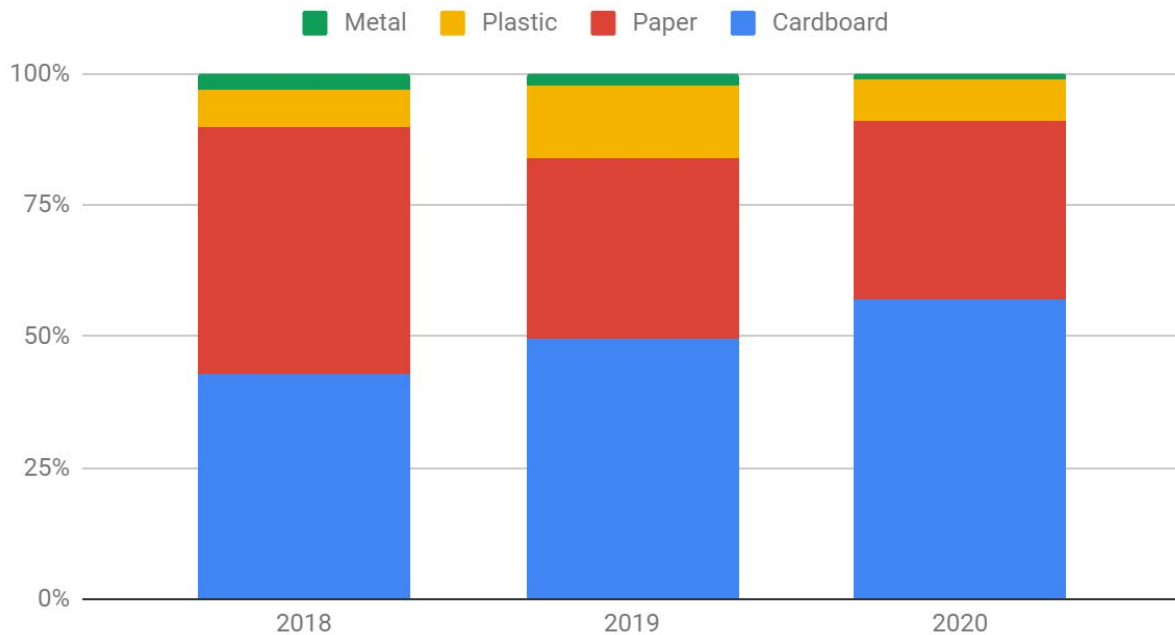
- Eccentric Eddy Current Separator with vibrating plate

Fibre (paper/cardboard) Line Improvement

- Old Corrugated Cardboard (OCC) Screen
- Scalping Screen
- Fines Screen
- Optical sorter for fibre line (ONP line)

The composition of recyclables in the waste stream has changed over time and the proposed modifications will enhance the facility's ability to process the current composition. The following chart² shows the change in material composition over time. 2018 and 2019 represent the full year's data, and 2020 is June year-to-date.

Blue Bag Composition



3. Initiative Description

3.1. Initiative Description

This initiative replaces various process equipment and building components, including upgrades to the paper/cardboard line, that will extend the life, improve efficiencies, and increase the capacity of system processes at the Materials Recovery Facility (MRF). The initiative provides the City of Edmonton with an effective recycling program and contributes to the City's goal of a 90% diversion rate.

3.2. Initiative Justification

² Figure 2: Blue bag composition analysis between 2018 - June 2020
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This initiative will reduce equipment downtime and unplanned maintenance while improving commodity quality, plant capacity and overall system efficiency.

3.3. Urgency of Need

Administration submitted the City Operations report CR_6866 in March 2019 that outlined the urgent needs for this facility renewal and the strategy for moving forward with this project. CR_6866 highlighted capacity limitations with the facility only processing approximately 85% of the blue bag material collected, while the remaining amount is sent directly to landfill. As well, 65% of the material that is processed through the plant is not recycled and instead goes to landfill or is used as refuse derived fuel (RDF) in the biofuels facility at the Edmonton Waste Management Centre (EWMC) for further processing. Furthermore, the threat of not being able to market the paper and cardboard commodities due to poor quality has forced the facility to significantly reduce its throughput below capacity requirements in order to meet the quality standards to market these commodities. The current operating requirements result in a cost per tonne which is higher than the industry average.

3.4. Anticipated Outcomes

The anticipated outcomes of this project, with the assumption that all milestones will be achieved on time to increase the reliability of the MRF, are:

Replacement of the key end-of-life process and building equipment and upgrades to the paper/cardboard line to improve the MRF efficiency and help to achieve the City's strategic goal of a diversion rate of 90% residential waste from landfill. The detailed tangible and intangible benefits of the project are discussed in the Cost Benefits Section.

3.5. Scope

The current project scope is to replace the key end-of-life process and building equipment and improve the paper/cardboard line. Improvements to the paper/cardboard line have been fast-tracked from the proposed timeline presented in the 2019 business case (CR_6866) as a result of further deterioration of the processing line and changes to the marketplace.

Goal: Design, procure, install and commission various MRF process and building components including the following **key** deliverables and activities:

- Replace key end-of-life process and building equipment as identified in condition assessment reports;
- Paper/cardboard line optimization;
- Project, construction and contract management for all contractors and consultants;

- Procure equipment and design/construction services;
- Develop and design concept to meet all applicable codes and requirements;
- Detailed design including all components such as architectural, structural, mechanical, and electrical;
- Obtain all permits required for construction;
- Install process equipment, hardware, and associated structural support (both new and modifications to existing) and integrate with existing mechanical equipment and process systems;
- Install building equipment, hardware, any required structural support (both new and modifications to existing) and integrate with existing systems;
- Execute a quality control program which includes, but is not limited to, regular inspections, verifications, reporting and testing to ensure specifications are met;
- Full commissioning of all installed equipment;
- Project handover, including final acceptance certificate, warranty, operation and maintenance manual and project close-out;
- Warranty related issues.

To achieve the above goal, the initiative is managed by the Infrastructure Planning and Design (IPD) Lead Project Manager until Checkpoint #3. Once Utility Committee and City Council approve the Delivery Phase Budget, the scope of delivery will be as follows:

- Waste Services will lead the delivery of end-of-life equipment replacement and process equipment upgrades through to completion of Checkpoint #5. Given that the Operating and Maintenance contract is due for renewal in 2021, delivery will occur through a Design-Build-Operate-Maintain type contract procured through the RFP process.. IIS will continue to support the project;
- IIS Infrastructure Delivery will lead the delivery of end-of-life building components and building equipment through to completion of Checkpoint #5.

Project manager roles and responsibilities are as defined by Project Management Reference Guide.

The detailed scope of work for the MRF Renewal project include:

- Engineering & Design:
 - Design development of the schematic design;
 - Major equipment specifications to enable the gathering of engineering and budget information (RFI) and later more detailed specifications suitable for tendering;
 - Development of detailed design with allowances for 30%, 60%, and 90% design reviews, to provide a basis for confident budget information for City Council approval;
 - Cost estimates at significant milestones;
 - Schedules for design, procurement, installation, and commissioning;
 - Engineering to support construction, installation, commissioning, and performance testing;

- Engineering support for any regulatory approvals (such as Alberta Environment and Parks) that may be required; and
- Engineering support for any studies that may be required, including but not limited to:
 - Arc flash study
 - Industrial hygiene
 - Geotechnical reports
 - Surveys
 - Fire protection
 - Process integration to ensure a smooth running operation with no bottlenecks
 - Hazard ID (HAZID) and Hazardous Operation (HAZOP) review
- Preparation of As-Built record drawings
- Construction quality assurance and control to ensure the installation meets the design requirements
- Commissioning plan development and leadership, in conjunction with Vendor(s) and Construction Manager
- Construction Management:
 - The pre-construction services (cooperate with the Consultant to provide its skill and judgment as design input, class 3 cost estimate etc.) as required
 - Procurement of major process equipment, off-loading and storage of equipment until it can be installed into the work
 - Trades procurement
 - Coordination of construction and construction activities
 - Post construction activities
- Construction support throughout the construction phase;
- Vendor(s) commissioning and operator training from and transfer of standard operating procedures.

