



CITY OF KIRKLAND
Planning and Building Department
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MEMORANDUM

To: Kurt Triplett, City Manager

From: Deb Powers, Urban Forester
Adam Weinstein, AICP, Deputy Planning Director

Date: November 20, 2018

Subject: 2018 Kirkland Tree Canopy Assessment Report and Code Amendments to Kirkland Zoning Code Chapter 95, Tree Management and Required Landscaping, File Number CAM18-00408

Staff Recommendation

The City Council should receive an update on the Kirkland Zoning Code Chapter 95 (KZC 95) code revision process and the 2018 canopy cover analysis, and provide feedback on proposed code amendments.

Background

Balancing growth and development while maintaining a [livable community](#) is a primary reason to adopt tree protection codes. KZC 95 (Attachment 1) establishes a permit process and standards for the protection and replacement of trees primarily on private property. With the exception of minor code amendments, KZC 95 was last updated in 2010 and was identified for an update in the 2018-20 Planning Work Program.

The purpose of the city-wide 2018 tree code revision is to support goals established in Kirkland's Comprehensive Plan and the objectives in the [Urban Forestry Strategic Management Plan](#), to address issues and challenges that have arisen since the last major tree code revision and to update the code so that it is effective and easier to use.

Separately, as part of developing the new Finn Hill Neighborhood Plan, staff had looked at revising the Holmes Point Overlay (HPO) code, Kirkland Zoning Code Chapter 70 (KZC 70). The original HPO was developed to address stormwater runoff, critical areas and tree protection in a sub-neighborhood area within the Finn Hill neighborhood. When the draft HPO was presented to the City Council in June 2018, HPO adoption was postponed for a number of reasons:

- Desire to address some proposed HPO code provisions as part of the city-wide code update
- Desire to update tree code enforcement rules simultaneously with updating the city-wide tree code

- Recognition that pending Planning work projects (review of the efficacy of tree regulations on development sites, and the tree canopy assessment) should influence the tree code update

Staff will be looking for City Council direction on proposed HPO code amendments in spring 2019, following KZC 95 and Kirkland Municipal Code 1.12.100 (tree code enforcement) adoption. Proposed changes to KMC 1.12.100 include increased penalties for unauthorized tree removal and revising tree protection inspection procedures.

As a foundation to the code update project, the background of Kirkland's tree code and a description of how the code currently works was outlined in the [June 28, 2018 memo](#) (pages 4-11) to the Planning Commission. Since a basic understanding of tree canopy cover was needed to make decisions on whether the City should change its metric for code requirements, background information on canopy cover was provided in the same memo (pages 2-3).

Staff's list of code issues and interpretations from 2014 is a key component of the potential tree code amendments. Additional code issues and potential amendments were identified from various sources such as:

Holmes Point Overlay Code Amendment Process

There were a number of proposed HPO code amendments for consideration on a city-wide basis, including:

- Establish a minimum tree canopy cover percentage on a lot-by-lot basis
- Increase quantitative tree retention/planting requirements (tree credits)
- Redefine/increase qualitative tree retention/planting requirements (tree retention values)

2018 Intern Findings on Tree Code Efficacy

In 2018, the Planning and Building Department hired an intern to review the efficacy of the tree code in protecting existing trees on development site and adding new trees to the urban forest. Intern findings were presented in the [August 9, 2018 Planning Commission memo](#). Some of the key takeaways resulting from this research project are:

- Arborvitae, a slow-growing, columnar conifer, is used excessively to meet tree credit requirements
- Many newly planted (required) trees are poorly located
- Improvements in retaining large trees on development sites are needed

2018 Canopy Cover Analysis

The 2018 Urban Tree Canopy Assessment report (Attachment 2) was presented in the [November 8, 2018 Planning Commission memo](#). Overall, urban tree canopy cover (UTC) dropped from 40 to 38 percent between 2010 and 2017. The analysis shows:

- Single Family Residential areas had the greatest canopy loss by acreage, but offer the greatest potential for planting new trees
- The Moss Bay and South Rose Hill neighborhoods have the lowest percentage of UTC

- Tree canopy cover increased in Industrial, Parks and Institutional land classes from 2010 to 2017

Recent changes to arboricultural industry standards and continued discussions with Planners, Code Enforcement and Legal staff have provided further direction on potential code amendments, along with guidance from the Planning Commission/Houghton Community Council, local developers, neighborhood groups, and the general, outlined in the sections below.

Once compiled, potential code amendments were classified by the policy impact of the modification using Planning and Building Department guidelines:

No Impact - amendments that clarify or further define something already in the code, address redundancies and typos, or involve reformatting or removal of outdated references. They do not change the meaning of the code.

Minor Impact - amendments resulting from updates to Best Available Science, Best Management Practices, industry standards, etc. that do not result in changes to code intent or an increase in requirements.

Moderate Impact - relatively uncontroversial restructuring of code sections, and any of the above that result in new, increased or eliminated requirements.

Major Impact - substantially prohibit/ban or add new requirements to what's currently allowed. These may result in significant changes to procedures, additional cost to permit applicants or change the intent of the code.

Public Comment

Public outreach was conducted as scoped in the Public Engagement Plan, Attachment 9 in the November 8, 2018 PC [memo](#). Staff met with two stakeholder groups (Kirkland developers and citizens from the Finn Hill Neighborhood) and utilized multiple public engagement events to reach the general public. All letters and correspondence on the KZC 95 code amendments received by staff and the Planning Commission up to 12 p.m. on October 31, 2018 were included in Attachment 10 of the same memo.

All themes derived from public engagement are currently being addressed with the KZC 95 code amendments. Staff expects that continued public involvement with the tree code updates may result in additional contributions to the current list of potential code amendments.

As a result of the public engagement process, staff identified a need for additional education about the tree code. Educating the community about tree protection after the updated code is adopted will be an important follow-up task.

Due to the complexity and volume of potential code amendments, staff presented the amendments to the Planning Commission/Houghton Community Council in manageable segments over the course of multiple study sessions.

Houghton Community Council Comments

The Houghton Community Council (HCC) communicated to staff at an [August 27, 2018 meeting](#) that code changes should address areas where the code is:

- Too ambiguous or unclear
- Not very predictable for developers
- Inconsistent in its outcomes across multiple users encountering similar situations

More specifically, the HCC expressed an interest in code or procedural changes that would address:

- A High Retention Value tree definition that is less subjective
- Clarifying KZC 95.23 on public tree removals
- Retaining tree groves when designing parking lots
- Clarifying KZC 95.30.6 (b) on tree plan modifications
- Planned tree removal prior to development permit submittal that is the “unintended consequence” of unclear and unpredictable codes
- Damage to trees adjacent to development properties (which should remain a civil issue)
- Integrating tree protection inspections with building inspection procedures

Planning Commission Comments

The most straightforward (no/minor policy impact) potential code amendments were the focus of the [September 13, 2018 Planning Commission](#) meeting memo. While the Planning Commission acknowledged that these amendments may need additional refinement, there was agreement that the general text and direction of the draft code was appropriate. These revisions may, however, be affected by factors such as additional amendments to KZC 95.

