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# BETHLEHEM STREET TREE INVENTORY ANALYSIS AND MANAGEMENT PLAN

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## EXECUTIVE SUMMARY

**Prepared for:**

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# EXECUTIVE SUMMARY

This plan was developed for the Town of Bethlehem, New York by Davey Resource Group, Inc. “DRG” with a focus on addressing short-term and long-term maintenance needs for inventoried public street trees. DRG completed a tree inventory to gain an understanding of the needs of the existing public trees and to project a recommended maintenance schedule for tree care. Analysis of inventory data and information about the Town’s existing program and vision for the street tree canopy were utilized to develop this *Street Tree Inventory Analysis and Management Plan*. Also included in this plan are economic and environmental benefits provided by the inventoried trees in Bethlehem.

## State of the Inventoried Tree Population

The public tree inventory was conducted in September and October of 2019 and included trees, stumps, and planting sites along state and county road rights-of-way (ROW), trees and stumps along town road ROWs, and trees and stumps in specified parks (4) and public facilities (3). A total of 6,649 sites were recorded during the inventory: 4,849 trees, 143 stumps, and 1,657 planting sites. Analysis of the tree inventory data found the following:

- On the street ROW, maple (*Acer* spp.) were found in abundance (31%), which is a concern for Bethlehem’s biodiversity.
- One species, Norway maple (*Acer platanoides*), comprises a large percentage of the street ROW (11%), also a concern for biodiversity.
- The size class distribution of the inventoried tree population trends toward the ideal, with a greater number of young trees than established, maturing, or mature trees.
- The overall condition of the inventoried tree population is rated Fair.
- Approximately 48% of the inventoried trees had dead and dying parts.
- Overhead utilities interfering with street trees occur among 3% of the inventoried population.
- Asian longhorned beetle (*Anoplophora glabripennis*) and spotted lanternfly (*Lycorma delicatula*) pose the biggest threat to the health of the inventoried population.

## Environmental, Economic, and Social Benefits of Trees

The trees growing along public streets constitute a valuable community resource. Their shade and beauty contribute to a community’s quality of life and soften the hard appearance of urban landscapes and streetscapes. When properly maintained, trees provide numerous tangible and intangible environmental (pollution control, stormwater management, wildlife habitat), economic (higher property value, energy reduction), and social (education, aesthetics, human health and safety) benefits that can justify the time and money invested in planting, pruning, protection, and removal. Various examples of the benefits derived from trees are shown in the following figure.

## Environmental Benefits

- Trees decrease energy consumption and moderate local climates by providing shade and acting as windbreaks.
- Trees act as mini reservoirs, helping to slow and reduce the amount of stormwater runoff that reaches storm drains, rivers, and lakes. One hundred mature tree crowns intercept roughly 100,000 gallons of rainfall per year (United States Forest Service 2003a).
- Trees help reduce noise levels, cleanse atmospheric pollutants, produce oxygen, and absorb carbon dioxide.
- Trees can reduce street-level air pollution by up to 60% (Coder 1996). Lovasi (2008) suggested that children who live on tree-lined streets have lower rates of asthma.

## Economic Benefits

- Trees in a yard or neighborhood increase residential property values by an average of 7%.
- Commercial property rental rates are 7% higher when trees are on the property (Wolf 2007).
- Trees moderate temperatures in the summer and winter, saving on heating and cooling expenses (North Carolina State University 2012, Heisler 1986).
- On average, consumers will pay about 11% more for goods in landscaped areas, with this figure being as high as 50% for convenience goods (Wolf 1998b, Wolf 1999, and Wolf 2003).
- Consumers also feel that the quality of products is better in business districts surrounded by trees than those considered barren (Wolf 1998b).
- The quality of landscaping along the routes leading to business districts had a positive influence on consumers' perceptions of the area (Wolf 2000).

## Social Benefits

- Tree-lined streets are safer; traffic speeds and the amount of stress drivers feel are reduced, which likely reduces road rage/aggressive driving (Wolf 1998a, Kuo and Sullivan 2001a).
- Chicago apartment buildings with medium amounts of greenery had 42% fewer crimes than those without any trees (Kuo and Sullivan 2001b).
- Chicago apartment buildings with high levels of greenery had 52% fewer crimes than those without any trees (Kuo and Sullivan 2001a).
- Employees who see trees from their desks experience 23% less sick time and report greater job satisfaction than those who do not (Wolf 1998a).
- Hospital patients recovering from surgery who had a view of a grove of trees through their windows required fewer pain relievers, experienced fewer complications, and left the hospital sooner than similar patients who had a view of a brick wall (Ulrich 1984, 1986).
- When surrounded by trees, physical signs of personal stress, such as muscle tension and pulse rate, were measurably reduced within three to four minutes (Ulrich 1991).