3.6. Out of Scope

The following are **not** included in scope:

- Building expansion (material receiving area/tip floor and bale storage area), container line equipment additions and upgrades to be completed in a separate phase.
- Baler replacement, already approved through Checkpoint #3 and being delivered separately by IIS.

3.7. Critical Success Factors

Critical success factors include:

- Improve the capacity to process more of the recyclable materials collected by the blue bag, blue bin, and recycle depot programs while reducing the labour hours/shifts.
- Improve manual and automatic sorting in order to achieve end market specifications.
- Provide process equipment that is adjustable to account for changing mix of recyclables over the next decade
- Improve the diversion rate while increasing the recovery rate per commodity

The following list³ identifies items that contribute to the successful realization of the initiative, along with their respective success measures for this project.

Deliverable	Acceptance Criteria
Checkpoint #3 - Readiness Criteria and Handover Package	<p>Plan and check are ready for approval by Project Review Team, project managers and supervisors and directors from Facility Planning and Design Section within IIS Department for the project handover</p> <p>Outcome:</p> <p>Pending on project handover approval;</p> <p>Pending Utility Committee and City Council's approval of the Delivery Phase Budget at Checkpoint #3</p>
RFP Input	<p>Recommendation approved by Utility Committee and City Council to inform the requirements of RFP for MRF Renewal.</p> <p>Outcome:</p> <p>Contract awarded to vendor with the expectation of MRF Renewal upgrades.</p>
Detailed Design Package	<p>Review by project team, business partners, IIS and vendor. Comments are addressed to the City's satisfaction.</p> <p>Outcome: Pending on prerequisites</p>

³ Table 1: Project deliverables and success criteria per deliverable
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Project Class 1 Cost Estimate (by Consultant and Construction Manager)	Review by project team, business partners, and the vendor. Outcome: Pending on prerequisites
Delivery Phase (Checkpoint #3-5) Project Charter	Review by project team Review and approve by the project sponsor and business partners Outcome: Pending on prerequisites
Checkpoint #4 - Readiness Criteria and Handover Package	Plan and check approval by Project Review Team, project manager, project sponsor, supervisors and Directors Outcome: Pending on prerequisites
Construction	Led by vendor to the City's satisfaction. Outcome: Pending on prerequisites
Final Product, training, O&M manual, As-Built drawings	Product meets goals identified in this document for: <ul style="list-style-type: none"> The replacement of key end-of-life process and building equipment and improvements of the paper/cardboard line Outcome: Pending on prerequisites
Checkpoint #5 - Readiness Criteria and Handover Package	Plan and check approval by Project Review Team, project manager, supervisors and Directors Authorization for Project Closeout Outcome: Pending on prerequisites

4. Strategic Alignment

Vision 2050

This project aligns with the City's Vision 2050 strategic plan by ensuring recyclable waste is collected and processed responsibly, minimizing the amount landfilled, Edmonton will be a healthy city, urban places will be clean, regional prosperity is increased by building a circular economy, and a low carbon future is assured.

Waste Services Business Plan 2019-2022

The MRF renewal supports the vision and commitments outlined in the *City of Edmonton Waste Services Business Plan 2019-2022*. Importantly, this plan acknowledges a significant gap between current system performance on the diversion rate and the City's 90% goal. To close the diversion rate gap, it is essential to renew the MRF as it enables greater recovery of recyclables and diversion from landfill while working toward these long-term goals in a fiscally responsible manner.

5. Context Analysis

Context analyses for this initiative was provided in the Materials Recovery Facility Rehabilitation Business Case (Attachment #1 to CR_6866) in 2019. The analysis is summarized as:

- Consumer purchasing behaviour and packaging practice changing the blue bag composition;
- Environmental impacts due to Extended Producer Responsibility in other provinces;
- China's Green Fence Policy's impact on recyclable product end-markets.

6. Alternatives

Alternatives include the status quo (no new equipment), full scope renewal, a phased renewal scope, a reduced renewal scope, and producing Refuse Derived Fuel (RDF) from the combustible portion of the collected residential recyclables. All alternatives were analyzed based on a thirty-year project life.

Alternative 1: Status quo

The status quo involves no capital investment with operations continuing as is with existing process equipment. The key impacts of this alternative are as follows:

- Limited capacity of 38,000 tonnes per year with an average production rate of 12.2 tonnes per hour, leading to operating and maintenance (O&M) costs increases due to insufficient capacity;
- Capacity will decrease over time as downtime increases due to more frequent breakdowns;
- No mitigation of market rejection risk due to inadequate/insufficient commodity purity; and
- At the end of the 30 year-period, diversion rate is projected to decrease to less than 40%.

The status quo will lead to ever increasing operating costs, no improvements in quality, increased downtime, and a loss of efficiency. Based on the February 2019 strategic business

case and further analysis, status quo is not recommended.

Alternative 2: Full Scope (Paper/Cardboard (Fibre) Line Optimization and EOL) in 2021/2022

Alternative 2 includes the completion of the fibre (paper/cardboard) line optimization and end-of-life (EOL) equipment replacement in 2021 and 2022 requiring a capital investment of \$15.7 million. The key impacts of this alternative relative to the status quo are as follows:

- Production rate improves from 12 to 23 tonnes per hour and plant availability improves from 75% to 90% increasing capacity to about 86,000 tonnes per year from 40,000 tonnes per year;
- Recovery efficiency is estimated to improve to 95% for all fibre (OCC, ONP, mixed fibre) and aluminum leading to an additional \$250,000 per year in revenue relative to status quo;
- An average savings of \$11.7 million / year from 2022-2026 and overall net savings of \$560 million over the lifecycle in O&M costs due to savings in labour, maintenance, and avoided residual landfilling and/or RDF/WTE processing, relative to the status quo; and
- More competitive commodity marketing and mitigation of market rejection risk due to improved paper/cardboard purity to >90%.

Alternative 3: Phased Renewal Implementation

Alternative 3 is a phased approach which includes completing the paper/cardboard line optimization (fibre line) in 2021/2022 and replacing the end-of-life (EOL) equipment in 2024/2025. Compared to Alternative 2, this splits the capital outlay to \$10 million in 2021/2022 and \$5.4 million in 2024/2025. The key impacts relative to the status quo are similar to Alternative 2 and are as follows:

- Production rate improves from 12 to 23 tonnes per hour after phase 1 paper/cardboard line optimization is complete in 2022 and plant availability improves to 80% leading to a capacity of about 76,000 tonnes /year;
- After phase 2 EOL construction is complete in 2025, plant availability improves to 90% and capacity increases to approximately 86,000 tonnes per year;
- Total recovery efficiency improves, leading to an additional \$59 million in revenue relative to status quo;
- An average savings of \$9.5 million / year from 2022-2026 and net savings of \$465 million over the lifecycle in O&M costs due to savings in labour, maintenance, and avoided residual landfilling and/or RDF/WTE processing, relative to the status quo;
- After phase 1 construction, fibre purity improves to >92% creating more competitive commodity and decreasing market rejection risk;and
- Risk of EOL equipment failure until 2025 when the equipment will be replaced.

A phased renewal scope will result in an extended capital outlay and delayed improvements and achievement of goals. The phased renewal will consist of the paper/cardboard line upgrade in 2021 and end-of-life equipment replacement in 2024.