At the same meeting, the moderate- and major-impact potential code amendments were discussed, leaving the most complex and controversial of the potential KZC 95 code amendments, Tree Retention Associated with Development Activity, as the focus of the [November 8, 2018 PC meeting](#). Of those, the most substantial code updates are summarized below:

Prevent girdling/tree removal prior to development permit submittal
Code sections: KZC 95.23.5, KZC 95.30.2, KZC 95.23.2, KZC 95.10.19
Issue: High quality trees are being preemptively removed from potential development sites.
Discussion: Girdling/tree removal occurs under the 2-per-year tree removal allowance prior to development permit submittal to intentionally avoid compliance with “High Retention Value” tree requirements.
Options: 1. Define girdled trees as tree removal (similar to “topping”). 2. Clearly prohibit such activities, similar to City of Renton (RMC 4-4-130D): <i>“Prohibited Activities: Tree Cutting in Advance of Issuance of Land Development Permit – there shall</i>

<p><i>be no tree removal or land clearing on any site for the sake of preparing that site for future development.”</i></p> <p>3. Specify an acceptable time period between tree removal and development permit submittal in KZC 95.23.5 such as “...any private property owner may remove up to two significant trees provided that a development permit application will not be submitted within 90 days.”</p> <p>4. Consider recently girdled/removed trees at development permit submittal as unauthorized tree removal subject to code enforcement. Verification could include use of surveys and arborist reports submitted with permit applications, GIS data, Google street view photos, and material evidence of recent tree removal.</p>
<p>Staff recommendation: All options, address related code amendments #38, #56 and #58.</p>

<p>Determine tree retention early in the short plat/subdivision design process (i.e., Citywide Integrated Development Plan (IDP) review)</p>
<p>Code sections: KZC 95.35.5, KZC 95.30.6</p>
<p>Issues: Phased short plat/subdivision plan review results in protracted discussions and disagreements about tree retention between staff and permit applicants. Preemptive tree removal prior to permit submittal is an “unintended consequence” of complying with a code that some deem too restrictive. Intern findings indicate a prevalence of preemptive tree removal.</p>
<p>Discussion: Make tree retention/removal decisions early, as utilities, access and building footprint locations are being determined. A Citywide IDP process would allow for a more predictable and consistent process for tree plan review.</p>
<p>Options:</p> <ol style="list-style-type: none"> 1. Require IDP Citywide 2. Amend the related modifications to IDP (#22)
<p>Staff recommendation: All options</p>

<p>Consider using canopy cover vs. tree density credits requirements</p>
<p>Code section: KZC 95.33</p>
<p>Issue: The FHNA strongly advocates using a canopy-based metric on a lot-by-lot basis to determine adequate tree retention/planting.</p>
<p>Discussion: See the June 28, 2018 Planning Commission memo on the pros/cons of using canopy cover as a tree retention/replanting metric. At that meeting, the PC expressed opposition to transitioning to a canopy-based system due to:</p> <ul style="list-style-type: none"> • Ease of diameter at breast height (DBH) data collection regardless of expertise • Trunk size generally correlates to tree size • Other cities use credit-based systems including Issaquah, Medina, Kenmore, Woodinville and Vancouver, WA
<p>Options:</p> <ol style="list-style-type: none"> 1. No change to existing tree credit requirements, or

2. Focus on trees worthy of retention without numerical thresholds (see #64/72). For sites devoid of trees, require a minimum number of new trees based on lot size
Staff recommendation: Option 2

Clarify grove retention requirements
Code section: KZC 95.05, 95.10, KZC 95.51.3
Issue: Disagreement on designating groves between staff and permit applicants.
Discussion: KZC 95.10 defines groves as 3 or more significant trees with overlapping or touching crowns. Retaining groves of trees enhances community character, helps to slow the loss of canopy cover and furthers the intent and purpose of KZC 95. Other cities that protect tree groves are Bellevue, Issaquah, Mercer Island, Renton, Sammamish, Shoreline, and Woodinville.
Options: <ol style="list-style-type: none"> 1. Revise code so retention requirements are located in the same code section. 2. Clarify grove designations on sites undergoing remodels/additions.
Staff recommendation: Options 1 and 2

Clearly define trees of merit
Code section: KZC 95.10
Issue: Definitions of retention values and High Retention Value tree requirements often are areas of disagreement between staff and development permit applicants.
Discussion: A sustainable urban forest is ensured when tree planting is driven by canopy status, age distribution and species diversity objectives. Prior to KZC 95, Kirkland required only 25% existing tree retention, resulting in isolated remnants of poor quality trees on Single Family Residential lots. The 2018 tree canopy analysis shows a city-wide decrease in canopy cover between 2010 and 2017, most notably in the Single Family Residential land use classification. Current intern findings show: <ul style="list-style-type: none"> • The notably good condition of trees retained on development sites indicate that High Retention Value Tree requirements are effective if such trees are preserved as part of development plans. • Required tree planting is providing an abundance of new trees. • Only 10% of all trees retained on development sites are large trees (over 22" trunk diameter). • No trees that were required to be retained had been removed after the 5 Year Maintenance Agreement had expired. <p>Findings and data provide justification for pursuing retention efforts for trees of merit. The challenge is to balance the need for high quality tree retention in a manner that does not limit development potential or risk constitutional takings challenges.</p>
Options:

<ol style="list-style-type: none"> 1. Eliminate the Low, Moderate and High Retention Value tree definitions, which have not been very effective per Planning and Building Department staff, and 2. Clearly define and prioritize trees of merit by size, condition, grove status, etc. <ol style="list-style-type: none"> a. Landmark – healthy tree over 30” DBH (Redmond, Issaquah) b. Specimen – the current KZC 95.10.17 definition: a viable tree greater than 6” DBH that’s in very good to excellent health and free of major defects as determined by the City. “Viable” generally means that the tree is in good health as determined by the applicant’s arborist (Issaquah, Lake Forest Park, Olympia and others) c. Grove – significant trees that form a contiguous canopy (numerous cities protect groves, see #63), and 3. Clearly define the location of trees that must be retained using options such as: <ol style="list-style-type: none"> a. outside building envelope, or b. within required setbacks, in yards and around the site perimeter, or c. “within the site interior” (Bellevue), or d. “not within the building footprint of the principal building on the lot, excluding those trees where alternative design of the building is feasible in retaining the tree” (Medina), or e. “outside the area of land disturbance except where necessary to install site improvements, e.g., driveways, utilities, etc.” (Mercer Island), and 4. Incentivize tree preservation on private property. For example, if resources allow: <ol style="list-style-type: none"> a. Offer a template Voluntary Tree Conservation Easement (Example: Attachment 4) b. Support a citizen-led volunteer Heritage Tree Program similar to the City of Seattle-PlantAmnesty model c. Conduct public education on the benefits of trees and mature tree maintenance
<p>Staff Recommendations: All options</p>

<p>Clarify retention requirements for trees of merit</p>
<p>Code section: KZC 95.30.5</p>
<p>Issue: Provides City with increased authority to require retention of trees of merit and to require applicants to use variations to development standards for their retention.</p>
<p>Discussion: Code currently reads: retain High Retention Value trees “to the maximum extent possible” and the applicant “shall pursue where feasible applicable variations in the development standards,” which often results in code interpretation disagreements between Planning and permit applicants.</p>
<p>Options:</p> <ol style="list-style-type: none"> 1. Clearly define and prioritize trees worthy of retention (#63, 64/72), and 2. Specify that <i>site improvements shall be designed and constructed to protect trees with the following characteristics...</i>(Redmond, Shoreline), or 3. Applicant must show where <i>alternative design of the building is feasible in retaining the tree</i> (Medina), or

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| 4. Consider Reasonable Use Exception language so an applicant would need to apply for an exception <i>if the tree code will prevent any reasonable economic use of the owner's property</i> (Redmond, Lake Forest Park) to the Hearing Examiner. |
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Staff recommendation: Options 1 and 2 or 3
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Other potential code amendments currently under consideration by the Planning Commission:

- Require tree retention early in the shortplat/subdivision design process (IDP)
- Improve tree protection fence/sign standards
- Limit credits awarded for arborvitae/address excessive planting on SPL/SUB
- Assure new (required) trees are planted in appropriate locations
- Regulate hedges (height, removal of multiple trees in a hedge)
- Clarify/streamline code, make it "less subjective"
- Require developers to post bonds for new required trees (vs. 5-Year Maintenance Agreements)

The specific issues, discussion, options and staff recommendations for these and other potential code amendments are detailed in the [November 8, 2018 Planning Commission memo](#).