## Tree Benefit Analysis

Up until recently, the services and benefits of trees in urban and suburban settings were once considered difficult to quantify. Using extensive scientific studies and practical research, these benefits can now be estimated using tree inventory information. One such tool is i-Tree, a program based on peer-reviewed, United States Forest Service research. An analysis was used to provide insight into the overall health of the town's public trees and the management activities needed to maintain and increase the benefits of trees into the future. The results are presented in this report, and summarized below:



- Bethlehem's trees have an estimated replacement (structural) value of \$8,419,176.
- The inventoried trees provide approximately \$14,927 in the following annual benefits:
  - *Carbon sequestration*: valued at \$5,575 per year.
  - *Air pollution removal*: 1,844 pounds of pollutants removed valued at \$2,357 per year.
  - *Avoided stormwater runoff*: 104,640 cubic feet (ft<sup>3</sup>) avoided valued at \$6,995 per year.
  - *Total carbon stored*: 3,337 tons valued at \$569,135.

**Photograph 1.** The Town of Bethlehem recognizes that its public tree resource is critical to ecosystem health and economic growth. Planning and action are central to promoting and sustaining the street tree canopy in town.

## Street Tree Program Needs

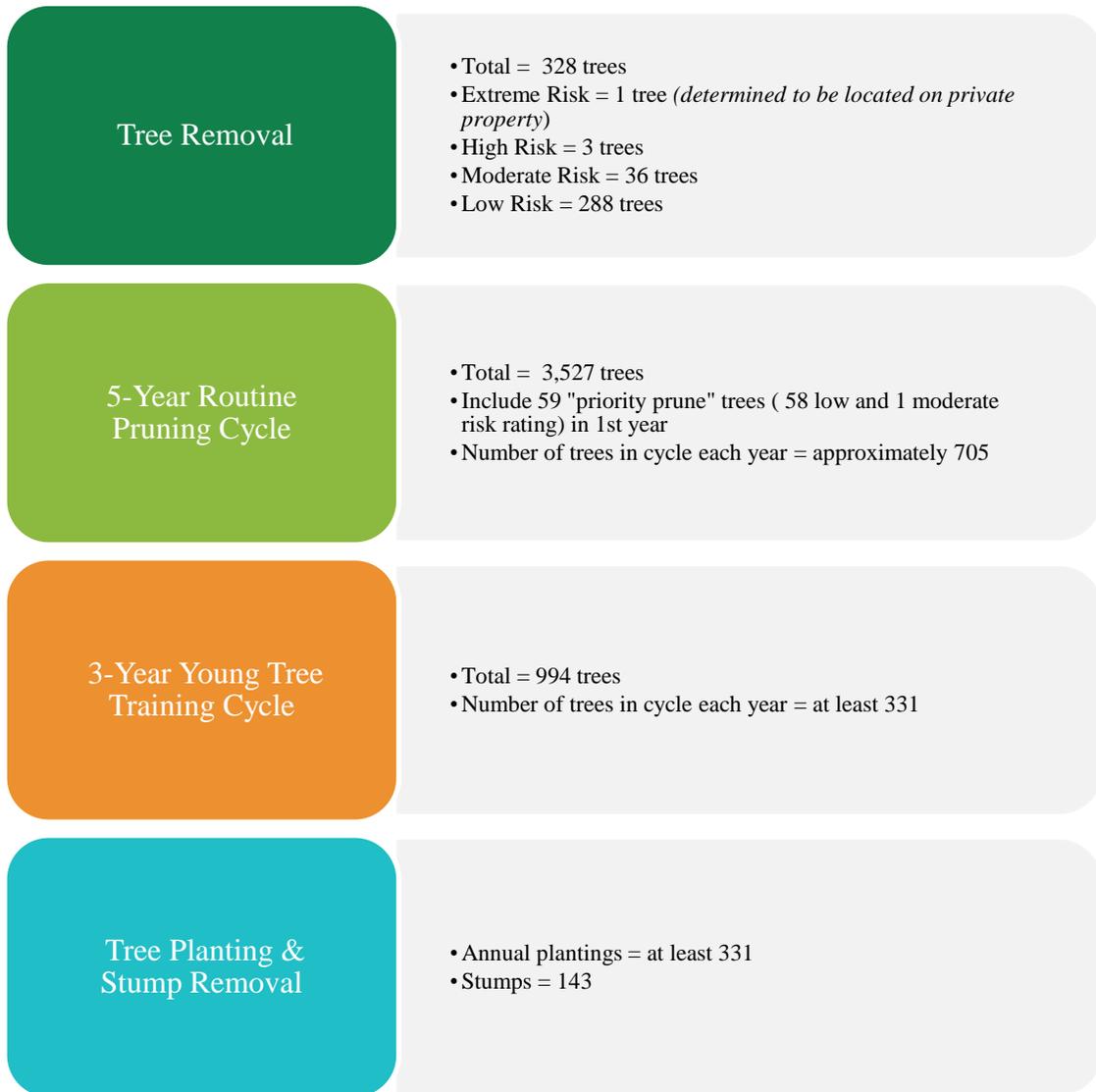
*Recommended maintenance needs include:* Tree Removal; Stump Removal; Routine Pruning; Young Tree Training; and Tree Planting. Maintenance should be prioritized by addressing trees with the highest Risk first. Low and Moderate Risk trees should be addressed after all elevated risk tree maintenance has been completed. Trees should be planted to mitigate the negative effects of removals and to create canopy. A summary of the program needs is presented in Figure 2.