Alternative 4: Reduced Scope - EOL Only

Alternative 4 only includes end-of-life (EOL) equipment replacement to be completed in 2021/2022 with a capital investment of \$9.5 million. The key impacts relative to status quo are as follows:

- After construction completion in 2022, capacity will increase to approximately 43,000 tonnes per year, production rate remains at 12 tonnes per hour, and plant availability improves from 75% to 80% ;
- Recovery efficiency for mixed paper/cardboard only (not the separate cardboard or paper lines which is bulk of material received), aluminum improves to 95% for an additional \$30,000/year in revenue relative to status quo and diversion rate improves to >50%;
- Net savings of \$7 million in O&M costs primarily due to reductions in residual landfilling and RDF/WTE processing, relative to the status quo; and
- No mitigation of market rejection risk since no improvements to OCC and ONP purity. Commodity marketing becomes less competitive as other competing MRFs commit more capital investment to improve their commodity purity.

A reduced renewal scope will result in a lower capital outlay, likely resulting in follow-on projects in the future. Improvements will be delayed and only some goals will be achieved.

Alternative 5: Refuse derived fuel (RDF) production

Alternative 5 investigates the option of shifting to RDF processing of the majority of recycling material collected. In this scenario, the MRF would still receive blue bag material, but the only commodities recovered would be cardboard and deposit returnables with the remainder sent for RDF processing. It is assumed that this transition would occur by 2023. The key impacts are as follows:

- Minimal Capital investment to the MRF;
- Production rate remains at 12 tonnes per hour and no increase in processing capacity which remains at 40,000 tonnes per year;
- Net reduction in revenue of \$40 million due to reduction in recovery and sorting operation;
- Net savings of \$396 million in O&M costs primarily due to reductions in labour, relative to the status quo;
- Diversion rate is >50%; and
- Due to the holding and processing capacity limits, capital investment may be required for the RDF.

Alternatives Comparison

Appendix A highlights the alternatives financial analysis summary. Based on the financial summary and the alternatives review above, the following table⁴ provides a high level summary that will determine the best alternatives using the triple bottom line approach:

⁴ Table 2: Analysis of alternatives using triple bottom line approach.
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Waste Services MRF Renewal (2020-2050)	ALT. 1- Status Quo	ALT. 2 Fibre Line & EOL in 2021/2022	ALT. 3 Phased Approach	ALT. 4 Reduced Scope (EOL only)	ALT. 5 RDF Processing
Profit Increase (+) or decrease (-) of revenue from status quo	N/A	+	+	+	-
People Increase (+) or decrease (-) of operating & maintenance costs from status quo (resulting in a safer work env.)	N/A	+	+	+	+
Planet > 90% diversion rate (yes/no)	No	Yes	Yes	No	No
NPV Increase (+) or decrease (-) from status quo	N/A	+	+	-	+
Meets ALL criteria above (yes or no)	No	Yes	Yes	No	No

While the above listed options are in alignment with the strategy business case (CR_6866) submitted to the Utility Committee in 2019, Waste Services took the opportunity presented in conducting the options analysis for this business case to investigate the possibility of outsourcing blue bag recycling in Edmonton. This investigation showed that there may not be sufficient private sector processing capacity currently available, but more importantly that outsourcing this function is cost prohibitive. A summary of the financial analysis is included in Appendix C.

Based on the triple bottom line analysis table above, alternatives 1, 4 and 5 can be eliminated for not meeting all of the criteria. Outsourcing the processing of the blue bag material has also been eliminated from further consideration due to high costs. Alternatives 2 and 3 meet all criteria and either could be implemented.

A closer inspection and analysis of Alternatives 2 and 3 yields the following comparison. Both

alternatives are compared against Alternative 1 to better understand the benefits of each alternative compared to status quo. As the two alternatives have different life cycles, it is inappropriate to compare the two project NPVs. The appropriate method for comparing projects with different life cycles is to convert each project's NPV to an annuity and select the highest annuity amount.

Key Comparison Elements	Alternative 2	Alternative 3	Favourable Alternative	Difference
NPV	\$226,642,872	\$217,813,568	Alternative 2	\$8,829,304
Cost of Capital	\$15,732,246	\$16,235,156	Alternative 2	-\$502,910
Equivalent Annual Annuity	\$15,032,015	\$13,279,792	Alternative 2	\$1,752,223

- Cost differences are primarily due to delaying EOL replacements in Alternative 3, which delays benefits of improved mixed fibre and aluminum recovery (which would therefore reduce RDF/WTE cost)
- Fibre line optimization benefits of improving processing capacity, reduced sorter labour, reduced avoided landfill and avoided residual processing cost still applies after construction in 2022 for both alternatives

When comparing the two alternatives, Alternative 2 has a higher NPV and a higher Equivalent Annual Annuity calculation. This indicates that Alternative 2 is the preferred option. Revenue requirement comparison between the alternatives is outlined in Appendix B.

7. Organizational Change Impact

This section identifies the potential impacts of the initiative.

7.1. Stakeholder Impact

The following table⁵ lists all interested parties that may be impacted by the initiative.

Stakeholder	City Relationship	Type of Impact	Business Requirements
Sustainable Waste Processing Section, Waste Services -	Internal	Direct	Business requirement is the replacement of the end-of-life process equipment and building

⁵ Table 4: Detailed list of stakeholders impacted by the proposed project.
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Capital project operating business partner			components as well as upgrades to the paper/cardboard line.
Technical Services Section, Waste Services - Capital project strategic business partner	Internal	Direct	Business requirement is to complete the necessary orientation and training on new systems/equipment in order to provide the future technical support to the operations.
Waste Collections	Internal	Direct	Business requirement is to reduce the waiting time for collection trucks tipping at MRF. May be delays during project construction.
MRF Operations & Maintenance Contractor	External	Direct	Business requirements are to complete the necessary orientation and training on new systems/equipment so a maintenance schedule can be planned. Operating shifts should be reduced which will allow for more maintenance time.
Residential Ratepayers	External	Indirect	Business requirements are to reduce the amount of material sent to Landfill and to avoid increasing the utility rate.
Facility Planning and Design Section, Infrastructure Planning and Design Branch, Integrated Infrastructure Services	Internal	Direct	Business requirement is to have the project scope confirmed with the business partner and lead the project from Checkpoint #1 to Checkpoint #3
Facility Infrastructure Delivery, Infrastructure Delivery, Integrated Infrastructure Services	Internal	Direct	Business requirement is to have a confirmed scope and sufficient Delivery Funding to get the project through Checkpoint #3 to Checkpoint #5.

Other MRF Users/Markets	External	Direct	Business requirement is to have the MRF commodities available for them and meet their specifications.

7.2. Business and Operational Impact

The Business & Operational Impacts table⁶ is to provide a list of all business and operational impacts for each stakeholder.

Stakeholder	Business and Operational Impacts
Sustainable Waste Processing Section, Waste Services - Capital project operating business partner	Human Resource impact: the staff currently working shifts adjustment may be required Operational impact: staff will have to be trained to operate the new system
Technical Services Section, Waste Services - Capital project strategic business partner and engineering support	Technology impact: how to support for successful integration of the new equipments/systems
Operations & Maintenance Contractor	Human Resource impact: less staff or the staff currently working shifts adjustment might be required for the new equipment/systems Technology impact: the technology in the new facility might be different from existing
Residential Ratepayers	Financial impact: the utility fee might increase due to Waste Services capital investment
Other MRF Users/Markets	Environmental impact: the MRF commodities will become more marketable

⁶ Table 5: The impact to stakeholders in their line of business and operational areas
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ICI Waste Haulers	Excess capacity could be used to process ICI recyclables collected in Edmonton
Regional Communities	Excess capacity could be used to process regional recyclables

8. Cost Benefits

This section identifies overall value contribution and costs incurred to realize the proposed initiative.

8.1. Tangible Benefits

The following tables below outline both tangible⁷ and intangible⁸ benefits expected from this project.

