City of Edmonton
Office of the City Auditor

Forestry Services Audit

September 1, 2020

Report Highlights

Audit Objectives

The objectives of this audit were to:

1. Determine whether the City is effective in maintaining and monitoring their tree inventory.
2. Determine whether the City is efficient in using resources to support a healthy and growing urban forest.
3. Determine whether guiding documents provide clear direction in managing the City's urban forest.

Scope and Methodology

The scope of this review included the documentation, controls, processes, and procedures related to the City's Corporate Tree Management Policy and Procedure.

We used the following methods to gather evidence to conclude on the above objectives:
*   Reviewing related policies, procedures, bylaws, management plans and guidelines;
*   Discussions with management and staff;
*   Analysis of data; and
*   Testing samples for confirmation of work completed and inspections.

Statement of Professional Practice

This project was conducted in accordance with the International Standards for the Professional Practice of Internal Auditing.

Audit Summary

Effectiveness

In order to determine whether the City is effective in maintaining and monitoring their tree inventory, we reviewed processes to confirm whether:

- City staff and contractors are completing the planned tree maintenance work;
- The inspection process is adequate and consistent;
- Forestry and Natural Areas staff completed mandatory training; and
- The City has plans in place to deal with pest outbreaks and natural disasters.

Recommendation 1 Review pruning targets	Review pruning service level and budgeted workload to ensure performance targets can be met within their current budget.
Recommendation 2 Inspections and invoices	Ensure inspections are properly documented and invoices are verified for tree maintenance.

Efficiency

In order to determine whether the City is efficient in using resources to support a healthy and growing urban forest, we reviewed:

- The tree inventory data to determine if it is accurate and complete;
- The technology used to track and conduct tree maintenance work;
- Equipment usage and utilization; and
- City and contractor costs for pruning, planting and watering.

Recommendation 3 Review tree inventory data	Conduct a periodic review of the tree inventory to ensure data is complete and accurate.
Recommendation 4 Review equipment utilization	Review the equipment utilization to identify opportunities to optimize the use of forestry equipment.

Guiding Documents

In order to determine whether guiding documents provide clear direction in managing the City's urban forest, we reviewed them for:

- Clarity, accuracy, and consistency.
- Methodology, accuracy, targets, and comparability of the measures in place to assess performance.

Recommendation 5 Update guiding documents	Review and update the guiding documents relating to Forestry Services to improve their clarity, accuracy, and consistency.
Recommendation 6 Review performance measures	Review Forestry's publicly reported performance measures to ensure they are understandable, accurate, reasonable, and comparable.

Background

Forestry Services at the City of Edmonton

The Corporate Tree Management Policy outlines the roles and responsibilities in managing the City of Edmonton's (City) urban forest. The policy's purpose is to ensure the growth, sustainability, acquisition, tree maintenance, protection and preservation of trees in the City's urban forest (urban forest).

The urban forest includes all City owned ornamental trees (trees on boulevards and in open spaces such as parks) and trees in the natural areas on City owned land.

The two main groups that manage the urban forest are:
- Forestry Operations; and
- Natural Areas (formed in 2018).

Forestry Operations is responsible for the City's ornamental trees and consists of the following functions:
- Planting - Planting, watering, and assessing the tree inventory.
- Pruning - Pruning City trees.
- Community Forestry - Supporting other City Departments and the public, answering inquiries relating to the urban forest and taking care of Neighbourhood Renewal.
- Project Forestry - Managing forestry projects including cost recovery work such as IIS projects and Light Rail Transit projects.

Natural Areas is responsible for the trees in the City's natural areas and consists of the following functions,:
- Natural Areas Coordination - Strategic planning, including risk management and stakeholder relations.
- Natural Areas Hazard Mitigation - Identifying hazards and taking corrective actions.
- Invasive Weeds Coordination - Identifying invasive species and taking corrective actions.
- Natural Areas Operations - Managing operations such as trail crews, homeless camp cleanup and mechanical weed removal.

Ornamental Trees

Ornamental trees provide many benefits to the City and its citizens including:

- Improving air and water quality, moderating temperature and reducing exposure to ultraviolet rays.
- Reducing energy costs during winter and summer as trees provide shade and windbreak, potentially increasing land and property value for those situated near trees and green spaces.
- Providing aesthetic value and improved quality of life.

The City keeps an inventory of its ornamental trees. Using this inventory they can determine the diversity of tree types, the value of the trees, and the age of the trees. As of January 2020, there are over 385,000 ornamental trees in the City's inventory listing. This has grown by approximately 14% from the 337,000 trees in 2015. Understanding these aspects of the inventory will help the City complete tree maintenance work effectively and efficiently.

Types of Trees

The City has many varieties of trees in its inventory. The general industry guideline is to have no more than 10% of any one tree species. A diverse urban forest provides habitat for a wider range of organisms and increases resilience to pests and diseases such as dutch elm disease.