Next Steps

Staff will seek consensus from the Planning Commission and Houghton Community Council at the November 26, 2018 joint meeting. The intent of the joint meeting is to allow continued discussion of the code amendments and provide clear direction to staff to draft proposed code language. Staff will be returning with draft code at the December 13, 2018 Planning Commission meeting so that any changes to the draft code can be made prior to the Public Hearing scheduled for January 24, 2019.

Staff provided status reports to City Councilmembers through Council Committee meetings throughout the tree code amendment process. The emphasis of this memo is to provide a summary update of the KZC 95 code amendments and to ask the City Council:

- *Does the City Council have additional KZC 95 or related issues that may warrant a code amendment, procedural change, incentive or public education?*
- *Is there any other information the City Council needs to review the potential KZC 95 code amendments?*

Attachments:

1. Kirkland Zoning Code Chapter 95, Tree Management and Required Landscaping
2. 2018 Urban Tree Canopy Assessment report

cc: File Number CAM18-00408

Chapter 95 – TREE MANAGEMENT AND REQUIRED LANDSCAPING

Sections:

- 95.05 Purpose and Intent
- 95.10 Definitions
- 95.20 Exemptions

- 1. Emergency Tree Removal
- 2. Utility Maintenance
- 3. Commercial Nurseries or Tree Farms

95.21 Tree Pruning

- 1. Tree Pruning of Street Trees
- 2. Tree Pruning on Private Property

95.23 Tree Removal – Not Associated with Development Activity

- 1. Introduction
- 2. Permit Required for Removal of Trees on Private Property or City Right-of-Way
- 3. Tree Removal Permit Application Form
- 4. Tree Removal Permit Application Procedures and Appeals
- 5. Tree Removal Allowances

95.25 Sustainable Site Development

95.30 Tree Retention Associated with Development Activity

- 1. Introduction
- 2. Tree Retention Plan Required
- 3. Tree Retention Plan Review
- 4. Tree Retention Plan Components
- 5. Tree Retention Plan
- 6. Additional Tree Retention Plan Standards for Short Plats and Subdivisions
 - a. Phased Review
 - b. Modifications to Tree Retention Plan for Short Plats and Subdivisions

95.32 Incentives and Variations to Development Standards

- 1. Common Recreational Open Space
- 2. Parking Areas and Access
- 3. Required Yards

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5. Additional Variations
- 95.33 Tree Density Requirement
 1. Tree Density Calculation
 2. Supplemental Trees Planted to Meet Minimum Density Requirement
 3. Tree Location
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- 95.34 Tree and Soil Protection during Development Activity
 1. Placing Materials near Trees
 2. Protective Barrier
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 5. Additional Requirements
- 95.40 Required Landscaping
 1. User Guide
 2. Use of Significant Existing Vegetation
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- 95.41 Supplemental Plantings
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- 95.42 Minimum Land Use Buffer Requirements
- 95.43 Outdoor Use, Activity, and Storage
- 95.44 Internal Parking Lot Landscaping Requirements
- 95.45 Perimeter Landscape Buffering for Driving and Parking Areas
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- 95.46 Modifications to Landscaping Standards
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- 95.47 Nonconforming Landscaping and Buffers
- 95.50 Installation Standards for Required Plantings
 1. Compliance

2. Timing
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6. Fertilization
7. Irrigation
8. Drainage
9. Mulch
10. Protection

95.51 Tree and Landscape Maintenance Requirements

1. Responsibility for Regular Maintenance
2. Maintenance Duration
3. Maintenance of Preserved Grove
4. Maintenance in Holmes Point Overlay Zone
5. Nonnative Invasive and Noxious Plants
6. Landscape Plans and Utility Plans

95.52 Prohibited Vegetation

95.55 Enforcement and Penalties

95.57 City Forestry Account

1. Funding Sources
2. Funding Purposes

95.05 Purpose and Intent

1. Trees and other vegetation are important elements of the physical environment. They are integral to Kirkland's community character and protect public health, safety and general welfare. Protecting, enhancing, and maintaining healthy trees and vegetation are key community values. Comprehensive Plan Policy NE-3.1 describes working towards achieving a City-wide tree canopy coverage of 40 percent. The many benefits of healthy trees and vegetation contribute to Kirkland's quality of life by:

- a. Minimizing the adverse impacts of land disturbing activities and impervious surfaces such as runoff, soil erosion, land instability, sedimentation and pollution of waterways, thus reducing the public and private costs for storm water control/treatment and utility maintenance;
- b. Improving the air quality by absorbing air pollutants, mitigating the urban heat island effect, assimilating carbon dioxide and generating oxygen, and decreasing the impacts of climate change;
- c. Reducing the effects of excessive noise pollution;

- d. Providing cost-effective protection from severe weather conditions with cooling effects in the summer months and insulating effects in winter;
- e. Providing visual relief and screening buffers;
- f. Providing recreational benefits;
- g. Providing habitat, cover, food supply and corridors for a diversity of fish and wildlife; and
- h. Providing economic benefit by enhancing local property values and contributing to the region's natural beauty, aesthetic character, and livability of the community.

2. Tree and vegetation removal in urban areas has resulted in the loss to the public of these beneficial functions. The purpose of this chapter is to establish a process and standards to provide for the protection, preservation, replacement, proper maintenance, and use of significant trees, associated vegetation, and woodlands located in the City of Kirkland.

The intent of this chapter is to:

- a. Maintain and enhance canopy coverage provided by trees for their functions as identified in KZC 95.05(1);
- b. Preserve and enhance the City of Kirkland's environmental, economic, and community character with mature landscapes;
- c. Promote site planning, building, and development practices that work to avoid removal or destruction of trees and vegetation, that avoid unnecessary disturbance to the City's natural vegetation, and that provide landscaping to buffer the effects of built and paved areas;
- d. Mitigate the consequences of required tree removal in land development through on- and off-site tree replacement with the goals of halting net loss and enhancing Kirkland's tree canopy to achieve an overall healthy tree canopy cover of 40 percent City-wide over time;
- e. Encourage tree retention efforts by providing flexibility with respect to certain other development requirements;
- f. Implement the goals and objectives of the City's Comprehensive Plan;
- g. Implement the goals and objectives of the State Environmental Policy Act (SEPA); and
- h. Manage trees and other vegetation in a manner consistent with the City's Natural Resource Management Plan.
- i. Preserve and protect street trees, trees in public parks and trees on other City property.

(Ord. 4238 § 2, 2010; Ord. 4010 § 2, 2005)

95.10 Definitions

The following definitions shall apply throughout this chapter unless the context clearly indicates otherwise. Definitions that apply throughout this code are also located in Chapter 5 KZC.

- 1. Caliper – The American Association of Nurserymen standard for trunk measurement of nursery stock. Caliper of the trunk shall be the trunk diameter measured six (6) inches above the ground for up to and including 4-inch caliper size and 12 inches above the ground for larger sizes.
- 2. Critical Root Zone – The area surrounding a tree at a distance from the trunk, which is equal to one (1) foot for every inch of trunk diameter measured at 4.5 feet from grade or otherwise determined by a qualified professional (example: one (1) foot radius per one (1) inch DBH).