Tangible Benefits	Benefit Description
Ability to process recyclables as projected including anticipated increase in the recyclables due to collection system changes	Potential benefit is realized upon completion of equipment replacements/upgrades expected in 2022.
Higher processing rate, leading to reduction in shifts and overtime, as well as more planned maintenance; all leading to lower operating costs	Potential benefit is realized upon completion of equipment replacements/upgrades expected in 2022.
Increased recovery of recyclables	New technology will allow for a higher capture rate - less residuals - reduced from 25% to 15% in mass balance. Potential benefit is fully realized in 2022.
Reduction of maintenance costs due to reduction of unplanned maintenance	The long-term need for unplanned maintenance will be gradually reduced as new equipment is phased into the facility, aligned with phased equipment replacements beginning in 2021.

⁷ Table 6: List of tangible benefits of the project

⁸ Table 7: List of intangible benefits of the project

8.2. Intangible Benefits

Intangible Benefits	Benefit Description
Reduced greenhouse gas impact through reduction of haulage to landfill	Potential benefit is realized in phases, aligned with phased equipment upgrades and resulting reduction of discards in 2022. This alternative will ensure that all blue bag / bin materials can be processed for recycling at the MRF.
Better employee work environment, changes to sort areas	Improvements to employee comfort and morale anticipated from upgrades to the employee lunch room, tip floor and sort area beginning in 2021.
Improved quality, resulting in lower marketing effort, and reduces risk of rejection	Potential benefit is realized upon completion of equipment replacements/upgrades expected in 2022.
Improvement of safety	Potential benefit is realized upon completion of equipment replacements/upgrades expected in 2022. New operating equipment reduces risk of breakdowns and potential unsafe conditions.

8.3. Costs

Operating Costs

The operating costs for the new assets are mainly associated with electrical power to operate the new equipment and building, and ongoing maintenance costs for the new assets. The new equipment results in a reduction in sort labour and maintenance. The expected increase in diversion of material will also result in a decreased landfill cost.

Capital Cost

The final \$15.7 million Class 3 Cost Estimate for the recommended equipment and building systems replacement scope of work as well as the paper/cardboard line upgrades exceeds the approved funding of \$10.5 million for the project. It is recommended by the team that this Business Case to be approved following Alternative 2 and authorized for Capital Expenditure

(Funding Approval) of \$15.7 million at Checkpoint #3 of the Corporate PDDM within the 2019-2022 budget.

8.4. Cost Assumptions

Following are a list of assumptions made during the formation of this Business Case that may have an impact on the success of the project.

- Funding will be adequate to achieve the objectives outlined;
- All necessary background information will be available to the team;
- All consultants and contractors will be able to meet deadlines;
- The Construction Manager and the contractor(s) will have the capacity to complete the project on schedule and are qualified and experienced in this type of work.
- Permits/licenses, regulatory agreement, and approvals will be granted.
- All affected civic departments approve and support the deliverables;
- Scope will not increase over the Checkpoint #3-5 of the project;
- All stakeholders understand impact relationships between project scope, budget, schedule, and quality and may require compromise on some parameters; and
- Project resource requirements as identified in the Resourcing Section are available.

9. Resourcing

Waste Services will manage the process equipment replacement and upgrades portion of the project and provide a lead project manager. The work will be executed by the successful Operations & Maintenance contractor for the MRF based on open competition. This contract will be re-tendered in 2021 and the scope of this project will be included in the statement of work for that contract as a Design-Build-Operate-Maintain type contract. Contract management will be led by Waste Services staff. IIS will continue to have a support role throughout this project.

IIS Infrastructure Delivery will manage and provide a lead project manager for the end-of-life building equipment and component replacement portion of the scope.

Throughout this project, Waste Services will lead and contribute to the project team and the Design Technical Review Team. Other members of the project team may include other IIS or Waste Services representatives (including the maintenance contractor), or other stakeholders as necessary.

Special Resources

The following special resources are available to the project:

Engineering Services, IIS:

Resources available to review engineering design associated with building refurbishments scope of work.

Infrastructure Planning and Delivery (IPD), IIS:

Resources available for technical and project management support.

Technical Services, Waste Services:

Waste Services Technical Services in-house engineering review is available for: process, electrical, and mechanical disciplines, as well as project management support.

MRF Operational Contractor

Provide field level expertise and input throughout the project.

Operations Resources

Per the above, it is expected that Waste Services will provide resources to participate in the project team. The project team resources will come from both the Technical Services and Sustainable Waste Processing sections.

10. Key Risk(s) and Mitigation Strategy

A comprehensive risk register⁹ was developed for this initiative, in both the Concept stage and the Planning and Design stage. Risks (prior to the mitigation strategies) and their mitigation strategies are summarized below:

Event/Risk Factor	Risk Rating (Score) [Low, Medium, High, Extreme]	Mitigation Strategy (Response)
Changes in recyclables composition	Medium	Ensure equipment selection aligns with market requirements. Specify equipment that can be adjusted for materials. Schedule 5-year rehabilitation analyses post-project.

⁹ Table 8: Project risk register
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Mass Balance estimates are low, resulting in demand for additional capacity at the MRF	Medium	Mass Balance numbers will be validated against actual quantities over time. Throughput requirements will be revisited as required and changes will be incorporated in the design. Excess recyclables can be processed by the existing RDF, a third party, or sent to landfill.
Site utility connection/disconnect may result in change/delay of schedule as timelines for utility companies' services are unpredictable.	Medium	Utility providers will be engaged as early as possible in the project.
Co-mingled glass disposal	Medium	Design will incorporate a mechanism to separate glass upfront at the start of the process. Public education will also take place.
Cost estimates are low resulting in budget or rate increases that are higher than announced to the Utility Committee and the Public	Medium	The project will include contingencies appropriate to each project stage in the project budget. Design will be advanced to Checkpoint 3, including developing more accurate cost estimates, prior to proceeding to final design and construction
Existing equipment available doesn't meet the market's quality standards.	Medium	If standards are not relaxed, more new technologies will become available. Available technologies should be revisited prior to detailed design.
Process design engineer required to integrate multiple vendor technologies for best performance - this may be difficult to achieve	Medium	One vendor may be contracted to supply process design. This may be achievable for a non-phased approach.

Construction for removing older equipment and replacing with new is more difficult than estimated	Medium	Laser scan of existing facility has been performed to obtain data on existing installation and develop 3D models for new equipment installations.
Construction affects processing capacity and managing recycling (or landfill) of collected materials.	Medium	This can be mitigated by using CM project delivery to get CM involved in design early in process so that potential impacts can be identified and managed as much as possible.
Process design and/or equipment doesn't meet throughput or quality standards.	Medium	Clearly specify outcomes of project for consultants and contractors and including penalties or holdbacks as required.
Number of sorters necessary after full retrofit may be more than estimated.	Medium	Financial model has assumed conservative labour reduction schedule in business case development. Further, discussions should be held with the vendors during procurement.
Future equipment does not fit into existing structure or impacts efficiency of operations.	Medium	Development design will review equipment requirements in detail prior to purchase.
Unknown conditions may be encountered during construction (renovation risk)	Medium	Include appropriate contingencies in project budget for unknown conditions. Laser scan of processing area to obtain good drawings.

11. Conclusion and Recommendations

11.1. Conclusion

Summary of the project current development stage:

- This project was initialized to Integrated Infrastructure Services in July 2019.
- In October 2019, Stantec was procured as the prime consultant, responsible for conceptual design and development design up to Checkpoint #3.
- The project is at the stage for the Checkpoint #3 Readiness approval and the Delivery Phase Budget Approval to be entered into the Deliver stage.