*Tree Removal:* Trees that have been rated High Risk should be removed or pruned immediately. The removal of stumps is a lower priority.

*Young Tree Training and Routine Pruning:* Inventoried trees will benefit greatly from a three-year young tree training cycle and a five-year routine pruning cycle. Proactive pruning cycles improve the overall health of the tree population and may eventually reduce program costs. In most cases, pruning cycles will correct defects in trees before they worsen, which will avoid costly problems.

*New Tree Plantings:* Planting trees is necessary to maintain and increase canopy cover, and to replace trees that have been removed or lost to natural mortality (expected to be 1–3% per year) or other threats (for example, construction, invasive pests, or impacts from weather events such as drought, flooding, ice, snow, storms, and wind). Planting a variety of species each year will offset

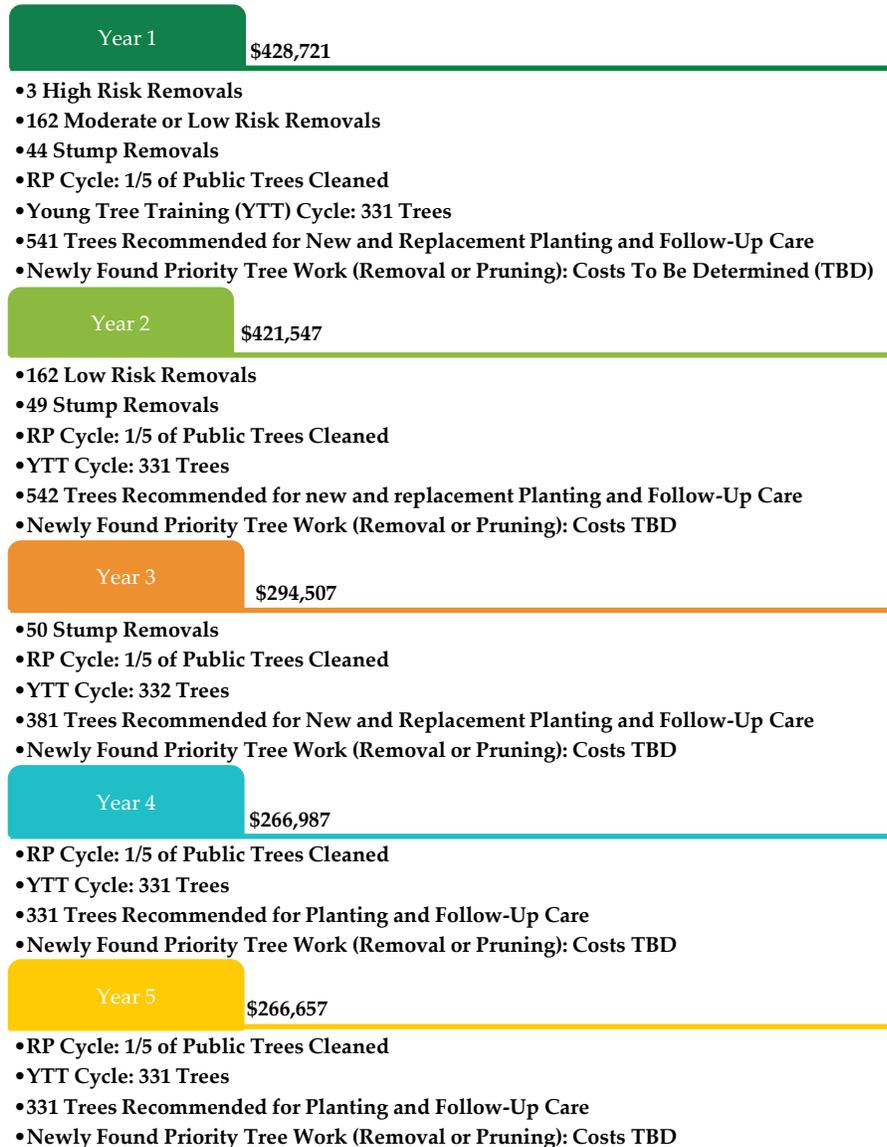
these losses, increase canopy, maximize benefits, and account for ash tree loss, based on a five-year plan.