The following graph shows the top ten individual tree species owned by the CIty.
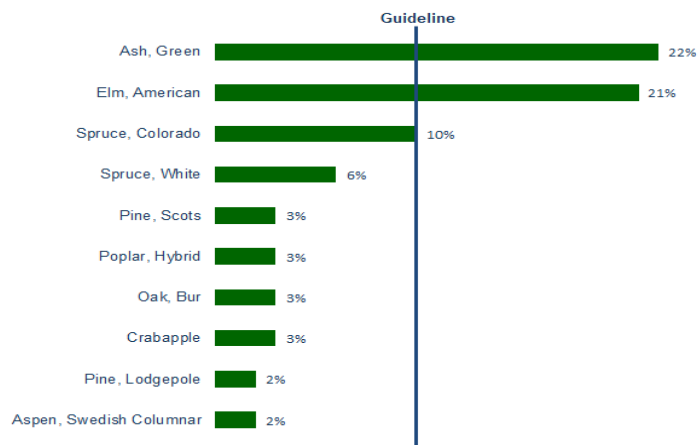
Elm and ash trees make up 43% of the City's tree inventory.

The City has 3 tree species over the 10% industry guideline. Forestry is aware of the importance of tree diversity and is concerned about the high percentage of elm and ash trees. Some of the action taken to address diversity include:

- Reducing the planting of ash trees over the last 4 years.
- Removing ash and elm trees from the list of recommended species for the *Commemorative Tree and Request to Plant* program.
- Purchasing and trialing new tree varieties that can grow and survive in Edmonton to increase tree diversity.

Tree Value

Tree value is commonly calculated using the trunk formula[1].

City trees are worth approximately $1.8 billion. The majority of this is elm and ash trees.

|	Elm trees	- $749 million - 42% of total value of all trees - $4,700 per tree
	Ash trees	- $421 million - 23% of total value of all trees - $8,800 per tree
	Other trees	- $630 million - 35% of total value of all trees - $3,000 per tree

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[1] Trunk Formula - Cross Sectional Area [(Diameter Breast Height/2)^2 * 3.14] * Tree Species Rating * Basic Unit Value of $11.01 * Tree Condition %.

Age of Trees

The age of a tree is estimated using the Diameter Breast Height (DBH)[2] as a proxy for the age. There are industry guidelines for the diversity of ages within a tree population.

60% of the City's trees are considered young.
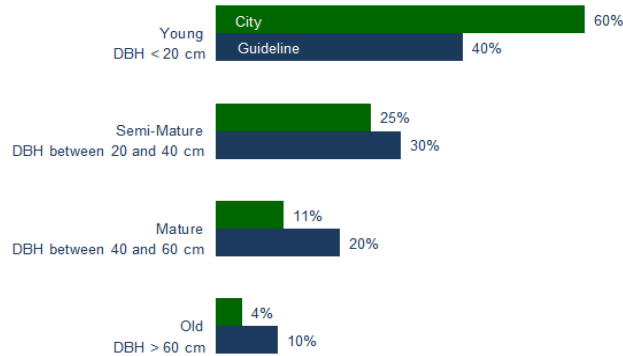
Age diversity is important in maintaining a healthy and stable urban forest.

Natural Areas

There are over 2,500 hectares of natural areas owned by the City with an estimated value of over $5 billion.

Natural areas are defined as an area of land or water that is naturally occurring and contains native vegetation. This includes grasslands or forests, but not sports fields or schoolyards.

The City has identified 434 natural area sites in the City. They are currently in the process of completing a risk assessment for each site by evaluating each of them for weeds, vandalism, homeless camps, garbage, tree damage, disease, and fallen trees. Once the risk assessment is complete, this will allow for better prioritization of work. Currently, Natural Areas attend to work on a reactive basis. (e.g., when a citizen reports a hazard).

In 2019, they had evaluated 24 of the 434 sites (5.5%). The goal is to evaluate all 434 sites by December 2028.

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[2] DBH - measured in centimetres and at a height of 1.2 metres above ground.

Financial Information

Over the past 5 years, Forestry's average annual expenditures are $11.1 million .

Forestry's average expenditure budget for each of the past 5 years is $9.7 million. The average amount it actually spent was $11.1 million each year. The over expenditures were due to recoverable work, such as neighbourhood renewal, special projects, and accident claims. These resulted in additional revenues of $1.3 million per year. Overall, the result is a nearly balanced budget.

Natural Areas spent $2.7 million in 2019 (its first full year of operations).

The Natural Areas group was formed in the summer of 2018. The budgeted expenditures for 2019 was $2.9 million and actual expenditure was $2.7 million. This also results in a nearly balanced budget.

Tree Reserve Fund

The balance in the Tree Reserve Fund at the end of 2019 was $8.2 million.

Forestry maintains a Tree Reserve account to collect and distribute funds for the growth of the City's urban forest. The majority of collection into the Tree Reserve is received from insurance claims or construction projects for tree damage. Withdrawals from the reserve are mainly used to fund the planting of new trees.