3. Crown – The area of a tree containing leaf- or needle-bearing branches.
4. Diameter at Breast Height (DBH) – The diameter or thickness of a tree trunk measured at 4.5 feet from the ground. DBH is also known as Diameter at Standard Height (DSH).
5. Dripline – The distance from the tree trunk, that is equal to the furthest extent of the tree’s crown.
6. Grove – A group of three (3) or more significant trees with overlapping or touching crowns.
7. Hazard Tree – A tree that meets all the following criteria:
 - a. A tree with a combination of structural defects and/or disease which makes it subject to a high probability of failure;
 - b. Is in proximity to moderate to high frequency targets (persons or property that can be damaged by tree failure); and
 - c. The hazard condition of the tree cannot be lessened with reasonable and proper arboricultural practices nor can the target be removed.
8. Impact – A condition or activity that affects a part of a tree including the trunk, branches, and critical root zone.
9. Limit of Disturbance – The boundary between the protected area around a tree and the allowable site disturbance as determined by a qualified professional measured in feet from the trunk.
10. Nuisance Tree – A tree that meets either of the following criteria:
 - a. Is causing obvious physical damage to private or public structures, including but not limited to: sidewalk, curb, road, driveway, parking lot, building foundation, or roof; or
 - b. Has sustained damage from past maintenance practices.

The problems associated with the tree must be such that they cannot be corrected by reasonable practices including but not limited to: pruning of the crown or roots of the tree, bracing, and/or cabling to reconstruct a healthy crown.
11. Public Works Official – Designee of the Public Works Director.
12. Qualified Professional – An individual with relevant education and training in arboriculture or urban forestry, having two (2) or more of the following credentials:

- International Society of Arboriculture (ISA) Certified Arborist;
- Tree Risk Assessor Certification (TRACE) as established by the Pacific Northwest Chapter of ISA (or equivalent);
- American Society of Consulting Arborists (ASCA) registered Consulting Arborist;
- Society of American Foresters (SAF) Certified Forester for Forest Management Plans;

For tree retention associated with a development permit, a qualified professional must have, in addition to the above credentials, a minimum of three (3) years’ experience working directly with the protection of trees during construction and have experience with the likelihood of tree survival after construction. A qualified professional must also be able to prescribe appropriate measures for the preservation of trees during land development.

13. Retention Value – The Planning Official’s designation of a tree based on information provided by a qualified professional that is one (1) of the following:

a. High, a viable tree, located within required yards and/or required landscape areas. Tree retention efforts shall be directed to the following trees if they are determined to be healthy and windfirm by a qualified professional, and provided the trees can be safely retained when pursuing alternatives to development standards pursuant to KZC 95.32:

- 1) Specimen trees;
- 2) Tree groves and associated vegetation that are to be set aside as preserved groves pursuant to KZC 95.51(3);
- 3) Trees on slopes of at least 10 percent; or
- 4) Trees that are a part of a grove that extends into adjacent property, such as in a public park, open space, critical area buffer or otherwise preserved group of trees on adjacent private property. If significant trees must be removed in these situations, an adequate buffer of trees may be required to be retained or planted on the edge of the remaining grove to help stabilize;

b. Moderate, a viable tree that is to be retained if feasible; or

c. Low, a tree that is either (1) not viable or (2) is in an area where removal is unavoidable due to the anticipated development activity.

14. Significant Tree – A tree that is at least six (6) inches in diameter at breast height (DBH) as measured at 4.5 feet from the ground.

15. Significantly Wooded Site – A subject property that has a number of significant trees with crowns that cover at least 40 percent of the property.

16. Site Disturbance – Any development, construction, or related operation that could alter the subject property, including, but not limited to, soil compaction, tree or tree stump removal, road, driveway or building construction, installation of utilities, or grading.

17. Specimen Tree – A viable tree that is considered in very good to excellent health and free of major defects, as determined by the City’s Urban Forester.

18. Street Tree – A tree located within the public right-of-way; provided, that if the trunk of the tree straddles the boundary line of the public right-of-way and the abutting property, it shall be considered to be on the abutting property and subject to the provisions of this chapter.

19. Tree Removal – The removal of a tree, through either direct or indirect actions, including but not limited to: (1) clearing, damaging or poisoning resulting in an unhealthy or dead tree; (2) removal of at least half of the live crown; or (3) damage to roots or trunk that is likely to destroy the tree’s structural integrity.

20. Viable Tree – A significant tree that a qualified professional has determined to be in good health, with a low risk of failure due to structural defects, is windfirm if isolated or remains as part of a grove, and is a species that is suitable for its location.

21. Wildlife Snag – The remaining trunk of a tree that is intentionally reduced in height and usually stripped of its live branches.

22. Windfirm – A condition of a tree in which it withstands average peak local wind speeds and gusts.

(Ord. 4551 § 4, 2017; Ord. 4238 § 2, 2010; Ord. 4193 § 1, 2009; Ord. 4010 § 2, 2005)

95.20 Exemptions

The following activities are exempt from the provisions of this chapter:

1. **Emergency Tree Removal.** Any tree that poses an imminent threat to life or property may be removed. The City must be notified within seven (7) days of the emergency tree removal with evidence of the threat for removing the tree to be considered exempt from this chapter. If the Planning Official determines that the emergency tree removal was not warranted or if the removed tree was required by a development permit, the Planning Official may require that the party obtain a permit and/or require that replacement trees and vegetation be replanted as mitigation.
2. **Utility Maintenance.** Trees may be removed by the City or utility provider in situations involving interruption of services provided by a utility only if pruning cannot solve utility service problems. Utility maintenance shall conform to a City-approved Utility Vegetation Management Plan.
3. **Commercial Nurseries or Tree Farms.** A nursery or tree farm owner may remove trees that are being grown to be sold as Christmas or landscape trees.

(Ord. 4238 § 2, 2010; Ord. 4010 § 2, 2005)

95.21 Tree Pruning

1. **Tree Pruning of Street Trees.** It is the responsibility of the abutting property owner to maintain street trees abutting their property, which may include pruning, watering, and mulching. In order to prune, trim, modify, or alter a street tree, the abutting property owner shall apply for a permit by filing a written application with the City. Pruning shall conform to the most recent version of the American National Standards Institute (ANSI) A300 Part 1 – 2001 pruning standards or as outlined in an approved Utility Vegetation Management Plan. The City reserves the right to have City or utility crews perform routine pruning and maintenance of street trees.
2. **Tree Pruning on Private Property.** A permit is not required to prune trees on private property. Pruning which results in the removal of at least half of the live crown will be considered tree removal and subject to the provisions in KZC 95.23.

Tree topping is not allowed. If a tree required by this chapter is smaller than six (6) inches in diameter and is topped, it must be replaced pursuant to the standards in Chapter 1.12 KMC. If a tree six (6) inches or larger in diameter is topped, the owner must have a qualified professional develop and implement a 5-year restoration pruning program.

(Ord. 4281 § 1, 2011; Ord. 4238 § 2, 2010)

95.23 Tree Removal – Not Associated with Development Activity

1. **Introduction.** Tree and vegetation removal in urban areas has resulted in the loss of beneficial functions provided by trees to the public. The majority of tree canopy within the City of Kirkland is on private property. The purpose of this section is to establish a process and standards to slow the loss of tree canopy on private property, contributing towards the City's canopy goals and a more sustainable urban forest.
2. **Permit Required for Removal of Trees on Private Property or City Right-of-Way.** It is unlawful for any person (other than City crews) to remove, prune, trim, modify, alter or damage a tree in a public park or on any other City property.