The future activities pending on Checkpoint #3 Readiness approval and the Delivery Phase Budget Approval at Checkpoint #3:

- Vendor will be selected to carry out the remaining work as part of the Operating & Maintenance Contract.
- The vendor will be responsible for detailed design, through to commissioning.
- The vendor will be responsible for pre-construction services (Checkpoint #3-4), construction, post-construction services, warranty and commission.
- The vendor will be responsible for the ongoing operation and maintenance throughout the term of the agreement and ensure the facility is maintained to meet Waste Services asset management requirements.

Conclusion:

Accomplishing the Project Goal supports goals outlined in *Vision 2050*, such as an increased waste diversion rate, and the vision and commitments outlined in *The City of Edmonton Waste Services Business Plan 2019-2022*.

To deliver this project for the replacement of the end-of-life equipment and building scope of work as well as the paper/cardboard line upgrades, a capital investment of \$15.7M is required. It is recommended by the Project Team that this Business Case is approved and authorized following Alternative 2 for Capital Expenditure (Funding Approval) of \$15.7 million at Checkpoint #3 of the Corporate PDDM within the 2019-2022 budget. The approval of this Business Case will enter the project to the Delivery Phase in 2021/2022.

11.2. Recommendations

This Business Case corresponds to the PDDM requirements for Checkpoint #3 - Authorization for Capital Expenditure. It is recommended that funding of \$15.7M be approved to progress this project through Delivery Phase for the replacement of the end-of-life equipment and building scope of work as well as the paper/cardboard line upgrades scope, to the completion of the Checkpoint #5.

11.3. Composite Profiles

	Amount	Supported by Profile
Planning and Design Phase	\$787,099.00	CM-81-0005
Delivery Phase (Checkpoint #3-5) Budget	\$15.7M	Funding will be transferred from CM-81-2045 , CM-81-2047 and CM-81-2048 to a standalone profile 20-81-2020

11.4. Project Responsibility and Accountability

The project sponsor is accountable for the project and ensures that the objectives of the project are achieved and in compliance with all City of Edmonton policies, procedures and directives¹⁰.

Project Role	Name and Title	Roles and Responsibilities
Strategy Business Partner	Ellen Tian, Director - Technical Services, Waste Services; Ron Tupas, Project Engineer, Technical Services, Waste Services;	<p>A designated role that identifies and justifies a business need in alignment with the organization's strategic goals (defines the problem and measures of success). Strategy BP is responsible for developing a condensed business case for the project and championing the project. A BP can include the role of both Strategy and Operate BP for a project.</p> <ul style="list-style-type: none"> Responsible for the Development of the Condensed Strategy Business Case that supports the long-term needs, functional requirements, project goals, and objectives. Leads the completion of PDDM Checkpoint 1 with support from IIS as outlined in Strategy Transition Checkpoint 1

¹⁰ Table 9: Project roles & responsibilities
Owned by City of Edmonton | Template Last Updated 2018-07-10

	Peter Lacatusu, Electrical Engineer, Technical Services, Waste Services;	<p>Overview.</p> <ul style="list-style-type: none"> Approval of significant changes to scope, budget, and schedule in conjunction with the IIS Project Sponsor. Participates in development and approves the project charter. Participates in concept and development design reviews to ensure the project meets the Strategy, project goals, and objectives including operational requirements. Participates in lessons learned and risk registry. Responsible for communications and updates to their Section, Branch, and Department as required.
Operate Business Partner	<p>Neil Kjelland, Director, Sustainable Waste Processing, Waste Services;</p> <p>Jawad Farhad, General Supervisor, Sustainable Waste Processing, Waste Services;</p> <p>Michael Robertson, Contract Manager, Sustainable Waste Processing, Waste Services;</p>	<p>A designate project role that participates in identifying and justifying a business need with Strategy BP in alignment with the organization's strategic goals. An Operate BP may also identify and justify a business need to provide on-going, day-to-day programs and service delivery (an "operational" strategy). The Operate BP will benefit from the output and receive the asset to operate, use, and/or maintain. A BP can include the role of both a Strategy and Operate BP for a project.</p> <ul style="list-style-type: none"> Approval of significant changes to scope, budget, and schedule in conjunction with the IIS Project Sponsor. Participates in development and approves the project charter. Participates in concept and development design reviews to ensure the project meets the Strategy, project goals, and objectives including operational requirements. Participates in lessons learned and risk registry. Responsible for communications and updates to their Section, Branch, and Department as required.
IIS Project Sponsor -	Shannon Fitzsimmons,	A designated project role within IIS with the delegated authority and accountability to the Project Manager. The IIS

<p>Planning and Design</p>	<p>Director, Facility Planning and Design, Infrastructure Planning and Design</p>	<p>Project Sponsor provides direction, financial resources, and supports the project objectives.</p> <ul style="list-style-type: none"> • Ensures objectives are achieved through the PDDM for Planning and Design up to the end of Checkpoint #3. • Ensure changes to scope, budget and schedule are approved as required. • Approves key deliverables (eg. Project Charter, Project Management Plan).
<p>IIS Project Manager - Planning and Design</p>	<p>Melanie Lee, Project Manager, Facility Planning and Design, Infrastructure Planning and Design</p>	<p>A designated project role given the delegated accountability, authority, and responsibility to achieve the project objectives. The Project Manager is responsible for planning and designing the project, which includes duties related to management, communications, reporting, review, and approval. The Project Manager is the Agent of the IIS Project Sponsor and the Business Partners.</p> <ul style="list-style-type: none"> • Accountable and responsible for all project management activities, acts as the project lead through planning and design up to the end of Checkpoint #3. • Leads the project team to accomplish the planned deliverables to fulfill the project requirements and ensures all reviews and approvals are complete (outlined in Facility Project Responsibility Matrix). • Manages, tracks, and reports project budget and milestones through detailed plans and scheduled to ensure the project is on budget, on schedule, and within the defined scope and quality. • Adheres to the Project Management methodology, policies, processes, and core requirements, guiding the expectations for each project knowledge excellence (outlined in the Facility Project Classification). • Coordinates the distributions and reviews of Business Partners, other IIS sections, and identified project stakeholders to ensure a collaborative, effective, and efficient delivery of the project. • Ensures project development complies with all applicable policies, codes, and regulations. • Responsible for development of project related Council

		<p>Reports, responses to Executive Leadership Team, and Council with support from the project team.</p> <ul style="list-style-type: none"> ● Responsible for the Public Engagement and Communication requirements, responding to citizen and stakeholder inquiries, and following applicable policies, procedures, and processes. ● Responsible to ensure Occupational Health and Safety requirements, procedures, and objectives are integrated in all project activities and deliverables. ● Acts as the Contract Manager and manages consultant(s) in conjunction with Project Architect, CPSS, and Law as required, following all procurement and contract management requirements, policies, and procedures. ● Leads the development and documentation of project lessons learned and risk register. ● Leads the transition of the project to Facility Infrastructure Delivery at the end of Checkpoint #3. ● Acts as support for the Delivery lead Project Manager, following Checkpoint #3, to achieve the project goals and objectives as defined in the Project Charter and addenda during the planning and design phase up to the end of Checkpoint #5.
<p>IIS Project Sponsor - Delivery (Building Equipment & Systems)</p>	<p>Jack Ashton - Acting Director, Facility Infrastructure Delivery, Infrastructure Delivery</p>	<p>A designated project role within IIS with the delegated authority and accountability to the Project Manager. The IIS Project Sponsor provides direction, financial resources, and supports the project objectives.</p> <ul style="list-style-type: none"> ● Ensures objectives are achieved through the PDDM for Delivery Phase up to the end of Checkpoint #5. ● Ensure changes to scope, budget and schedule are approved as required. ● Approves key deliverables (eg. Project Charter, Project Management Plan).
<p>IIS Project Manager - Delivery (Building Equipment & Systems)</p>	<p>Terry Bohaichuk, Project Manager, Facility Infrastructure Delivery,</p>	<p>A designated project role given the delegated accountability, authority, and responsibility to achieve the project objectives. The Project Manager is responsible for delivery of the project, which includes duties related to management, communications, reporting, review, and approval. The Project</p>