The balance of the Tree Reserve has been increasing each year since 2009.

$8.2 million in the reserve in 2019

$3.4 million in the reserve in 2014

$500,000 in the reserve in 2009
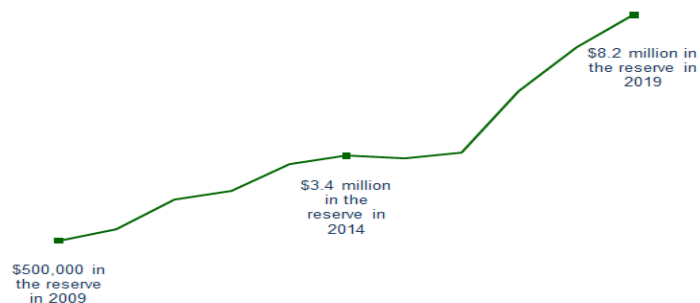
Forestry did not withdraw from the reserve in the past 2 years as they were updating the *Tree Reserve Policy*. Now that the Policy is in place, Forestry has put in a plan to use the reserve to increase the City's tree canopy[3] coverage. They plan to allocate 65% of the reserve for new tree growth and 35% for tree replacement.

The City's goal is to increase the canopy coverage across the City to 20%. In 2019, the canopy coverage was 13.8%.

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[3] The uppermost layer in a forest, formed by the crowns of the trees.

Effectiveness

Summary of Findings

We reviewed four areas of Forestry Services and/or Natural Areas to determine their effectiveness and found:

1. Forestry has not been effectively completing tree maintenance work:
   - They have not achieved the yearly targeted tree prunings for the past three years.
   - They are not completing tree pruning within the targeted four and seven year cycles.
   - They are not planting the majority of trees within the three year target after being removed.

   We did find that the number of waterings of newly planted trees appear reasonable.

2. Forestry can improve its inspection process by documenting the tree maintenance inspections and verifying the work completed by reconciling invoices with the paper maps used to track work location.

3. Mandatory training for staff is substantially complete.

4. Plans are in place to identify, detect, and deal with pest infestation.

Tree Maintenance

Tree maintenance is defined as work conducted on City trees by trained urban forestry personnel. This includes pruning, tree removal & replanting, and tree watering.

Pruning

The City prunes trees to maintain the tree's health and structure, for public safety, beautification, and utility clearance. Each year the City sets a target for the number of trees they will prune; this is based on the service target to prune elm trees every 4 years and all other trees every 7 years. The 4 year service target for elm trees is particularly important in order to prevent/limit Dutch Elm disease. Pruning all other trees every 7 years would also limit the spread of pests such as Emerald Ash
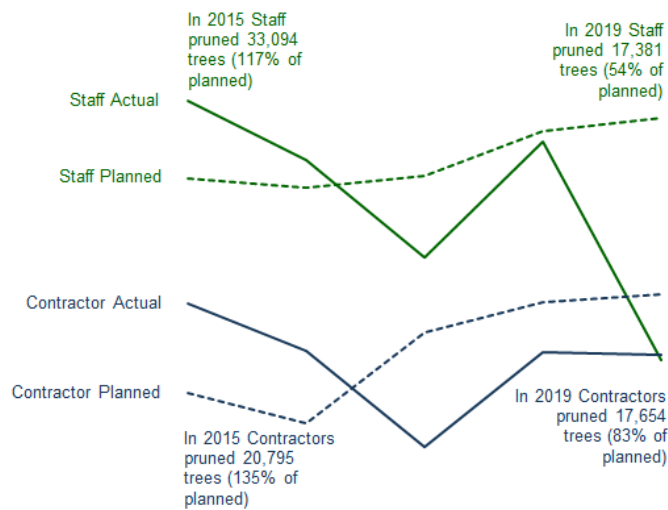
Borer. The plan in 2019 was for City staff to complete about 60% of the pruning and contractors complete the remainder.

Planned Pruning vs Completed Pruning

The amount of trees Forestry staff and contractors have pruned compared to the amount of trees Forestry planned to be pruned has been decreasing since 2015.

In 2015, Forestry staff and contractors pruned 53,889 trees (123% of planned). In 2019, they only pruned 35,035 (66% of planned).

In 2015 Staff pruned 33,094 trees (117% of planned)

In 2019 Staff pruned 17,381 trees (54% of planned)

Staff Actual

Staff Planned

Contractor Actual

Contractor Planned

In 2015 Contractors pruned 20,795 trees (135% of planned)

In 2019 Contractors pruned 17,654 trees (83% of planned)

Management noted a variety of reasons for why the number of trees pruned has decreased, including:

- In the past they pruned smaller trees which resulted in more trees being pruned.
- Recently they have been pruning trees in complex locations with high traffic such as Whyte Avenue and Jasper Avenue, which results in fewer trees being pruned.
- In recent years, there were delays in recalling seasonal staff to complete the work plan.
- In recent years, staff were focused on other tasks such as storm response instead of the pruning program.