No person, directly or indirectly, shall remove any significant tree on any property within the City, or any tree in the public right-of-way, without first obtaining a tree removal permit as provided in this chapter, unless the activity is exempted in KZC 95.20 and subsection (5) of this section.
3. **Tree Removal Permit Application Form.** The Planning and Building Department and Public Works Department shall establish and maintain a tree removal permit application form to allow property owners to request City review of tree removal for compliance with applicable City regulations. The tree removal application form shall include at a minimum the following:
 - a. A site plan showing the approximate location of significant trees, their size (DBH) and their species, along with the location of structures, driveways, access ways and easements.

b. For required replacement trees, a planting plan showing location, size and species of the new trees in accordance to standards set forth in KZC 95.33(3).

4. Tree Removal Permit Application Procedure and Appeals.

a. Applicants requesting to remove trees must submit a completed permit application on a form provided by the City. The City shall review the application within 21 calendar days and either approve, approve with conditions or modifications, deny the application or request additional information. Any decision to deny the application shall be in writing along with the reasons for the denial and the appeal process.

b. The decision of the Planning Official is appealable using the applicable appeal provisions of Chapter 145 KZC.

c. Time Limit. The removal shall be completed within one (1) year from the date of permit approval.

5. Tree Removal Allowances.

a. Except in the Holmes Point Overlay zone, any private property owner of developed property may remove up to two (2) significant trees from their property within a 12-month period without having to apply for a tree removal permit; provided, that:

1) There is no active application for development activity for the site;

2) The trees were not required to be retained or planted as a condition of previous development activity; and

3) All of the additional standards for tree removal and tree removal permits as described in subsections (5)(b) through (e) of this section are met.

The Planning and Building Department shall establish and maintain a tree removal request form. The form may be used by property owners to request Department review of tree removal for compliance with applicable City regulations.

b. Tree Retention and Replacement Requirements.

1) Tree Retention. For single-family homes, cottages, carriage units, two/three-unit homes, two (2) trees shall be required to remain on the subject property.

2) Tree Replacement.

a) For every significant tree that is removed and is not required to remain based on subsection (5)(b)(1) of this section, the City encourages the planting of a tree that is appropriate to the site.

b) If a tree removal request is for one (1) or both of the trees required to remain, a tree removal permit and one-for-one replacement is required. the replacement tree shall be six (6) feet tall for a conifer and 2-inch caliper for deciduous or broad-leaf evergreen tree.

c) For all other uses not listed in subsection (5)(b)(1) of this section, a tree removal permit is required and the required tree replacement will be based on the required landscaping standards in KZC 95.40 through 95.45.

c. Shoreline Jurisdiction. Properties located within the City's shoreline jurisdiction are subject to additional tree removal and replacement standards if the tree(s) to be removed are located within the required shoreline setback. See Chapter 83 KZC for additional standards.

d. Removal of Hazard or Nuisance Trees. Any private property owner seeking to remove any number of significant trees which are a hazard or nuisance from developed or undeveloped property or the public right-of-way shall first obtain approval of a tree removal permit and meet the requirements of this subsection.

1) Tree Risk Assessment. If the nuisance or hazard condition is not obvious, a tree risk assessment prepared by a qualified professional explaining how the tree(s) meet the definition of a nuisance or hazard tree is required. Removal of nuisance or hazard trees does not count toward the tree removal limit if the nuisance or hazard is supported by a report prepared by a qualified professional and approved by the City.

2) Trees in Critical Areas or Critical Areas Buffers. See Chapter 90 KZC.

3) The removal of any tree in the Holmes Point Overlay Zone requires the planting of a native tree of a minimum of six (6) feet in height in close proximity to where the removed tree was located. Selection of native species and timing of installation shall be approved by the Planning Official.

4) Street Trees. Street trees may only be removed if determined to be a hazard or nuisance. If the removal request is for street trees, the Public Works Official may consider whether the tree(s) are now, or may be in the future, part of the City's plans for the right-of-way. The City shall require a one-for-one tree replacement in a suitable location.

e. Forest Management Plan.

1) A Forest Management Plan must be submitted for developed, significantly wooded sites (over 40 percent canopy coverage) of at least 35,000 square feet in size in which removal of more than two (2) trees is requested and is not exempt under KZC 95.20. A Forest Management Plan must be developed by a qualified professional and shall include the following:

a) A site plan depicting the location of all significant trees (a survey identifying tree locations is not required) with a numbering system of the trees (with corresponding tags on trees in the field). The site plan shall include size (DBH), species, and condition of each tree;

b) Identification of trees to be removed, including reasons for their removal and a description of low impact removal techniques pursuant to subsection (5)(e)(2) of this section;

c) A reforestation plan that includes location, size, species, and timing of installation;

2) The following Forest Management Plan standards shall apply:

a) Trees to remain should be dominant or co-dominant in the stand, healthy and windfirm.

b) No removal of trees from critical areas and their buffers, unless otherwise permitted by this chapter.

c) No removal of specimen trees, unless otherwise permitted by this chapter.

d) No removal of healthy trees that would cause trees on adjacent properties to become hazardous.

e) The reforestation plan ensures perpetuity of the wooded areas. The size of planted trees for reforestation shall be a minimum of three (3) feet tall.

f) Logging operations shall be conducted so as to expose the smallest practical area of soil to erosion for the least possible time. To control erosion, native shrubs, ground cover and stumps shall be retained where feasible. Where not feasible, appropriate erosion control measures to be approved by the City shall be implemented.

g) Removal of tree debris shall be done pursuant to Kirkland Fire Department standards.

h) Recommended maintenance prescription for retained trees with a specific timeline for such management.

(Ord. 4551 § 4, 2017; Ord. 4491 § 3, 2015; Ord. 4437 § 1, 2014; Ord. 4408 § 1, 2013; Ord. 4372 § 1, 2012; Ord. 4238 § 2, 2010)

95.25 Sustainable Site Development

All activities regulated by this chapter shall be performed in compliance with the applicable standards contained in this chapter, unless the applicant demonstrates that alternate measures or procedures will be equal or superior to the provisions of this chapter in accomplishing the purpose and intent of this chapter as described in KZC 95.05.

Applicants requesting alternative compliance shall submit a site assessment report prepared by a qualified professional detailing how the proposed alternative measures will be equal or superior to the benefits provided by the established trees to be removed. Qualifying projects shall implement sustainable site development strategies throughout the construction process as well as contain measurable performance standards for the techniques used. Examples of sustainable site development include building placement with minimal site impact, habitat protection, water conservation, heat island reduction, storm water flow runoff control and water quality, and utilization of the site's natural services such as solar and wind. Requests to use alternative measures and procedures shall be reviewed by the Planning Official, who may approve, approve with conditions, or deny the request.

(Ord. 4238 § 2, 2010; Ord. 4010 § 2, 2005)

95.30 Tree Retention Associated with Development Activity

1. Introduction. The City's objective is to retain as many viable trees as possible on a developing site while still allowing the development proposal to move forward in a timely manner. To that end, the City requires approval of a tree retention plan in conjunction with all development permits resulting in site disturbance and for any tree removal on developed sites not exempted by KZC 95.20. This section includes provisions that allow development standards to be modified in order to retain viable significant trees.

In order to make better decisions about tree retention, particularly during all stages of development, tree retention plans will require specific information about the existing trees before removal is allowed. Specific tree retention plan review standards provided in this section establish tree retention priorities, incentives, and variations to development standards in order to facilitate preservation of viable trees.

A minimum tree density approach is being used to retain as many viable trees as possible with new development activity. The requirement to meet a minimum tree density applies to new single-family homes, cottages, carriage units, two/three-unit homes, and new residential subdivisions and short subdivisions. If such a site falls below the minimum density with existing trees, supplemental planting is required. A tree density for existing trees to be retained is calculated to see if new trees are required in order to meet the minimum density for the entire site. Supplemental tree location priority is set as well as minimum size of supplemental trees to meet the required tree density.