<p>Systems)</p>	<p>Infrastructure Delivery</p>	<p>Manager is the Agent of the IIS Project Sponsor and the Business Partners.</p> <ul style="list-style-type: none"> ● Acts as lead project manager to achieve the project goals and objectives as defined in the Project Charter and addenda during the delivery phase up to the end of Checkpoint #5 ● Accountable and responsible for all project management activities, acts as the project lead through delivery phase up to the end of Checkpoint #5. ● Leads the project team to accomplish the planned deliverables to fulfill the project requirements and ensures all reviews and approvals are complete (outlined in Facility Project Responsibility Matrix). ● Manages, tracks, and reports project budget and milestones through detailed plans and scheduled to ensure the project is on budget, on schedule, and within the defined scope and quality. ● Adheres to the Project Management methodology, policies, processes, and core requirements, guiding the expectations for each project knowledge excellence (outlined in the Facility Project Classification). ● Coordinates the distributions and reviews of Business Partners, other IIS sections, and identified project stakeholders to ensure a collaborative, effective, and efficient delivery of the project. ● Ensures project development complies with all applicable policies, codes, and regulations. ● Responsible for development of project related Council Reports, responses to Executive Leadership Team, and Council with support from the project team. ● Responsible for the Public Engagement and Communication requirements, responding to citizen and stakeholder inquiries, and following applicable policies, procedures, and processes. ● Responsible to ensure Occupational Health and Safety requirements, procedures, and objectives are integrated in all project activities and deliverables. ● Acts as the Contract Manager and manages consultant(s) in conjunction with Project Architect, CPSS, and Law as required, following all procurement and contract
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		<p>management requirements, policies, and procedures.</p> <ul style="list-style-type: none"> Leads the development and documentation of project lessons learned and risk register. Leads the transition of the project to operations at the end of Checkpoint #5.
WS Project Sponsor - Delivery (Process Equipment)	Ellen Tian, Director, Technical Services, Waste Services	<p>Delegates authority and accountability to the Project Manager. The IIS Project Sponsor provides direction, financial resources, and supports the project objectives.</p> <ul style="list-style-type: none"> Ensures objectives are achieved through the PDDM for Delivery Phase up to the end of Checkpoint #5. Ensure changes to scope, budget and schedule are approved as required. Approves key deliverables (eg. Project Charter, Project Management Plan).
WS Project Manager - Delivery (Process Equipment)	Ron Tupas, Project Engineer, Technical Services, Waste Services	<p>A designated project role given the delegated accountability, authority, and responsibility to achieve the project objectives. The Project Manager is responsible for delivery of the project, which includes duties related to management, communications, reporting, review, and approval. The Project Manager is the Agent of the WS Project Sponsor and the Business Partners.</p> <ul style="list-style-type: none"> Acts as lead project manager to achieve the project goals and objectives as defined in the Project Charter and addenda during the delivery phase up to the end of Checkpoint #5 Accountable and responsible for all project management activities, acts as the project lead through delivery phase up to the end of Checkpoint #5. Leads the project team to accomplish the planned deliverables to fulfill the project requirements and ensures all reviews and approvals are complete (outlined in Facility Project Responsibility Matrix). Manages, tracks, and reports project budget and milestones through detailed plans and scheduled to ensure the project is on budget, on schedule, and within the defined scope and quality. Adheres to the Project Management methodology, policies, processes, and core requirements, guiding the expectations for each project knowledge excellence

		<p>(outlined in the Facility Project Classification).</p> <ul style="list-style-type: none"> ● Coordinates the distributions and reviews of Business Partners, other IIS sections, and identified project stakeholders to ensure a collaborative, effective, and efficient delivery of the project. ● Ensures project development complies with all applicable policies, codes, and regulations. ● Responsible for development of project related Council Reports, responses to Executive Leadership Team, and Council with support from the project team. ● Responsible for the Public Engagement and Communication requirements, responding to citizen and stakeholder inquiries, and following applicable policies, procedures, and processes. ● Responsible to ensure Occupational Health and Safety requirements, procedures, and objectives are integrated in all project activities and deliverables. ● Acts as the Contract Manager and manages consultant(s) in conjunction with Project Architect, CPSS, and Law as required, following all procurement and contract management requirements, policies, and procedures. ● Leads the development and documentation of project lessons learned and risk register. ● Leads the transition of the project to operations at the end of Checkpoint #5.
<p>Subject Matter Experts</p> <p>IIS Engineering Services (PRT Team is not involved with this project), Law, etc.</p>		<ul style="list-style-type: none"> ● Reviews designs to ensure planning and design meets functional requirements, project goals, and objectives. ● Provides input and supports reviews of key deliverables. ● Attends meetings as required. ● Engineering Services as outlined in Base Services Guidelines for Facility Projects - Level of Involvement and Budgeting for Engineering Services. ● Ensures all applicable policies, procedures, and processes are followed based on Subject Matter Expertise. ● May be a member of the Project Team or provide support as required.

Senior Buyer (CPSS)	Linda Lu, Senior Buyer, CPSS	<ul style="list-style-type: none"> Assists with the procurement of services. Refers to the roles and responsibilities of the Senior Buyer as defined by Corporate Procurement and Supply Services.
Contract Management & Procurement Unit	Jason Haverstock	<ul style="list-style-type: none"> Assists with the procurement of services. Provides contract management oversight and management reporting.
Prime Consultant - Concept	Manoj Singh, Project Manager, Stantec	<ul style="list-style-type: none"> Interprets the intent of the project to complete schematic design and leads the design process with the Project Team. Production of all concept and schematic design requirements. Supports Communication and Public Engagement requirements and Operational Impact Plan. Resource of the Project Team. Works with the major equipment vendor(s) to provide a design for an engineered process system.
Prime Consultant - Detailed Design	TBD	<ul style="list-style-type: none"> Interprets the intent of the project to finalize schematic design and leads the design process with the Project Team. Production of all schematic and detailed design requirements. Supports Communication and Public Engagement requirements and Operational Impact Plan. Resource of the Project Team. Works with the major equipment vendor(s) to provide a design for an engineered process system. Supports the construction with field inspections, and responding to RFIs. Leads the commissioning of the process, in conjunction with the major equipment vendor(s).
Construction	TBD	<ul style="list-style-type: none"> Becomes involved during the design period and provides

<p>Manager</p>		<p>construction expertise and input to the design.</p> <ul style="list-style-type: none"> ● In conjunction with the Consultant, develops work packages for construction and tenders these out to sub-contractors. ● Manages sub-contractors during the construction period. ● Takes over management of the major equipment contracts and logistics, off-loading, storage, and insurance of equipment during the construction period. ● Resource of the Project Team.
<p>Key Project Team</p>	<p>Waste Services: Ron Tupas (Project Engineer) Micheal Robertson (MRF Contract Manager) Peter Lacatusu (Electrical Engineer)</p>	<p>Project Team works with the Project Manager to successfully deliver project goals, objectives, and deliverables. The membership may evolve through the project phases with key representatives from the Business Partners, Architect, FID Project Manager, Consultant, Contractor, and others as required.</p> <ul style="list-style-type: none"> ● IIS Project Manager chairs and leads the Project Team meetings and works with the Project Team to successfully deliver the project outputs in concept. ● Supports or completes project deliverables and responsibilities as defined by the Project Manager.