Forestry indicated that starting in November 2019, an inspector will manage and focus on the pruning program.

Pruning Cycle

The City's service target is to prune elm trees every 4 years and all other trees every 7 years. We found that the City has met this target for 47% of elm trees and 52% of all other trees requiring pruning (deciduous trees only).

Pruning cycle targets have not been met.

We discussed with management the reasonability of the four and seven year pruning cycle. Research provided by management indicates that frequent pruning will maintain the health of the tree and reduce the risk of pest infestation. Additionally, tree condition is one of the inputs to calculate tree value. Therefore, any change in condition would change the value of the tree. If pruning cycles were extended beyond five to seven years; the reduction in tree value would be greater than any realized cost savings.

$7 million to prune the remaining elm and deciduous trees.

We obtained pruning contract rates from existing contracts for the pruning of elm trees and non-elm trees. These rates are based on the size of the tree. We used these rates to estimate the amount required to prune the shortfall for both elm and deciduous trees that currently do not meet the pruning cycle target. Based on these rates, the estimated cost is approximately $3 million for elm trees and $4 million for deciduous trees.

Recommendation 1
Review pruning targets

Review pruning service levels and budgeted workload to ensure performance targets can be met within their current budget.

Responsible Party
Branch Manager, Parks and Roads Services

Accepted

Management Response
Administration is currently developing an Urban Forest Asset Management Plan (UFAMP) that will clearly define goals, timelines, budgetary and staffing requirements, and measurement and monitoring techniques. The UFAMP will enable City Operations to

set pruning service levels and meet performance targets.

📅 **Implementation Date**
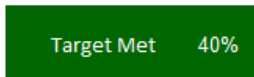November 30, 2021

Tree removal and replanting

In 2009, the City's Urban Forest Management Plan committed to growing the urban forest canopy from 10% to 20% coverage. In addition to planting new trees and ensuring the growth of planted trees, the City also aims to ensure that all trees removed[5] are replanted. The target is to replant trees within 3 years of removal.

The process to remove and replant a tree had previously required 8 visits under normal circumstances. In 2018/2019 with the help of the Business Performance and Customer Experience (BPCE) Branch, the process was streamlined through the identification and elimination of non-value added activities. The number of visits has been reduced to six visits[6] by a crew.

Prior to December 2019, Forestry kept track of the tree status (e.g., date removed, date replaced) on spreadsheets. There is a spreadsheet for each quadrant of the City with tree removal dating back to 1997. We reviewed the Southwest quadrant to get a sense of time required to replant a tree after removal.

> 4,500[4] trees removed were not replanted within the target of 3 years (60%) (SW region).

Replacement trees planted within 3 years	Replacement trees not replanted or replanted after 3 years
Target Met 40%	**Target Not Met** 60%

Management noted the reason for the backlog is due to droughts in the early 2000's which led to a large number of trees that were removed. The current capital profile indicates

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[4] Approximately 1,500 trees had a replant date that was more than 3 years and 3,000 trees are currently vacant with a removal date of more than 3 years.
[5] Removal of trees can occur for a variety of reasons including construction and new developments.
[6] Visits include assessment, tree removal, planning & routing, first-call, stump grind, and planting.

approximately 3,000 trees will be planted each year. From 2015 to 2019, Forestry achieved this target.

Tree watering

27,000 less waterings than planned in 2019 resulted in savings of $227,000.

Newly planted trees require more water than established trees in order to adapt to their new environment and help their roots to grow. The City contracts out water trucks to water new trees. The City's guideline is to water new trees for an estimated 21 waterings in the first 3 years. Using this guideline, we estimated there to be approximately 131,000 waterings in 2019. They completed 104,000 (79%).

Management indicated that a higher than average amount of rain that summer resulted in less watering required. This explanation is valid[7] as there was a higher than average amount of precipitation in 2019. When there is sufficient precipitation for trees, Forestry limits the use of water truck usage to conserve financial resources.

Inspections

A mix of City staff and contractors complete maintenance work for over 385,000 City trees. Monitoring this work is complex. Therefore, having a formal inspection process for pruning and watering helps ensure that work is completed in accordance to the required standards.

Pruning inspections

The City's *Task Standards Manual* establishes the pruning standards. When a tree is pruned, the pruning crew will mark it on a paper map. The inspector notes any deficiencies on the same paper map and follows up with the applicable pruning crew.

In Fall 2019, with the support of the BPCE Branch, a Tree Pruning/Inventory Management review was conducted. An inspection opportunity was identified resulting in the hiring of a dedicated inspector to perform inspections of both City staff and contractors in November 2019. Prior to this, there was no formal process or timeline in place to inspect pruning work. Instead, inspections were completed on an informal basis and when time was available. Management noted that inspections were sometimes done months after the pruning crew completed the work.

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[7] Based on Edmonton Historical Total Precipitation - 2019 had 5th highest annual precipitation in the last 20 years.

