



Report to: Development Services Committee

Meeting Date: November 22, 2021

SUBJECT: Automated Vacuum Collection (AVAC) System

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RECOMMENDATION:

- 1) That the report titled Automated Vacuum Collection (AVAC) System be received;
- 2) That the financial feasibility report titled “Langstaff Secondary Plan Area – Vacuum Waste Collection Financial Feasibility Report” prepared by The Municipal Infrastructure Group (TMIG) attached as Appendix A be received;
- 3) That staff consult with the developers in Langstaff Gateway Area, and other relevant development areas in Markham, regarding the results of the feasibility report, the application of AVAC in these development areas and explore potential financial contribution as outlined in the financial section of this report for implementation of the AVAC system
- 4) That staff report back on the implementation strategy for the AVAC system including financial, governance, legal, technical and operational matters
- 5) That Staff be authorized and directed to do all things necessary to give effect to this resolution.

PURPOSE:

The purpose of this report is to provide an overview of AVAC and to provide an overview of considerations for implementation in growth areas in Markham. The report summarizes a consultant’s report on a financial analysis of the implementation of AVAC in Langstaff and seeks DSC concurrence for staff to consult with developers on implementation of AVAC

BACKGROUND:

Generally Ontario municipalities are responsible for waste management functions including the collection of waste which is accomplished using garbage collection vehicles

collecting from, in the case of multi-residential buildings, multiple large waste containers located in internal waste rooms, back alleyways, or external parking lots.

While other urban services, such as water, sewer, electricity and IT infrastructure, are provided underground, waste remains a surface-level service. However, in recent years, automated below grade waste collection systems have been examined, and in some cases implemented, in various cities in high-density areas.

AVAC systems are designed to transport waste at high speed through underground pipes to a centralized terminal facility. The AVAC system is suitable for space -constrained pedestrian oriented developments where there is an emphasis on the public realm. AVAC systems are available 24 hours a day, are not impacted by weather, eliminates trash bags from the street and reduces CO2 emissions as a result of reduced trucking activity. It is more cost effective to pre-install the system in new development areas rather than retrofitting a system once development is already complete. AVAC systems are scalable allowing for small pilots with future expansion capability.

The AVAC process begins with the deposit of materials into intake inlets which may be specialized for waste, recycling, and organics. The material is then pulled through an underground pipeline by air pressure differential created by large industrial fans. Sensors help ensure that only one stream of waste material is travelling through the pipe at a time. The pipelines converge at a central facility terminal that uses automated software to direct the waste to the proper container. (Refer Appendix B for a diagram of how the system works). AVAC systems have been widely used in cities around the world (Refer Appendix C for examples of city AVAC installations worldwide)

AVAC Potential For Future Developments

Markham staff have gained familiarity with AVAC systems and have studied various systems and toured several areas with AVAC waste collection. Furthermore, over the past many years meetings have been held with the development sector, senior staff and system vendors to explore AVAC opportunities for Markham.

In 2014, an Automated Vacuum Collection Feasibility Working Group was formed consisting of Senior Management and members of Council. Several Workshops were held including presentations from various vendors and developers to evaluate options for AVAC in future planned developments.

In 2015, City staff and Councillors visited the new AVAC installation “La Cité Verte” in Quebec City which manages three waste streams (organic, garbage and recyclables) with 48 inlets for household use and 9 inlets for commercial use in a multi-residential development.

In 2016, the AVAC Working Group contracted with Canadian Urban Institute to complete a Feasibility Study which evaluated AVAC system opportunities. Potential developments identified in the Feasibility Study included Markham Center, Buttonville Airport lands, and the future Langstaff development. The Feasibility Study was provided to Markham District Energy for assessment but no synergies were identified.

In February 2020, presentations were made by Swedish municipalities highlighting the advantages of implementing AVAC amongst other Smart City initiatives. Following the Smart Cities workshop, the City, in collaboration with Business Sweden, conducted a workshop in February 2021 focused on implementing AVAC. Representatives from the City of Bergen, Norway made a presentation sharing their experience in implementing the AVAC system and its benefits. The workshop also included presentations from the consultant to the Lakeview Project in Mississauga (redevelopment of 177 acres of former industrial lands into a cohesive live-work-play neighbourhood) which is considering implementing an AVAC system

Following the workshop, staff engaged the Lakeview Project consultant to provide a financial feasibility analysis for the Langstaff development. The consultant completed the financial review and provided the City with the report (Appendix A). Details of the financial analysis from the consultant's report are discussed in the Financial Section of this report.