12. Implementation Strategy

To implement the proposed alternative, Utility Committee and City Council Approval for \$15.7M is required at Checkpoint #3 to keep the project on schedule slated for completion in 2022. The implementation strategy is to execute the work through the Operations & Maintenance contractor for the MRF. The current operating contract will expire in 2021 coinciding with planned construction start. This could lead to contractual issues with the incoming O&M contractor whose initial terms are based on pre-construction plant performance that will change post-construction leading to renegotiation because of the new conditions. Having the new MRF operator execute the capital project will ensure that contractual renegotiations can be avoided since the new operator will be directly involved in the design and delivery of the upgraded system. Consequently, the new MRF operator will be held more accountable for project outcomes and plant performance. The other benefit of this strategy is that the City can tap into the expertise of the MRF industry operators to develop an

optimal design.

To execute this strategy, the scope of this project will be included as part of the description of work for the new operating contract as a Design-Build-Operate-Maintain type contract.

Given the type of contract that will be procured, Waste Services staff will be responsible for contract management. Waste Services will also specifically manage the process equipment replacement and upgrades portion of the project while IIS Infrastructure Delivery will manage the end-of-life building equipment and component replacement portion of the scope. IIS will continue to have a support role throughout this project.

13. Review and Approval Process

This Business Case is drafted by the Lead Project Manager in Facility Planning and Design Section with input from Waste Services project representatives (Engineering economic analysis, Business Integration team, Finance team etc.).

This Business Case will be:

- Reviewed by key project team members
- Circulated for Directors review and approval
- Submitted for Waste Services Branch Manager review and approval

A City Council Report will be:

- Presented to Utility Committee for recommendation to the City Council for approval

13.1. Business Case Sign Off

The business case will be approved (signed and dated) by the Program Sponsor, Program Manager of the Waste Services Set-Out program, Directors of Technical Services, Sustainable Waste Processing Services, Business Integration and Safety Engagement. The final approval will be received from the Waste Services Branch Manager and the Deputy City Manager prior to submission to Utility Committee and the Council.

Appendix A: Costs - Financial Analysis Summary:

Waste Services MRF Renewal (2020-2054)	ALT 1- Status Quo	ALT 2- Fibre Line and EOL in 2021/2022	ALT 2 - Net Change from Status Quo	ALT 3 - Phased Implementation	ALT 3 - Net Change from Status Quo	ALT 4 - Reduced Scope (EOL only)	ALT 4 - Net Change from Status Quo	ALT 5 - RDF Processing	ALT 5 - Net Change from Status Quo
Total Capital Cost	\$0	(\$15,732,246)	(\$15,732,246)	(\$16,235,156)	(\$16,235,156)	(\$9,497,558)	(\$9,497,558)	\$0	\$0
Total Revenues	\$58,600,642	\$101,547,362	\$42,946,719	\$117,974,500	\$59,373,857	\$64,990,872	\$6,390,233	\$18,334,887	-\$40,265,755
Total Operating and Maintenance Costs	(\$1,061,189,723)	(\$500,030,855)	\$561,158,868	(\$595,927,245)	\$465,262,479	(\$1,174,815,094)	-\$113,625,371	(\$664,654,006)	\$396,535,717
Total Lease Costs	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Project Net Inflows (Outflows)	(\$1,002,589,081)	(\$414,215,740)	\$588,373,341	(\$494,187,901)	\$508,401,179	(\$1,119,321,776)	-\$116,732,695	(\$646,319,119)	\$356,269,962
WACC Discount Rate	5.41%	5.41%	0.00%	5.41%	0.00%	5.41%	0.00%	5.41%	0.00%
Net Present Value	(\$398,964,900)	(\$172,322,029)	\$226,642,872	(\$192,070,811)	\$206,894,089	(\$424,513,660)	-\$25,548,760	(\$261,794,281)	\$137,170,619
IRR	-88.04%	N/A	N/A	N/A	N/A	N/A	NA	N/A	N/A

Appendix B: Revenue Requirement

Reference	Alternatives				
	ALTERNATIVE 1- Status Quo	ALTERNATIVE 2- Fibre Line and EOL in 2021/2022	ALTERNATIVE 3 - Phased Implementati on	ALTERNATIVE 4 - Reduced Scope (EOL only)	ALTERNATIVE 5 - RDF Processing
Base Year	2020	2020	2020	2020	2020
In-Service Year	2020	2022	2025	2022	2020
Cumulative Revenue Requirement (from base year)	ALTERNATIVE 1- Status Quo	ALTERNATIVE 2- Fibre Line and EOL in 2021/2022	ALTERNATIVE 3 - Phased Implementati on	ALTERNATIVE 4 - Reduced Scope (EOL only)	ALTERNATIVE 5 - RDF Processing
CPV @ Yr 5	77,405,222	46,563,473	51,426,857	77,642,361	62,394,104
CPV @ Yr 10	157,524,228	79,002,654	81,287,094	157,258,065	113,454,625
CPV @ Yr 15	231,369,927	107,367,947	107,845,438	230,423,389	159,068,405
CPV @ Yr 20	299,501,481	131,226,821	131,757,758	298,005,906	199,938,391
CPV @ Yr 25	362,418,094	153,056,545	153,587,483	360,517,725	236,662,008
CPV @ Yr 30	420,566,855	173,060,738	173,591,675	418,378,103	269,748,709
CPV @ Yr 35	0	0	191,707,447	0	0
Capital Cost Summary (Base Year Dollars)	ALTERNATIVE 1- Status Quo	ALTERNATIVE 2- Fibre Line and EOL in 2021/2022	ALTERNATIVE 3 - Phased Implementati on	ALTERNATIVE 4 - Reduced Scope (EOL only)	ALTERNATIVE 5 - RDF Processing
Equipment	0	9,545,000	9,545,000	4,845,000	0
Building	0	560,000	560,000	560,000	0
Other (engineering/PM/etc)	0	2,524,718	2,674,718	2,236,059	0
Indirect Costs (insurance/permits/etc)	0	429,410	434,510	259,796	0
Total base costs	0	13,059,128	13,214,228	7,900,855	0
<i>Add: contingency, inflation,overhead</i>					
Contingency	0	1,894,458	1,916,958	1,146,159	0
Inflation	0	255,097	554,955	138,156	0

Overhead/Admin Costs	0	532,304	549,015	312,388	0
Total Capital	0	15,740,987	16,235,156	9,497,558	0