The new inspector is tasked with formalizing the inspection process through the creation of a Standard Operating Procedure (SOP) document in 2020. The SOP will be used to guide the coordination and management of tree pruning.

No standardized checklist for the inspector to document compliance.

Currently, inspections are completed based on experience and visual checks. The inspection results are not documented on a standardized checklist. As part of the development of the SOP, a standardized checklist will be developed.

Pruning invoice reconciliation

We attempted to verify whether the number of trees pruned and invoiced by the contractor reconciles to the paper maps submitted.

We obtained an invoice and the corresponding paper map from each of the 3 different pruning contractors from 2019. Based on the handwritten notes on the maps, we were not able to determine which trees were pruned. We reviewed the invoice and maps with management and concluded that this is difficult to determine.

Without a reconciliation process, there is a risk that payments are made without the ability to confirm which trees on the maps were pruned. Management noted that starting in January 2020, the inspector will reconcile the number of trees pruned through an inspection dashboard that tracks all pruning inspections to the monthly invoices submitted by contractors. Additionally, the inspector will be following up on all deficiencies noted in the pruning inspections prior to signing off on the invoice for payment. These process improvements will help ensure that all pruning work meets the pruning standards prior to payment.

Watering inspections

Forestry employs a watering inspector to ensure trees have been appropriately watered. The inspector's target is to be onsite at least once every two weeks for each of the contracted watering trucks.

Contracted water truck drivers complete a daily log which records the total trees watered, total water used, and total hours worked. We tested a total of 8 daily logs from 2018 and 2019 and verified that they were completed.

We reviewed the inspection forms associated with the above eight daily logs and noted that the inspection checklists were completed. Items reviewed included administrative components such as weather conditions, access to site, Personal Protective Equipment usage, etc. The inspection form contains an area to document whether the trees had the appropriate amount of water, but this is a checkbox only. This does not allow the inspector to record the details of which tree(s) were tested. Having a small checklist would allow the inspector to record what sites were checked and document any deficiencies for follow up.

Recommendation 2
Inspections and invoices

Ensure inspections are properly documented and invoices are verified for tree maintenance.

Responsible Party
Branch Manager, Parks and Roads Services

Accepted

Management Response
Administration will take the following actions to refine and formalize the inspection process in order to ensure consistency:
- Create a transparent inspection process with a checklist for tracking contractor and staff achievements including invoice approvals.
- Ensure capacity is available for inspections.
- Digitize inspection process using mapping technology.

Implementation Date
November 30, 2021

Mandatory Training

The Corporate Tree Management and Tree Reserve Procedure states that tree maintenance work is to be conducted by trained forestry personnel. Ensuring that training is completed for mandatory courses helps ensure effectiveness in that all staff are qualified to perform their duties.

We reviewed the following three types of training:

1. Mandatory for all City of Edmonton Employees (City Courses) – e.g. Drug and Alcohol, Code of Conduct, Indigenous Awareness.

2. Mandatory for Forestry and/or Natural Areas Staff (Staff Specific) – e.g. Driver Manual, First Aid, Workplace Violence, Critical Exotic Pests, Fuel Sense.

3. Mandatory for Forestry and/or Natural Areas staff (Certification Course) – International Society of Arboriculture (ISA). This course requires recertification every 3 years.

Forestry has developed and implemented a training matrix to track mandatory training for staff. Using the training matrix, mandatory training including City of Edmonton training, equipment training, and job specific training will be targeted and completed on an annual basis.

For Forestry and Natural Areas staff we reviewed 99 staff training records as of May 2020 and found:

- City courses were substantially completed.
- Staff specific courses were substantially completed.
- ISA certification course was substantially completed.

The completion of this training will be audited once per year for completion. Parks and Roads Services will ensure an adequate budget will be available to fund mandatory training.

Pest Management

The management of a pest infestation has been identified by management as one of the biggest risks facing the urban forest. We reviewed the documented plans the City has in

place to deal with Dutch Elm Disease and Emerald Ash Borer and the damage this could cause to the City's tree inventory.

In our discussion with the Pest Management Section, we gained an understanding of the impact and threat these diseases can have on the urban forest. The City has a process in place to detect and monitor these pests as well as other pests that may enter the City. This is done through traps to capture and a laboratory to identify the type of pest.

Pest Management also has *Management Plans* in place which address the steps to take within each phase of pre-infestation, initial detection, and confirmed infestation. However, these plans are not yet finalized and have been in draft since 2018.

The Pest Management Section also provides training sessions to Forestry staff as well as the public and institutional students to help in identifying pests and how to deal with reporting of trees that are at risk.

The City has plans in place to detect and monitor pest infestations in the urban forest.

Efficiency

Summary of Findings

We reviewed three areas of Forestry Services to determine their efficiency and found:

1. Improvements can be made to increase accuracy and completeness of the tree data.
2. Equipment is not being efficiently utilized.
3. City tree pruning unit costs are increasing while contractor unit costs are decreasing.

We also found the staff are efficiently planting and watering trees and they have taken positive steps to address the tree data issues, including the use of tablets to record information electronically.