OPTIONS/ DISCUSSION:

Opportunities for Implementing AVAC

The City of Markham provides multiple opportunities for consideration of smart city initiatives such as AVAC. The development of Markham Centre provides a potential opportunity to implement AVAC as well as future development in the Langstaff community. Other prospective areas in Markham include emerging secondary plan areas such as Mount Joy, the Buttonville lands and development within the urban expansion area employment lands in the north-west portion of the City

Markham Centre

Markham Centre, as the new downtown area of the community, continues to grow but also has areas of established residential, office and retail development. The City is currently undertaking a secondary plan process for Markham Centre and smart cities initiatives such as AVAC have been identified as worthy pursuits. While the existence of already built infrastructure and servicing can be an impediment, opportunities exist especially in newly developing areas such as the future Unionville GO transit-oriented development area.

Langstaff

Another area particularly well placed for implementation of AVAC is the Langstaff Gateway Area, which has been identified for further study as a candidate area for AVAC installation. The area is slated for significant intensification and mixed-use development over time and the western portion between Yonge Street and Cedar Avenue has recently been identified by the Province as a Transit Oriented Community (TOC) related to the extension of the Yonge North Subway. According to the Province, TOC sites are part of the government's plan to build new, sustainable transit by focusing more housing and jobs near or at transit stations, The site is also highly accessible by both highway, rail and local transit.

The Langstaff Gateway Secondary Plan (OPA 183) was adopted by Council on June 8, 2010. OPA 183 establishes policies and related requirements for the logical and successful implementation of the Langstaff Gateway, providing for an ultimate population of 32,000 (15,000 units) and approximately 15,000 jobs. This Regional Centre is intended to be a complete, pedestrian and transit oriented community having a full range of uses and served by the proposed Yonge North Subway Extension (YNSE), GO Transit, and York Region Transit. As noted above, the lands between Yonge Street and Cedar Avenue are part of the Province's identified TOC proposal and may result in increased development from what was planned in the Langstaff Secondary Plan.

Currently two development applications have been submitted in the Langstaff Gateway. Condor Properties Ltd located on the west side of Langstaff has submitted draft plan of subdivision and zoning by-law amendment applications to develop one 50 and one 45 storey tower that would include 1,090 residential units, 929 m² of commercial space, and 695 m² of community space. The applications were approved on February 11, 2020. Condor is currently completing detailed engineering and preparing a site plan application. Langstaff Land Holdings Ltd. (Kylemore) has submitted draft plan of subdivision and zoning by-law amendment applications to develop six buildings between 7 and 49 storeys in height that would include 1,668 residential units and 1,891 m² of commercial space. The public meeting for this proposal was held on June 28, 2021. Staff are currently reviewing the applications.

Benefits and Limitations of the AVAC System

AVAC requires the installation of a system of underground pipes within both the City right-of-way and private property limits. A collection station/terminal must also be constructed to allow for the vacuum suction requirements that the AVAC system needs to function. Typically, the maximum length of the AVAC piping infrastructure serving one collection terminal, cannot exceed a 2.0 km in length. Consideration of the location of the central collection terminal must have regard for potential noise and vibration impacts/complaints from adjacent development.

The City will need to navigate a number of legal agreements required for the various connections to the buildings as well as to address any operations and maintenance activities required for access.

Some of the key benefits and limitations of the AVAC systems versus a traditional waste collection system are:

Benefits:

Spatial

- Reduced above-grade space requirements for 3-stream waste storage (bulky material/cardboard only) Bulky material/cardboard collection will require suitable ROW cross-section to allow for collection
- Release of surface space for community needs or development – inlets in public space reduces litter and manual collection
- Improved public realm and citizen experience by reducing litter, rodents, and collection vehicles

Technical

- Reduced roadway maintenance, noise, congestion and accidents
- System is available 24/7
- Increased resilience to adverse events – weather

Environmental

- Reduced odours and carbon emissions
- Reduced truck traffic/congestion

Waste Diversion

- Improved waste diversion, as system is never full
- ‘Smart City’ technology to increase diversion and participation (i.e. access controlled)
- Ability to collect separated 3-streams from residential and small commercial tenants
- Benefit to commercial users may increase ICI diversion rates

Built Environment

- Opportunity to reduce truck loading space and first floor heights currently designed to accommodate truck access.
- Makes shared loading spaces, transportation of waste throughout the building easier.
- Scalable system as development expands

