Asset Management for Green Infrastructure

Case study title: Regional Municipality of York Green Infrastructure Asset Management Plan

Authors: Janice Lam (York Region), Karen Robichaud (WSP)

Who / Where? - An introduction to your organisation – overview, location, size, mission etc.

The Regional Municipality of York (York Region) in Ontario, Canada takes a proactive approach to planning and managing its green infrastructure assets as it does for its built assets. York Region is the guardian of one of Ontario's largest and most strategically important green infrastructure portfolios, comprising $2 billion (2024) of green infrastructure, recreation, and educational assets that are essential to the social and economic well-being of the Region. The Natural Heritage and Forestry Division of Public Works manages this complex and diverse network of protected areas, natural habitats, recreation trails, and streetscapes across one of Ontario's largest and fastest growing regions.

Why? - Why did your organisation undertake this action of integrating green infrastructure into your asset management planning (opportunity, public demand, barrier to overcome, etc.)

Benefits of taking an asset management approach for green infrastructure included:

- Securing additional capital funding to support management of assets
- Implementing improvements in data collection and management for green infrastructure
- Identifying the need for a forestry replacement reserve
- Providing analysis to address the requirements of Ontario Regulation 588/17

What? - What did you do? What was the process of integrating green infrastructure into your assets management planning?

The integration of green assets into York Region's asset management system started with including the assets in the biennial state of infrastructure reporting in 2013, and their Environmental Services Asset Management Strategy in 2014. This led to the development of their first Green Infrastructure Asset Management Plan in 2017, with the support of WSP's asset management team and Silv-Econ Ltd.'s forest resource management experts. Plan content included:

- State of the infrastructure
- Levels of service
- Asset management strategy
- Financing strategy
- Continuous Improvement

York Region retained WSP and Silv-Econ again in 2022 to update the plan incorporating new future scenarios, and a more structured approach for assessing asset value and managing risk.

Learnings and future plans?

What aspects of the project worked and didn't work? How you plan to do things differently in the future?

The asset management plans were a success for York Region leading to additional capital funding for green infrastructure, improved data collection practices, more structured risk assessments, and additional reviews of return on investment for some treatments.

Photo:

Figure 1: York Regional Forest (Image courtesy of York Region).

Case Study

Regional Municipality of York Green Infrastructure Asset Management Plan

Authors: Janice Lam (York Region), Karen Robichaud (WSP**)**

Company represented: The Regional Municipality of York, Ontario, Canada

Roles: service provider and consultant

Sector: municipal green infrastructure

Asset owner: The Regional Municipality of York, Ontario, Canada

Introduction

The Regional Municipality of York (York Region) in Ontario, Canada takes a proactive approach to planning and managing its green infrastructure assets as it does for its built assets. York Region is the guardian of one of Ontario's largest and most strategically important green infrastructure portfolios, comprising $2 billion (2024) of green infrastructure, recreation, and educational assets that are essential to the social and economic well-being of the Region. The Natural Heritage and Forestry Division of Public Works manages this complex and diverse network of protected areas, natural habitats, recreation trails, and streetscapes across one of Ontario's largest and fastest growing regions.

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Innovative features of the asset management plan included:

- Valuing green assets such as urban forests and street trees.
- Selecting ecosystem performance measures for street trees and urban forest stands based on forecasted outcomes from the i-Tree Eco application of carbon sequestration and storage, water interception, and air pollution removal.
- Developing future scenarios for achieving level of service targets including silviculture management scenarios for the urban forest.
- Forecasting costs to manage climate change risks including invasive species and fire.
- Applying an optimization model to identify lifecycle strategies and forecast asset outcomes for various budget scenarios.

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Description of assets in study

York Region's green infrastructure is organized into biological assets and civil assets under two categories:

1. Urban Forest
    a. Biological – street trees, shrubs, perennials and growing media
    b. Civil – soil cells, irrigation and drainage
2. York Regional Forest
    a. Biological – vegetation communities
    b. Civil – trails, parking lots, fences, culverts, etc.

When was the activity carried out?

The plans were prepared over a 12-month period in 2017, and again in 2022

Why was the activity carried out?

- To provide analysis to address the requirements of Ontario Regulation 588/17 and to provide input to the Region's Corporate Asset Management Plan.
- To develop scenarios including lifecycle strategies and costs for achieving the goals and objectives in alignment with organizational priorities.
- To provide a business case documenting the unique value of green infrastructure compared to the long-term management costs
- To ensure the long-term sustainability of green assets to continue providing valuable services including climate change mitigation and providing an exceptional visitor experience.

Description of activity

The 2017 asset management plan followed the Ontario Ministry of Infrastructure Guide and the requirements of Ontario Regulation 588/17. The plan included the following:

- State of the infrastructure
- Levels of service
- Asset management strategy
- Financing strategy
- Continuous Improvement

Innovative Methodologies

- Various methods were used to value the assets.
    - Replacement cost was used for civil assets, shrubs, perennials and growing media
    - The Council of Tree and Landscape Appraisers (CTLA) Trunk Formula Method was used for street trees

    - The value of the York Regional Forest was calculated as the total cost of replacing the asset today using modern and cost-effective methods and materials that provide an equal level of service.