Tree Information and Data

Forestry should have complete and accurate tree inventory information such as the number of City trees, the tree's condition, the date it was last pruned, etc. in order to plan and report on tree maintenance.

Forestry uses a database to record the tree's information on both City owned trees as well as privately owned trees. From this, we performed data analytics to determine the completeness and accuracy of the data.

Data is mostly complete.

We found that the data was mostly complete, but improvements can be made in a few areas including:

- Developing a methodology to ensure consistency in filtering out the number of City owned trees.
- Ensuring all mandatory fields such as "last pruned date" are completed.
- Ensuring data is entered in a timely manner.
- Accuracy of the data relating to how it is captured and the condition of the trees.

Data capture

Forestry Services is highly dependent on recording tree data on paper maps for work completed by both contracted crews and City crews. Tree information such as the diameter of the tree at breast height, pruning date, etc. on paper maps are submitted to the Inventory and Assessment group to update into the City's

tree database. The City uses this information to plan and budget work and also for reporting on their performance.

This process is not efficient for a number of reasons including:

- Paper maps can get lost resulting in information not being entered into the database.
- Maps may not be returned on a timely basis or information may not be entered on a timely basis resulting in outdated information.
- Writing on the maps may not be legible resulting in inaccurate data being entered.

In 2019, Forestry Services began to rectify this by participating in a "LEAN Process". The project is in the pilot stage. Staff are using borrowed tablets to record tree maintenance work and tree information. So far management indicated that the crews using tablets are favoring this initiative as a means of efficiently entering information. Also, management is getting timely information and using reports generated to plan work, such as prioritizing neighbourhoods that require pruning.

The result of the pilot program is expected to be completed in 2021. Based on the preliminary results Forestry is preparing a business case to support a request to purchase approximately 70 tablets.

Condition rating

Forestry uses the condition of a tree to prioritize tree maintenance work as well as an input to calculate a tree's value. They classify tree conditions into eleven different condition ratings ranging from 0% (a dead tree) to 100% (a perfect tree).

The Corporate Tree Management and Tree Reserve Procedure indicates that the City inspect and evaluate City trees for condition. However, the City does not currently assess the condition for all of its trees. Condition is primarily assessed when they inspect a tree due to a citizen inquiry or a damage complaint. Therefore, a default value of 70% (above average tree) is given to all trees as a starting point. The current method of evaluating trees has resulted in 379,820 (98.51%) trees with a condition rating of 70% in the database.

Management indicated that assessing the condition of all City trees may not be practical. Management also indicated they will consider other methodologies to assess trees such as selecting samples of trees and extrapolating to the population.

Using a default value increases the risk of not having accurate tree condition to plan tree maintenance work. Additionally, this impacts the valuation of trees and performance reporting.

- The current asset value of the City's trees is $1.8 billion. However, if we replaced the 70% default value with 60% and 80%, the resulting asset value is $1.6 billion and $2.0 billion respectively.
- The City's current reported results for tree condition is 70% and is not based on accurate data. The City has set a target of 80% for this measure.

Recommendation 3
Review tree inventory data

Conduct a periodic review of the tree inventory to ensure data is complete and accurate.

Responsible Party
Branch Manager, Parks and Roads Services

Accepted

Management Response

Administration is currently developing The Urban Forest Asset Management Plan (UFAMP) which will identify gaps in inventory and the resources required to improve inventory data.

This includes:
- A methodology to calculate the number of city owned trees.
- A process to ensure that mandatory fields are streamlined and completed.

Administration will also create a plan to migrate from paper inputting to digital inputting of inventory data in order to improve on timeliness of data entry.

| | **Implementation Date**
November 30, 2021 |

Equipment

The City uses equipment such as aerials, chippers, trucks, and cranes for tree maintenance work. It tracks each piece of equipment on a daily basis to record the availability, as well as the usage. When equipment is not utilized efficiently and sitting idle, there is a risk that tree maintenance work is not being performed resulting in pruning targets not being met. (e.g. pruning 54% of planned pruning work in 2019.)

Forestry indicated the equipment is required for year-round operations. We reviewed Forestry's equipment for availability and usage to determine whether it is being used efficiently. We analysed the South region equipment data as the North region did not have complete records for 2019.

Equipment availability

Equipment was available for use for 76% of the work days in 2019.

Forestry equipment is available for use for approximately 76% of the year due to maintenance. Management indicated that some City equipment is stored outdoors during the winter which increases maintenance requirements.

In our discussion with the Fleet Services Branch, the majority of the maintenance performed is for planned work such as repairs required to deal with regular wear and tear on the equipment. These repairs may result in additional repair time due to the extra time required to obtain parts. Other factors influencing maintenance requirements include:

- The equipment is generally older and near the end of their useful life.
- The equipment is specialized so it is difficult to stock up on an inventory of special parts.
- The equipment is manufactured by different companies.