Revenue Requirement Assumptions

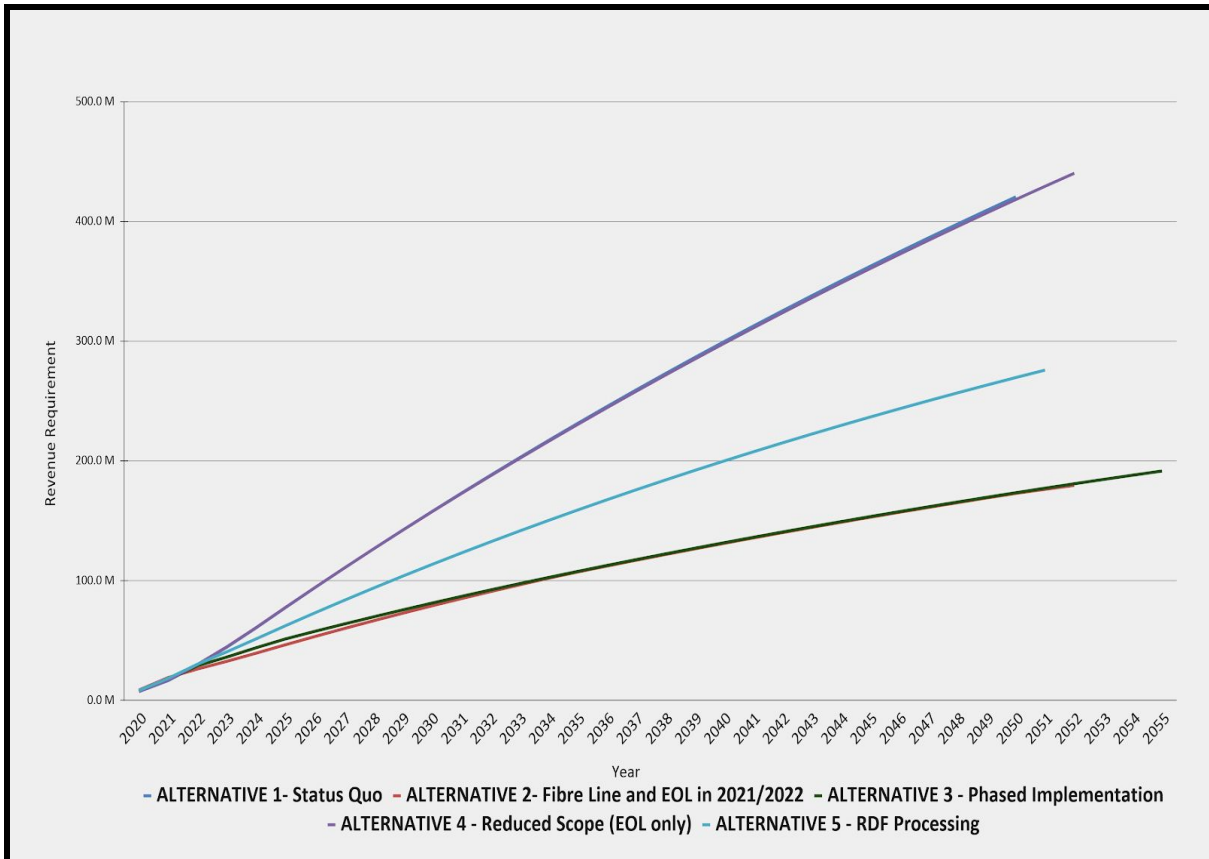
1. Inflation (compounded each year) - 1.70%
2. Contingency - 15%
3. Analysis is based on 30 years to capture the full life cycle costs of the assets
4. Assumes borrowing required at 84% (based on current Utility split) at 4%

Revenue Requirement Summary (cumulative present value)

Calendar Year	ALTERNATIVE 1- Status Quo	ALTERNATIVE 2- Fibre Line and EOL in 2021/2022	ALTERNATIVE 3 - Phased Implementation	ALTERNATIVE 4 - Reduced Scope (EOL only)	ALTERNATIVE 5 - RDF Processing
2020	\$7,541,500	\$8,881,801	\$7,847,128	\$7,800,414	\$8,475,653
2021	\$16,739,185	\$19,302,627	\$17,359,359	\$17,202,004	\$18,616,812
2022	\$29,778,172	\$26,389,440	\$29,059,335	\$30,199,120	\$30,389,872
2023	\$44,488,935	\$32,776,995	\$36,331,663	\$44,850,318	\$40,701,847
2024	\$60,574,661	\$39,546,956	\$44,103,343	\$60,876,361	\$51,457,872
2025	\$77,405,222	\$46,563,473	\$51,426,857	\$77,642,361	\$62,394,104
2026	\$93,959,970	\$53,395,295	\$57,750,424	\$94,119,218	\$73,079,759
2027	\$110,244,168	\$60,048,979	\$63,841,696	\$110,313,209	\$83,521,911
2028	\$126,262,952	\$66,530,804	\$69,791,996	\$126,230,431	\$93,727,399
2029	\$142,021,338	\$72,846,777	\$75,605,721	\$141,876,801	\$103,702,838
2030	\$157,524,228	\$79,002,654	\$81,287,094	\$157,258,065	\$113,454,625
2031	\$172,776,405	\$85,003,946	\$86,840,176	\$172,379,804	\$122,988,946
2032	\$187,782,548	\$90,855,932	\$92,268,869	\$187,247,442	\$132,311,787
2033	\$202,547,223	\$96,563,671	\$97,576,927	\$201,868,055	\$141,428,939
2034	\$217,074,895	\$102,132,009	\$102,767,959	\$216,258,338	\$150,346,004
2035	\$231,369,927	\$107,367,947	\$107,845,438	\$230,423,389	\$159,068,405
2036	\$245,436,585	\$112,312,761	\$112,813,630	\$244,367,169	\$167,601,390
2037	\$259,279,038	\$117,169,174	\$117,685,970	\$258,093,556	\$175,950,040
2038	\$272,901,362	\$121,939,093	\$122,465,785	\$271,606,343	\$184,119,274
2039	\$286,307,544	\$126,624,373	\$127,155,311	\$284,909,247	\$192,113,853
2040	\$299,501,481	\$131,226,821	\$131,757,758	\$298,005,906	\$199,938,391
2041	\$312,486,987	\$135,748,195	\$136,279,132	\$310,899,885	\$207,597,355
2042	\$325,267,791	\$140,190,207	\$140,721,145	\$323,594,672	\$215,095,071
2043	\$337,847,543	\$144,554,527	\$145,085,464	\$336,093,686	\$222,435,731
2044	\$350,229,813	\$148,842,779	\$149,373,716	\$348,400,277	\$229,623,398
2045	\$362,418,094	\$153,056,545	\$153,587,483	\$360,517,725	\$236,662,008
2046	\$374,415,807	\$157,197,369	\$157,728,307	\$372,449,244	\$243,555,375
2047	\$386,226,297	\$161,266,754	\$161,797,691	\$384,197,985	\$250,307,198
2048	\$397,852,842	\$165,266,164	\$165,797,102	\$395,767,035	\$256,921,062
2049	\$409,298,647	\$169,197,028	\$169,727,966	\$407,159,419	\$263,400,442
2050	\$420,566,855	\$173,060,738	\$173,591,675	\$418,378,103	\$269,748,709
2051	\$0	\$176,430,556	\$177,372,349	\$429,425,996	\$275,969,133
2052	\$0	\$179,752,790	\$181,072,176	\$440,305,946	\$0
2053	\$0	\$0	\$184,693,275	\$0	\$0

2054	\$0	\$0	\$188,237,702	\$0	\$0
2055	\$0	\$0	\$191,707,447	\$0	\$0

Cumulative Present Value Revenue Requirement Chart



Appendix C: In-House vs Private Processing Analysis

This section of the appendix provides further analysis between in-house upgrades to the MRF facility compared to complete outsourcing of the work to a vendor. The main analysis is based around the projected tonnage and cost to process (operating & maintenance cost + interest - revenue total for revenue requirement) compared to City run facility vs fully contracted cost. For this analysis only, tonnage projections have remained flat at the 2021 level to maintain appropriate cost comparisons.

	2020	2021	2022	2023	2024	2025	2026
Projected Tonnage	39,810	49,498	49,498	49,498	49,498	49,498	49,498
Alternative 2 O&M Cost	\$8,881,801	\$10,985,062	\$5,888,202	\$5,411,243	\$5,404,964	\$5,396,359	\$5,385,297
Alternative 3 O&M Cost	\$7,847,128	\$10,027,270	\$9,947,971	\$6,523,068	\$6,751,285	\$6,378,702	\$5,477,028
Contractor Cost	\$6,349,695	\$7,894,931	\$7,894,931	\$7,894,931	\$7,894,931	\$7,894,931	\$7,894,931
Cost/Tonne Alternative 2	\$223.10	\$221.93	\$118.96	\$109.32	\$109.20	\$109.02	\$108.80
Cost/Tonne Alternative 3	\$197.11	\$202.58	\$200.98	\$131.78	\$136.40	\$128.87	\$110.65
Cost/Tonne Contractor	\$159.5	\$159.5	\$159.5	\$159.5	\$159.5	\$159.5	\$159.5

The Contractor Cost in the above table is derived from a current contract amount. Assuming the Contractor Cost remains consistent year-over-year, internal cost is projected to be below the cost of outsourcing once capital upgrades are complete. While the contractor cost remains consistent, it is worthwhile to note the list of materials collected by contractors is shorter than what can be processed internally. The cost above does not include the additional cost that would incur due to the upgrade.