Limitations

- Significant capital/construction costs requiring front end investment
- Significant legal time will be required to consider decommissioning/abandonment of system within ROW
- Increased design work required due to competing interest in the ROW (MDE, telecom, water, sewer etc.,)
- May require public consultation prior to implementation
- Affordability for developers and residents
- Financial Feasibility – Risks
 - Densities not being realized as planned
 - Participation by developers
 - Actual costs higher than what is projected in the business case

While AVAC can deliver significant improvements in the day-to-day operations of waste management, there are certain waste streams such as cardboard and bulky items that cannot be managed with AVAC. Consequently, alternative systems or arrangements need to be made for those waste streams

Environmental Services - Waste Management staff have been a part of the AVAC assessment and study process and concur that AVAC systems have many benefits in high density intensification developments.

FINANCIAL CONSIDERATIONS

The Municipal Infrastructure Group has prepared a Financial Feasibility Report [Note: all figures are in 2021 dollars.] with respect to implementing an AVAC system in Langstaff. The report is meant to be directional in nature and would require further refinement of assumptions contained within the report.

As each planning area has different land use characteristics and development potential the following analysis is specific only to Langstaff. Implementing AVAC in other areas, especially when there has already been significant development may result in a much different business case.

The report was prepared using the following growth assumptions for Langstaff to 2065:

15,000 residential units

746,000 sq. ft. of retail and commercial gross floor area (GFA)

206,260 sq. ft. of community services GFA

2,400,000 sq. ft. of office GFA

The capital costs of an AVAC system in Langstaff were estimated to be \$32.2M, with approximately 72% of those costs to be incurred by 2035 (see table below).

	Phase 1 2022-2035	Phase 2 2036-2050	Phase 3 2051-2065
East System			
Pipes in Roadways	\$ 461,000	\$ 666,000	\$ 308,000
Building Connections	\$ 1,740,000	\$ 2,320,000	\$ 2,030,000
Parks Infrastructure	\$ 60,000	\$ 139,000	\$ 0
Central Terminal	\$ 7,185,000	\$ 0	\$ 0
Total East System	\$ 9,446,000	\$ 3,125,000	\$ 2,338,000
West System			
Pipes in Roadways	\$ 564,000	\$ 308,000	\$ 205,000
Building Connections	\$ 2,030,000	\$ 580,000	\$ 870,000
Parks Infrastructure	\$ 139,000	\$ 30,000	\$ 30,000
Central Terminal	\$ 7,185,000	\$ 0	\$ 0
Total West System	\$ 9,917,000	\$ 918,000	\$ 1,105,000
20% Contingency	\$ 3,873,000	\$ 809,000	\$ 689,000
Total East + West Systems	\$ 23,236,000*	\$ 4,852,000*	\$ 4,132,000*

The capital cost estimates assume:

- Capital costs to be staged as community develops and AVAC system expands
- No adverse soil conditions.

- AVAC piping will be installed concurrently with the typical municipal infrastructure (sewers, watermains etc.)
- Sufficient room is available within the roadways to accommodate the AVAC pipe infrastructure
- No land cost for the terminals they are expected to be incorporated under City parkland
- The extent of self-emptying litter bin infrastructure within the parks have been reduced to reflect the “business-as-usual” waste receptacle requirements identified by the City Parks staff
- 20% contingency applied to all capital and operating costs provided by AVAC suppliers

The annual operating costs were estimated to be \$1.34M at buildout (which are ramped up over time) and includes \$300,000/year to keep the AVAC system and terminals in a state of good repair. Over the 43 year buildout, operating costs are estimated to be \$40.2M

From implementation to full build out in 2065, the total capital and operating costs of AVAC are estimated to be \$72.4M.

As part of the financial analysis, potential future cost avoidance was also considered. The premise is that the City would attempt to collect contributions from the various stakeholders at an amount equal to the savings that would accrue to each of the parties (Note: all the per unit rates are in 2021 dollars and would need to be indexed on an annual basis).

City of Markham contributions (\$13.2M) - Under the status quo methodology (i.e. traditional bin pickups through a third party service provider), the costs to the City are estimated to be \$11.3M until buildout of Langstaff (2065). This only accounts for residential waste as non-residential sites are responsible for their own waste disposal. As well, the City would save approximately \$1.9M as City staff would no longer be required to collect waste out of Langstaff parks.