The importance of effective protection of retained trees during construction is emphasized with specific protection standards in the last part of this section. These standards must be adhered to and included on demolition, grading and building plans as necessary.

Properties within jurisdiction of the Shoreline Management Act are subject to additional tree retention and protection regulations as set forth in Chapter 83 KZC.

Properties within the Holmes Point Overlay zone are subject to additional tree retention and protection regulations as set forth in Chapter 70 KZC.

2. Tree Retention Plan Required. An applicant for a development permit must submit a tree retention plan that complies with this section. A qualified professional may be required to prepare certain components of a tree retention plan at the applicant's expense. If proposed development activities call for more than one (1) tree retention plan component, the more stringent tree retention plan component shall apply; provided, that the Planning Official

may require a combination of tree plan components based on the nature of the proposed development activities. If the proposed activity is not clearly identified in this chapter, the Planning Official shall determine the appropriate tree retention plan requirements.

The chart in subsection (5) of this section sets forth the tree retention plan requirements for development activities and associated tree removal. Applicants for development are encouraged to confer with City staff as early in the design process as possible so that the applicable tree planting and retention concepts can be incorporated into the design of the subject property. The Planning Official may waive a component of the tree retention plan if the Planning Official determines that the information is not necessary.

3. Tree Retention Plan Review. Any proposed development of the subject property requiring approval through a building permit, land surface modification permit, and/or demolition permit, or Design Review, Process I, IIA or IIB, described in Chapters 142, 145, 150 and 152 KZC respectively, shall include a tree retention plan to be considered as part of that process.

Based on the tree retention plan information submitted by the applicant and the Planning Official's evaluation of the trees relative to the proposed development on the subject property, the Planning Official shall designate each tree as having a high, moderate, or low retention value as defined in KZC 95.10, Definitions, for application towards the regulations in this chapter.

4. Tree Retention Plan Components. The tree retention plan shall contain the following information as specified in the chart in subsection (5) of this section, unless waived by the Planning Official:

a. A tree inventory containing the following:

- 1) A numbering system of all existing significant trees on the subject property (with corresponding tags on trees); the inventory must also include significant trees on adjacent property with driplines extending over the subject property line;
- 2) Limits of disturbance (LOD) of all existing significant trees (including approximate LOD of off-site trees with overhanging driplines);
- 3) Size (DBH);
- 4) Proposed tree status (trees to be removed or retained);
- 5) Brief general health or condition rating of these trees (i.e.: poor, fair, good, excellent, etc.);
- 6) Tree type or species.

b. A site plan depicting the following:

- 1) Location of all proposed improvements, including building footprint, access, utilities, applicable setbacks, buffers, and required landscaped areas clearly identified. If a short plat or subdivision is being proposed and the location of all proposed improvements cannot be established, a phased tree retention plan review is required as described in subsection (6)(a) of this section;
- 2) Accurate location of significant trees on the subject property (surveyed locations may be required). The site plan must also include the approximate trunk location and critical root zone of significant trees that are on adjacent property with driplines extending over the subject property line;
- 3) Trees labeled corresponding to the tree inventory numbering system;
- 4) Location of tree protection measures;

- 5) Indicate limits of disturbance drawn to scale around all trees potentially impacted by site disturbances resulting from grading, demolition, or construction activities (including approximate LOD of off-site trees with overhanging driplines);
 - 6) Proposed tree status (trees to be removed or retained) noted by an ‘X’ or by ghosting out;
 - 7) Proposed locations of any supplemental trees and any required trees in order to meet tree density or minimum number of trees as outlined in KZC 95.33.
- c. An arborist report containing the following:
- 1) A complete description of each tree’s health, condition, and viability;
 - 2) A description of the method(s) used to determine the limits of disturbance (i.e., critical root zone, root plate diameter, or a case-by-case basis description for individual trees);
 - 3) Any special instructions specifically outlining any work proposed within the limits of the disturbance protection area (i.e., hand-digging, tunneling, root pruning, any grade changes, clearing, monitoring, and aftercare);
 - 4) For trees not viable for retention, a description of the reason(s) for removal based on poor health, high risk of failure due to structure, defects, unavoidable isolation (windfirmness), or unsuitability of species, etc., and for which no reasonable alternative action is possible must be given (pruning, cabling, etc.);
 - 5) Describe the impact of necessary tree removal to the remaining trees, including those in a grove or on adjacent properties;
 - 6) For development applications, a discussion of timing and installation of tree protection measures that must include fencing and be in accordance with the tree protection standards as outlined in KZC 95.34; and
 - 7) The suggested location and species of supplemental trees to be used when required. The report shall include planting and maintenance specifications pursuant to KZC 95.50 and 95.51.

5. Tree Retention Plan. The applicant shall submit a Tree Retention Plan that includes the components identified in the following chart based on the proposed development activity.

TREE RETENTION PLAN

Development Activity	Minor ⁽¹⁾⁽³⁾ – Single-Family, or two attached, detached, or stacked dwelling units, and related demolition and land surface modification applications	Major ⁽²⁾⁽³⁾ Single-Family, or two attached, detached, or stacked dwelling units, and related demolition and land surface modification applications	Multifamily, Commercial, any other use other than residential, and related demolition and land surface modification applications	Short Plat, Subdivisions, cottages, carriage units, two/three-unit homes, and related demolition and land surface modification applications (see KZC 95.30(6)(a), Phased Review, for additional standards)
Required Components				
TREE INVENTORY AS DESCRIBED IN KZC 95.30(4)(a) FOR:				
All significant trees on the subject property		X	X	X
Significant trees potentially impacted by proposed development activity	X			
SITE PLAN AS DESCRIBED IN KZC 95.30(4)(b) TO INCLUDE:				
Surveyed tree locations if required by the Planning Official		X	X	

Development Activity	Minor ⁽¹⁾⁽³⁾ – Single-Family, or two attached, detached, or stacked dwelling units, and related demolition and land surface modification applications	Major ⁽²⁾⁽³⁾ Single-Family, or two attached, detached, or stacked dwelling units, and related demolition and land surface modification applications	Multifamily, Commercial, any other use other than residential, and related demolition and land surface modification applications	Short Plat, Subdivisions, cottages, carriage units, two/three-unit homes, and related demolition and land surface modification applications (see KZC 95.30(6)(a), Phased Review, for additional standards)
Required Components				
Surveyed tree locations				X
A final landscape plan showing retained trees			X	
REQUIREMENTS IN KZC 95.30(4)(c) SHALL BE PREPARED BY A QUALIFIED PROFESSIONAL AND APPLY TO:				
Significant trees within required yards or within 10 feet of any side property line		X		
Significant trees potentially impacted by proposed development activity as determined by the Planning Official			X	
Proposed removal of trees with a high retention value in required landscaping areas			X	
All significant trees				X
TREE RETENTION STANDARDS				
Applicant is encouraged to retain viable trees	X ⁽⁴⁾			
Retain and protect trees with a high retention value to the maximum extent possible		X ⁽⁴⁾	X ⁽⁴⁾	X ⁽⁴⁾
Retain and protect trees with a moderate retention value if feasible		X	X	X
Preservation and maintenance agreements pursuant to KZC 95.51 are required for all remaining trees on the subject property	X	X	X	X ⁽⁵⁾
TREE DENSITY				
Tree density requirements shall apply as required in KZC 95.33		X		X
A minimum of two trees must be on the lot following the requirement set forth in KZC 95.33(4)	X			
LANDSCAPING				
Preserved trees in required landscaping areas shall apply toward required landscaping requirements			X	

(1) Applicable when new development, redevelopment, or development in which the total square footage of the proposed improvements is less than 50 percent of the total square footage of the existing improvements on the subject property.