Equipment usage

In the time Forestry has equipment available (76%), they track the usage based on whether the equipment is being used (in-use) versus not being used (no operator and not in-use).

When available, equipment is used 60% of the work days.

Not in-use	No operator	In-use
12%	28%	60%

Reasons for equipment to be classified as "not in-use" or "no operator" (40% total) include:

- The outside temperature is too cold (lower than -25 degree celsius) to work.
- The type of work being done may not require certain equipment.
- Staff who would normally use the equipment are on vacation or sick.

There is an opportunity to review equipment usage within Forestry to ensure the equipment usage is optimized. In 2020, the Parks and Roads Services Branch started a fleet utilization project to examine the utilization of all equipment.

Recommendation 4
Review equipment utilization

Review the equipment utilization to identify opportunities to optimize the use of forestry equipment.

Responsible Party
Branch Manager, Parks and Roads Services

Accepted

Management Response
Administration will complete a review of their equipment utilization. The review of equipment utilization will address the following:

- Examine lifecycle management of Forestry equipment.
- Establishment of efficiency targets and review of opportunities to improve utilization.
- Creation of a methodology to report equipment utilization.

Implementation Date
November 30, 2021

Cost of Tree Maintenance

We compared the cost of tree maintenance services (pruning, planting, and watering) provided by City staff to those provided by contractors to determine which is more efficient.

We found contractors are more cost efficient at pruning trees while the City is more cost efficient at planting them. The City contracts out all the waterings and we found this to be cost efficient as well.

Tree pruning

The City splits pruning work between City staff and contractors.

Contractor actual pruning costs per tree has decreased from $80 per tree in 2015 to $66 per tree in 2019. Management indicated that contractors were pruning the larger trees in the past which led to this trend.

City staff pruning costs doubled from $50/tree in 2015 to $100/tree in 2019.
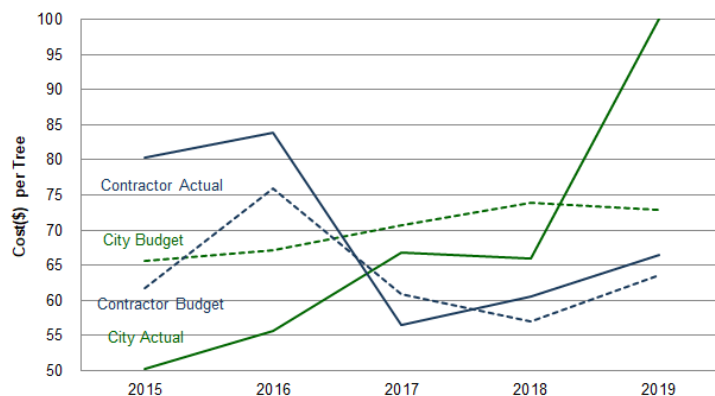
City actual pruning costs increased from $50 in 2015 to $100 in 2019. Management indicated that in recent years City crews began to focus on some of the larger and older trees, which took more time to complete and led to additional costs. These trees are usually in more complex or difficult areas to work in. (e.g., high traffic locations) resulting in higher unit costs.

The City should review the budget process to account for the size and cost of trees being pruned. Additionally the budget should consider the size of trees assigned to the City or contractor staff.

See Recommendation 1

Tree planting (2019)

The City plants all new boulevard and open space trees as part of the *Street and Park Tree Replacement Program*. Contractors plant commemorative trees or trees that originate from citizen requests.

	City	Contractor
# of trees planted in 2019	3,000	50
Cost per tree planted in 2019	$801	$976

The City is efficient in tree planting from a cost perspective. The cost of the tree, and coordination[8] costs were comparable. The difference is due to staff and equipment cost with the City averaging $163 less per tree than the contractor. This is likely due to efficiencies achieved due to the City planting the majority of trees.

Tree watering (2019)

Contractors perform 100% of the tree watering. Based on the City's summary spreadsheet, the total cost was approximately $1 million in 2019 for 104,000[9] instances of tree watering. This resulted in an average of $9.90 per watering. The budget was $9.60 per watering. The City is efficient in coordinating the tree watering from a cost perspective.

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[8] Coordination costs include On-Street Construction & Maintenance Permit, OneCall, routing, hydrovac, etc.
[9] Depending on planting date, trees are watered multiple times in a year.

Guiding Documents

Summary of Findings

Forestry should update their guiding documents to improve on clarity, accuracy and consistency. Additionally, reported measures should be reviewed to ensure they are described with a clear methodology, understandable, accurate, and comparable for readers to understand.

Policy, Bylaw, & Management Plans

We reviewed the following five guiding documents:

- Corporate Tree Management Policy
- Natural Area Systems Policy
- Community Standards Bylaw
- Urban Forest Management Plan
- Guideline for Evaluation of Trees

The guiding documents focus on growth, sustainability, acquisition, maintenance, protection and preservation of the City's urban forest. However, since these documents are on the City's website, improvements to the clarity, accuracy, and consistency in these documents is required so that a citizen can easily understand.