Developer contributions (\$16.5M) - Under an AVAC system, developers would be able to build a smaller waste room in their buildings, freeing up space for other uses, or potentially another unit. A building connection fee amounting to approximately \$700 per residential unit, \$3.20 per commercial sq.ft GFA, and \$1.48 per office sq.ft GFA was calculated based on an estimated waste storage space savings by each of these land uses. It should be noted that there is little industry precedence for establishing costs attributed to waste room space savings under AVAC, and as a result these fees would be subject to the Langstaff developer buy-in.

Residential Customer contributions (\$7.0M) - A Condo Corporation fee of \$22/unit/year, would be required as a funding contribution, consistent with current costs for bin jockeying and bin cleaning/ maintenance/replacement.

Non-residential Customer contributions (\$2.9M) - As non-residential buildings would be able to connect to AVAC, a per square foot charge of \$0.044/year would approximate the savings to non-residential customers as they would be able to reduce their waste collection costs.

The following table summarizes the above information:

	2023-2065
Capital and Operating Costs	(\$72.4M)
City Contributions	\$13.2M
Developer Contributions	\$16.5M
Residential Customer Contributions	\$7.0M
Non-residential Customer Contributions	\$2.9M
Funding Shortfall	(\$32.8M)

Setting the various stakeholder contributions at amounts equal to their cost savings results in a funding shortfall of \$32.8M over 43 years.

Sensitivity Analysis

The phasing plan supplied to the consultant by the City provides for an equal distribution of 385 residential units developed per year for the first 13 years, 243 residential units developed per year over the following 15 years, and 423 residential units developed per year for the final 15 years over a total of 43 years of buildout. Building connection fees, based on builder Business As Usual (BAU) costs comprise a significant portion of the system revenues. With too few units/year spread out over so many years, it will take 40 years before revenues start to exceed expenses.

If densities increase in Langstaff as is expected through the Province's TOC process, the \$32.8M funding shortfall should be reduced, as revenues would increase in tandem with the additional growth, but the expense structure would only marginally increase. Hypothetically, if Langstaff densities doubled compared to this business case, the \$32.8M shortfall would virtually be eliminated.

Options to Fund the \$32.8M Shortfall

1. Federal/Provincial Grants and Low Interest Funding – any grants obtained would help in reducing the \$32.8M shortfall
2. An increase in End User Fees charged to the Residential Condo Corporations from \$22/unit/year to \$125/unit/year. This equates to a \$103/year additional

charge to a condo owner. The average condo owner currently pays approximately \$700 per year in Markham taxes.

3. A City wide tax increase of \$750,000, which results in a 0.46% tax increase. This option spreads the cost over the entire tax base, even though just Langstaff residents and businesses benefit from AVAC.
4. An increase in Residential Builder Connection Fees from \$700 per unit to \$2,100 per unit. Of the \$2,100 connection fee, \$700 represents the estimated cost savings to the developer and \$1,400 represents a premium payment to facilitate implementation of the system. Likewise the commercial builder connection fee would increase from \$3.20 per sq. ft. to \$9.60 per sq. ft. and the office builder connection fee would increase from \$1.48 per sq. ft. to \$4.44 per sq. ft. This option is likely the most feasible, especially if developers can use the presence of an AVAC system to help sell their units.

A combination of the above options is also possible.

Staff recommend pursuing Option 1 (grants or low interest funding) and Option 4 (approaching Langstaff developers to contribute via a Builder Connection Fee based on the above rationale).

Apart from the above recommended options from the consultant's report, staff are looking into possibilities of a Public Private Partnership (PPP) model to fund this initiative.

Conclusion

AVAC is a proven technology that is used in large cities around the world. The system is designed to improve waste management in green field and high density developments. Based on the financial implications detailed in the report, implementing an AVAC system in Langstaff Gateway Area is feasible subject to the decision on the funding options.

Being a relatively new system of customer service delivery in Ontario and Canada there are other financial, governance, legal, technical and operational matters that require to be investigated prior to implementation of this system. Staff will develop an implementation strategy based on direction from DSC and report back at a future DSC meeting.

HUMAN RESOURCES CONSIDERATIONS

None

ALIGNMENT WITH STRATEGIC PRIORITIES:

The initiative aligns with the City's priorities of Managing Growth and Environment

BUSINESS UNITS CONSULTED AND AFFECTED:

Planning, Engineering, Environmental Services and Finance Departments

RECOMMENDED BY:

Arvin Prasad, Commissioner,
Development Services

Morgan Jones, Commissioner,
Community Services

Trinela Cane, Commissioner
Corporate Services

ATTACHMENTS:

- Appendix A - TMIG Consultants Financial Feasibility Report
- Appendix B - Diagram of how the system works
- Appendix C - Examples of AVAC installations