- Forecasting ecosystem benefits of street trees and forests as asset performance measures.
- Estimating the costs to mitigate the impacts of climate change on the civil assets using the methodology from the report on "Costing Climate Change Impacts and Adaptation for Provincial and Municipal Infrastructure in Ontario" available from the Financial Accountability Office of Ontario.

References

CTLA. 2019. Guide for Plant Appraisal, 10th Ed. Council of Tree and Landscape Appraisers/International Society of Arboriculture. 181 p.

IPWEA 2020. International Infrastructure Management Manual 6TH Edition. Institute of Public Works Engineering Australia.

i-Tree. I-Tree Eco website. https://www.itreetools.org/tools/i-tree-eco.

Nowak, D.J. (2020). Understanding i-Tree: Summary of programs and methods. USDA Forest Service. https://www.fs.usda.gov/nrs/pubs/gtr/gtr_nrs200.pdf

WSP (2023). Costing Climate Change Impacts and Adaptation for Provincial and Municipal Infrastructure in Ontario. Financial Accountability Office of Ontario. https://fao-on.org/wp-content/uploads/2024/08/cipi-wsp-report-2.pdf

Risk types

- Funding risk was considered through scenario analysis
- Climate change risks were identified and costs to mitigate risks such as additional inspections and treatments were forecasted
- Maintenance activities to reduce safety risks such as tree inspections and pruning hazardous branches were included in the cost forecasts
- Risks associated with future demand for street trees were assessed through scenario analysis

Risk management process

Costs were included in the forecasts for managing risks to the biological assets. Risks included invasive species, drought, and hazard trees. In the 2017 plan, costs to mitigate risks to biological assets were estimated and a portion of the costs was included in the forecast based on the probability of the risk occurring. In the 2022 plan, a risk scenario was developed based on the risks with the highest probability of occurring to estimate the mitigation costs. The mitigation costs were determined to be low compared to the overall lifecycle management costs.

The risk assessment undertaken was focused on risks related to delivering green infrastructure services to inform decision making. . The approach was based on best practices to allow for future integration with Corporate Asset Management risk processes in development at York Region.

Future opportunities for alignment with the Corporate Risk Strategy are currently being assessed.

Tools used

- Remsoft Woodstock optimization model for determining the optimal lifecycle strategy for civil assets over a 100-year planning horizon based on the asset inventory, treatment options, and deterioration models.
- i-Tree tools for estimating the benefits of individual trees and forested stands over the 100-year planning horizon.
- A customized Excel model for forecasting costs and outcomes for the York Regional Forest under three different silviculture management scenarios.
- A customized Excel model for forecasting the lifecycle costs of the street trees and landscaped areas along roadways.
- Model results were combined in an Excel spreadsheet to develop summaries of asset performance and costs for three future scenarios.

Costing

Costs for the civil assets, and biological assets in the Urban Forest such as street trees, were based on current replacement costs.

- Renewal costs were estimated using unit replacement costs and forecasting asset quantities.
- Renewal costs for the York Regional Forest were not estimated because the forest was assumed to be self-regenerating.
- Operating and maintenance costs for civil assets were estimated as a percentage of the renewal costs.
- Operating and maintenance costs for the biological assets were based on identifying and estimating the costs of the operational and management activities required for each asset type.

People

- York Region
    - Project Manager and Infrastructure Engineer from York Region's Asset Management Strategy Group
    - Manager and Program Managers from York Region's Natural Heritage and Forestry Group
    - Subject matter experts on forest, tree, and plant lifecycle activities and costs from York Region's Natural Heritage and Forestry Group
- WSP
    - Asset Management Advisory Team including specialists in data analysis, optimization modelling, risk analysis, and financial forecasts
    - Registered Professional Forester
- Silv-Econ Ltd.
    - Two Registered Professional Foresters

Evaluation

What was the main output of the activity?

A plan for managing York Region's green infrastructure assets with:

- Improved communication on the value of green infrastructure.
- Performance measures for levels of service.
- Mitigation actions identified for risks.
- Management strategies for various funding scenarios balancing levels of service, risk, and cost.
- Secured additional funding for managing green infrastructure.

Validation

Forecasting model inputs and outputs prepared by the consulting team were reviewed by York Region's team before using them to develop the management scenarios.

Outcome

The asset management plans were a success for York Region leading to additional capital funding for green infrastructure, improved data collection practices, more structured risk assessments, and additional reviews of return on investment for some treatments.

York Region, WSP, and Silv-Econ Ltd. received an award from the Association of Consulting Engineering Companies (ACEC) for the 2017 Green Infrastructure Asset Management Plan in recognition of Engineering Excellence.