(2) Applicable when new development, redevelopment, or development in which the total square footage of the proposed improvements is more than 50 percent of the total square footage of the existing improvements on the subject property.

(3) For lots created through a short subdivision, subdivision, or planned unit development with an approved Tree Retention Plan, the applicant must comply with the Tree Retention

Plan approved with the short subdivision, subdivision, or planned unit development unless subsection (6)(a) of this section, Phased Review, applies.

(4) To retain trees with a high retention value, the applicant shall pursue, where feasible, applicable variations in the development standards of this code as outlined in KZC 95.32.

(5) Prior to short plat or subdivision recording.

6. Additional Tree Retention Plan Standards for Short Plats and Subdivisions.

a. Phased Review.

1) If during the short plat or subdivision review process the location of all proposed improvements, including the building footprint, utilities, and access, was not able to be established, the applicant may submit a Tree Retention Plan that addresses trees only affected by the known improvements at the time of application. Tree removal shall be limited to those affected areas.

2) A new Tree Retention Plan shall be required at each subsequent phase of the project as more information about the location of the proposed improvements is known subject to all of the requirements in this section.

3) Phased review of Tree Retention Plans is not permitted in the Holmes Point Overlay zone. In the HPO zone, subdivision or short plat applications shall provide a comprehensive review of Tree Retention Plans as outlined in subsections (2) through (5) of this section.

b. Modifications to Tree Retention Plan for Short Plats and Subdivisions. A Tree Retention Plan modification request shall contain information as determined by the Planning Official based on the requirements in subsection (5) of this section, Tree Retention Plan. The fee for processing a modification request shall be established by City ordinance.

For Tree Retention Plans approved during the short plat or subdivision review process that established the location of all proposed improvements, including the building footprint, utilities, and access, a modification to the Tree Retention Plan may be approved as follows:

1) Modification – General. The Planning Official may approve minor modifications to the approved Tree Retention Plan in which the minimum tree density credits associated with trees identified for retention are not decreased.

2) Modification Prior to Tree Removal. The Planning Official may approve a modification request to decrease the minimum number of tree density credits associated with trees previously identified for retention if:

a) Trees inventoried in the original Tree Retention Plan have not yet been removed; and

b) The Planning Official shall not approve or deny a modification pursuant to this section without first providing notice of the modification request consistent with the noticing requirements for the short plat.

3) Modification after Tree Removal. A modification request is required to decrease the minimum number of tree density credits associated with trees previously identified for retention after which trees inventoried in the original Tree Retention Plan have already been removed. Such a request may be approved by the Hearing Examiner only if the following are met:

a) The need for the modification was not known and could not reasonably have been known before the tree retention plan was approved;

- b) The modification is necessary because of special circumstances which are not the result of actions by the applicant regarding the size, shape, topography, or other physical limitations of the subject property relative to the location of proposed and/or existing improvements on or adjacent to the subject property;
- c) There is no practicable or feasible alternative development proposal that results in fewer additional tree removals;
- d) The Hearing Examiner shall not approve or deny a modification pursuant to this section without the Planning Official first providing notice of the modification request consistent with the noticing requirements for the short plat and providing opportunity for comments for consideration by the Hearing Examiner; and
- e) Said comment period shall not be less than 14 calendar days.

(Ord. 4619 § 1, 2017; Ord. 4437 § 1, 2014; Ord. 4252 § 1, 2010; Ord. 4238 § 2, 2010; Ord. 4010 § 2, 2005)

95.32 Incentives and Variations to Development Standards

In order to retain trees, the applicant should pursue provisions in Kirkland's codes that allow development standards to be modified. Examples include but are not limited to number of parking stalls, right-of-way improvements, lot size reduction under Chapter 22.28 KMC, lot line placement when subdividing property under KMC Title 22, Planned Unit Developments, and required landscaping, including buffers for lands use and parking/driving areas.

Requirements of the Kirkland Zoning Code may be modified by the Planning Official as outlined below when such modifications would further the purpose and intent of this chapter as set forth in KZC 95.05 and would involve trees with a high or moderate retention value.

1. **Common Recreational Open Space.** Reductions or variations of the area, width, or composition of required common recreational open space may be granted.
2. **Parking Areas and Access.** Variations in parking lot design and/or access driveway requirements may be granted when the Public Works and Planning Officials both determine the variations to be consistent with the intent of City policies and codes.
3. **Required Yards.** Initially, the applicant shall pursue options for placement of required yards as permitted by other sections of this code, such as selecting one (1) front required yard in the RSX zone and adjusting side yards in any zone to meet the 15-foot total as needed for each structure on the site. The Planning Official may also reduce the front, side or rear required yards; provided, that:
 - a. No required side yard shall be less than five (5) feet; and
 - b. The required front yard shall not be reduced by more than five (5) feet in residential zones. There shall not be an additional five (5) feet of reduction beyond the allowance provided for covered entry porches;
 - c. Rear yards that are not directly adjacent to another parcel's rear yard but that are adjacent to an access easement or tract may be reduced by five (5) feet;
 - d. No required yard shall be reduced by more than five (5) feet in residential zones.
4. **Storm Water.** Requirements pertaining to stormwater may be varied if approved by the Public Works Official under KMC 15.52.060.
5. **Additional Variations.** In addition to the variations described above, the Planning Official is authorized to require site plan alterations to retain trees with a high retention value. Such alterations include minor adjustments to the location of building footprints, adjustments to the location of driveways and access ways, or adjustment to the

location of walkways, easements or utilities. The Planning Official and the applicant shall work in good faith to find reasonable solutions.

(Ord. 4547 § 1, 2016; Ord. 4350 § 1, 2012; Ord. 4238 § 2, 2010)

95.33 Tree Density Requirement

The required minimum tree density is 30 tree credits per acre for single-family homes, cottages, carriage units, two/three-unit homes, short plats, and/or subdivisions and associated demolition and land surface modification. For individual lots in a short subdivision or subdivision with an approved Tree Retention Plan, the tree density shall be calculated for each lot within the short plat or subdivision. The tree density may consist of existing trees pursuant to the tree’s retention value, supplemental trees or a combination of existing and supplemental trees pursuant to subsection (2) of this section. Existing trees transplanted to an area on the same site shall not count toward the required density unless approved by the Urban Forester based on transplant specifications provided by a qualified professional that will ensure a good probability for survival.

1. Tree Density Calculation. In calculating tree density credits, tree credits may be rounded up to the next whole number from a 0.5 or greater value. For the purpose of calculating required minimum tree density, public right-of-way, areas to be dedicated as public right-of-way, and vehicular access easements not included as lot area with the approved short plat shall be excluded from the area used for calculation of tree density.

Tree density calculation for existing individual trees:

- a. Diameter breast height (DBH) of the tree shall be measured in inches.
- b. The tree credit value that corresponds with DBH shall be found in Table 95.33.1. Existing native conifers (or other conifer species as approved by the Urban Forester) shall count 1.5 times credits for retention.

Table 95.33.1

Tree Density for Existing Significant Trees

(Credits per minimum diameter – DBH)

DBH	Tree Credits	DBH	Tree Credits	DBH	Tree Credits
3 – 5"	0.5				
6 – 10"	1	24"	8	38"	15
12"	2	26"	9	40"	16
14"	3	28"	10	42"	17
16"	4	30"	11	44"	18
18"	5	32"	12	46"	19
20"	6	34"	13	48"	20
22"	7	36"	14	50"	21

Example: a 7,200-square-foot lot would need five (5) tree credits ($7,200/43,560 = 0.165 \times 30 = (4.9)$ or five (5)). The tree density for the lot could be met by retaining one (1) existing 16-inch deciduous tree and one (1) existing 6-inch deciduous tree on site. The same 7,200-square-foot lot would meet the required five (5) tree credits by retaining one (1) existing 14-inch conifer.