Issues relating to clarity:
- In order to manage workload, the definition of "other city trees" or "non-elm trees" needs to be defined in relation to pruning work in the *Urban Forest Management Plan.*
- Flowcharts in the *Guidelines for Evaluation of Trees* are difficult for a reader to understand.

Clarity - easy to perceive, understand, or interpret.

Issues relating to accuracy:
- In the *Natural Area Systems Policy*, references are made to department names and roles and responsibilities of various job titles that no longer exist.
- Examples used to calculate equitable compensation in the *Guideline for Evaluation of Trees* is not accurate.

Accuracy - being true, correct, or exact.

Consistency - agreeing, compatible, and not self-contradicting.

Issues relating to consistency:
- Definitions for certain terms are not consistent between the *Corporate Tree Management Policy* and the *Urban Forest Management Plan*.
- Roles and responsibilities were not consistent in terms of who had authority for authorizing and permitting certain tasks in the *Community Standards Bylaw*.

Recommendation 5
Update guiding documents

Review and update the guiding documents relating to Forestry Services to improve their clarity, accuracy, and consistency.

Responsible Party
Branch Manager, Parks and Roads Services

Accepted

Management Response
Administration will review the guiding documents in place to improve their clarity, accuracy, and consistency.

Work is underway to update the Corporate Tree Management Policy and the Guideline for Evaluation of Trees. Parks and Roads Services anticipates presenting to Urban Planning Committee in the Fall of 2020. The remaining guiding documents are anticipated to be reviewed and updated by the implementation date.

Implementation Date
November 30, 2022

Performance Measures

We reviewed measures published in the Urban Forest Management Plan, Council Reports, and City dashboard. The measures reported by Forestry to assess performance should contain understandable methodology, be accurate, have reasonable targets, and have comparable results.

Forestry reports various measures that assess their performance in growing, sustaining, maintaining, protecting and preserving the City's urban forest. The measures are relevant,

however, improvements in the following areas should be considered.

Methodology - explains how and what is being measured.

- Define how the measure is calculated and then update their methodology documentation:
  - Tree condition measure currently uses a combination of assessed value and default value of 70%.
  - Mortality rate measure currently uses trees removed and does not include trees that are marked as "dead" and awaiting removal.

Accuracy - calculation should be true and correct.

- Improvement to accuracy:
  - Pruning accomplishment indicated that the target was achieved, however, the target was incorrectly calculated. The target would not have been achieved if the target was correctly calculated.

Target - should be achievable

- Consider whether the target is reasonable or achievable:
  - Current mortality rate is less than 1% and the target is less than 10%.
  - Current average lifespan of trees is 20 years and the target is 50 years.

Comparable - results should be comparable over different years.

- Consider whether results are comparable:
  - Not clear whether the same methodology or formula was used to calculate the value of trees in the various years.
  - Not clear whether the same methodology and technology was used to measure the canopy coverage.

The Parks and Roads Services Branch is in the process of reviewing and developing measures as part of the City's Enterprise Performance Management system. This work started in 2019 at the service level and will transition to the sub service level (e.g. Forestry) in 2020.

Recommendation 6
Review performance measures

Review Forestry's publicly reported performance measures to ensure they are understandable, accurate, reasonable, and comparable.

Responsible Party
Branch Manager, Parks and Roads Services

Accepted

Management Response

The Urban Forest Asset Management Plan (UFAMP) currently being developed by Administration will define methodology and set measurable targets.

Administration will ensure publically reported performance measures are understandable, accurate, reasonable, comparable, and aligned with Corporate Strategy.

Implementation Date
May 30, 2022

Conclusion

In this audit, we reviewed the effectiveness and efficiency of Forestry in managing the City's urban forest. There are multiple areas that require improvements. We made two recommendations to improve on effectiveness, two recommendations to improve on efficiency, and two recommendations to improve the guiding documents.

Effectiveness

Tree maintenance is not being completed effectively. For pruning, Forestry should review their plans to ensure workload for annual pruning and pruning cycles can be met. Documenting inspections and verification of invoices can be improved in order to verify that work has been completed and paid appropriately.

Forestry has been effective in completing mandatory training for staff, budgeting and tracking tree watering, and ensuring plans are in place to identify, detect, and deal with pest infestation.

Efficiency

In order to improve efficiency, the tree data should be accurate and complete in order to plan and report on tree maintenance work. There is also an opportunity to optimize the use of Forestry equipment. The City is currently not as cost efficient as contractors for tree pruning and the CIty should review the tree pruning budget to account for the size of trees being pruned in order to increase efficiency.

The cost to plant and water trees is being completed efficiently. Positive steps are being taken to address the tree data including piloting the use of tablets to record tree information electronically.

Guiding Documents

Forestry should update their guiding documents to improve on clarity, accuracy and consistency. Reported measures should be reviewed to ensure they are described with a clear methodology, are understandable, accurate, and comparable.

We thank the staff in Forestry and Natural Areas for their cooperation and openness in this audit.