Town-wide tree planting should focus on replacing tree canopy recommended for removal and establishing new canopy in areas that promote economic growth, such as business districts, recreational areas, trails, parking lots, areas near buildings with insufficient shade, and areas where there are gaps in the existing canopy.

## Town of Bethlehem Tree Management Program

As shown in the figure below, adequate funding will be needed for the Town to implement an effective management program that will provide short-term and long-term public benefits, ensure that priority maintenance is performed expediently, and establish proactive maintenance cycles. The estimated total cost for the first year of this five-year program is \$428,721. This total will decrease to approximately \$267,000 per year by Year 4 of the program.



These cost estimates are based on private contractor rates. It is expected that implementation of the Plan will be undertaken by various Town departments and use of Town Highway Department staff for tree care management would occur when resources and schedule allow. Utilizing Town staff to perform the work would allow the costs to be realized over annual budgeting operations.

High-priority tree removal and pruning is costly; since most of this work is scheduled during the first several years of the program, the budget is higher for those years. After high-priority work has been completed, the management program will mostly involve proactive maintenance, which is generally less costly. Budgets for later years are thus projected to be lower. Tree planting to fill vacant sites can also be spread over a longer period than the five years of the management plan, lowering planting and young tree maintenance costs each year. These cost estimates are based on contractor rates.

The implementation table following on the next page summarizes next steps by Town Departments.

Implementation Step	Responsible Department(s)
Update inventory database to reflect trees removed to date	Economic Development and Planning Department and Highway Department
Verify ROW for any remaining High Risk Trees	Department of Public Works
Perform Maintenance on/Remove High Risk Trees	Highway Department
Capture Tree Removals in Database Update	Economic Development and Planning Department
Verify ROW for Moderate Risk Trees	Department of Public Works
Perform Level III Risk Assessments	Highway Department
Perform Maintenance on/Remove Moderate Risk Trees	Highway Department
Discuss and decide a Town EAB strategy	Highway Department and Economic Development and Planning Department
Capture Tree Removals in Database Update	Economic Development and Planning Department
Closely Monitor and/or Inspect All Trees Recommended for Further Inspection	Highway Department
Verify ROW for Low Risk Removals	Department of Public Works
Remove Low Risk Trees	Highway Department
Capture Tree Removals for Database Update	Economic Development and Planning Department
Begin 5 Year Routine Pruning Cycle	Highway Department
Begin 3 Year Young Tree Training Cycle	Highway Department
Verify ROW for Stumps	Department of Public Works
Remove Stumps	Highway Department
Verify ROW for Identified Planting Sites as Trees are Planted	Department of Public Works and Highway Department
Expand Planting Program	Supervisor's Office

## Town Programs and Knowledge Resources

The Town's existing programs are detailed in this section of the plan. Knowledge resources for the Town include a planting list, guidance for tree planting with development projects, a review of Town Code related to street trees and recommendations for future changes, and notes on how the climate crisis may impact street trees or change their benefits or management.

## Pest and Disease Risk Management

Pests and diseases pose serious risk to tree health. Awareness and early diagnosis are essential to ensuring the health and longevity of urban trees. Pests and diseases can target a single species or an entire genus. The inventory data were analyzed to provide a general estimate of the percentage of trees susceptible to some of the known pests in New York. Additionally, a case study of a management program is presented in the report as an example of a typical management plan for the control of invasive pests and disease. Asian longhorned beetle (ALB) (*Anaplophora glabripennis*), spotted lanternfly (SLF) (*Lycorma delicatula*), elongate hemlock scale (EHS) (*Fiorinia externa*), and gypsy moth (*Lymantria dispar*) are the pest species with the potential to impact the greatest portions of the inventoried trees. Emerald ash borer (EAB) is more of an immediate concern due to its known activity in the town.

## Conclusion

Bethlehem has many opportunities to improve its urban forest. Planned tree planting and a systematic approach to public tree maintenance will help ensure a cost-effective, proactive program. Investing in this street tree management program will promote public safety, improve tree care efficiency, and increase the economic and environmental benefits the community receives from its trees.