2. Supplemental Trees Planted to Meet Minimum Density Requirement. For sites and activities requiring a minimum tree density and where the existing trees to be retained do not meet the minimum tree density requirement, supplemental trees shall be planted to achieve the required minimum tree density.
3. Tree Location. In designing a development and in meeting the required minimum tree density, the trees shall be planted in the following order of priority:
 - a. On-Site. The preferred locations for new trees are:
 - 1) In preserved groves, critical areas or their buffers.
 - 2) Adjacent to storm water facilities as approved by Public Works under KMC 15.52.060.
 - 3) Entrance landscaping, traffic islands and other common areas in residential subdivisions.
 - 4) Site perimeter – The area of the subject property that is within 10 feet from the property line.
 - 5) On individual residential building lots.
 - b. Off-Site. When room is unavailable for planting the required trees on site, then they may be planted at another approved location in the City.
 - c. City Forestry Account. When the Planning Official determines on-site and off-site locations are unavailable, then the applicant shall pay an amount of money approximating the current market value of the supplemental trees into the City forestry account.
4. Minimum Size and Tree Density Value for Supplemental Trees. The required minimum size of the supplemental tree worth one (1) tree credit shall be six (6) feet tall for Thuja/Arborvitae or four (4) feet tall for native or other conifers and 2-inch caliper for deciduous or broad-leaf evergreen tree. Additional credits may be awarded for larger supplemental trees. The installation and maintenance shall be pursuant to KZC 95.50 and 95.51 respectively.

(Ord. 4547 § 1, 2016; Ord. 4238 § 2, 2010)

95.34 Tree and Soil Protection during Development Activity

Prior to development activity or initiating tree removal on the site, vegetated areas, individual trees and soil to be preserved shall be protected from potentially damaging activities pursuant to the following standards:

1. Placing Materials near Trees. No person may conduct any activity within the protected area of any tree designated to remain, including, but not limited to, operating or parking equipment, placing solvents, storing building material or stockpiling any materials, or dumping concrete washout or other chemicals. During construction, no person shall attach any object to any tree designated for protection.
2. Protective Barrier. Before development, land clearing, filling or any land alteration, the applicant shall:
 - a. Erect and maintain readily visible temporary protective tree fencing along the limits of disturbance which completely surrounds the protected area of all retained trees, groups of trees, vegetation and native soil. Fences shall be constructed of chain link and be at least six (6) feet high, unless other type of fencing is authorized by the Planning Official.
 - b. Install highly visible signs spaced no further than 15 feet along the entirety of the protective tree fence. Said sign must be approved by the Planning Official and shall state at a minimum “Tree and Soil Protection Area, Entrance Prohibited” and provide the City phone number for code enforcement to report violations.
 - c. Prohibit excavation or compaction of soil or other potentially damaging activities within the barriers; provided, that the Planning Official may allow such activities approved by a qualified professional and under the supervision of a qualified professional retained and paid for by the applicant.

- d. Maintain the protective barriers in place for the duration of the project until the Planning Official authorizes their removal.
 - e. Ensure that any approved landscaping done in the protected zone subsequent to the removal of the barriers shall be accomplished with machinery from outside the protected zone or by hand.
 - f. In addition to the above, the Planning Official may require the following:
 - 1) If equipment is authorized to operate within the protected zone, the soil and critical root zone of a tree must be covered with mulch to a depth of at least six (6) inches or with plywood, steel plates or similar material in order to protect roots and soil from damage caused by heavy equipment.
 - 2) Minimize root damage by hand-excavating a 2-foot-deep trench, at edge of critical root zone, to cleanly sever the roots of trees to be retained. Never rip or shred roots with heavy equipment.
 - 3) Corrective pruning performed on protected trees in order to avoid damage from machinery or building activity.
 - 4) Maintenance of trees throughout construction period by watering and fertilizing.
3. Grade.
- a. The grade shall not be elevated or reduced within the critical root zone of trees to be preserved without the Planning Official's authorization based on recommendations from a qualified professional. The Planning Official may allow coverage of up to one-half (1/2) of the area of the tree's critical root zone with light soils (no clay) to the minimum depth necessary to carry out grading or landscaping plans, if it will not imperil the survival of the tree. Aeration devices may be required to ensure the tree's survival.
 - b. If the grade adjacent to a preserved tree is raised such that it could slough or erode into the tree's critical root zone, it shall be permanently stabilized to prevent soil erosion and suffocation of the roots.
 - c. The applicant shall not install an impervious surface within the critical root zone of any tree to be retained without the authorization of the Planning Official. The Planning Official may require specific construction methods and/or use of aeration devices to ensure the tree's survival and to minimize the potential for root-induced damage to the impervious surface.
 - d. To the greatest extent practical, utility trenches shall be located outside of the critical root zone of trees to be retained. The Planning Official may require that utilities be tunneled under the roots of trees to be retained if the Planning Official determines that trenching would significantly reduce the chances of the tree's survival.
 - e. Trees and other vegetation to be retained shall be protected from erosion and sedimentation. Clearing operations shall be conducted so as to expose the smallest practical area of soil to erosion for the least possible time. To control erosion, it is encouraged that shrubs, ground cover and stumps be maintained on the individual lots, where feasible.
4. Directional Felling. Directional felling of trees shall be used to avoid damage to trees designated for retention.
5. Additional Requirements. The Planning Official may require additional tree protection measures that are consistent with accepted urban forestry industry practices.

(Ord. 4547 § 1, 2016; Ord. 4238 § 2, 2010)

95.40 Required Landscaping

1. User Guide. Chapters 15 through 56 KZC containing the use zone or development standards tables assign a landscaping category to each use in each zone. This category is either "A," "B," "C," "D," or "E." If you do not know which landscaping category applies to the subject property, you should consult the appropriate use zone or development standards tables.

Requirements pertaining to each landscaping category are located throughout this chapter, except that Landscaping Category E is not subject to this section.

Landscape Categories A, B, C, D, and E may be subject to additional related requirements in the following other chapters:

- a. Various use zone charts or development standards tables, in Chapters 15 through 56 KZC, establish additional or special buffering requirements for some uses in some zones.
 - b. Chapter 85 KZC, Geologically Hazardous Areas, addresses the retention of vegetation on steep slopes.
 - c. Chapter 90 KZC, Critical Areas, addresses vegetation within critical areas and critical area buffers.
 - d. Chapter 110 KZC and Chapter 19.36 KMC address vegetation within rights-of-way, except for the I-405 and SR-520 rights-of-way, and the Cross Kirkland Corridor railbanked rail corridor or the Eastside Rail Corridor.
 - e. KZC 115.135, Sight Distance at Intersections, which may limit the placement of landscaping in some areas.
 - f. Chapter 22 KMC addresses trees in subdivisions.
2. Use of Significant Existing Vegetation.
- a. General. The applicant shall apply subsection KZC 95.30(3), Tree Retention Plan Procedure, and KZC 95.32, Incentives and Variations to Development Standards, to retain existing native trees, vegetation and soil in areas subject to the landscaping standards of this section. The Planning Official shall give substantial weight to the retained native trees and vegetation when determining the applicant's compliance with this section.
 - b. Supplement. The City may require the applicant to plant trees, shrubs, and groundcover according to the requirements of this section to supplement the existing vegetation in order to provide a buffer at least as effective as the required buffer.
 - c. Protection Techniques. The applicant shall use the protection techniques described in KZC 95.34 to ensure the protection of significant existing vegetation and soil.
3. Landscape Plan Required. In addition to the Tree Retention Plan required pursuant to KZC 95.30, application materials shall clearly depict the quantity, location, species, and size of plant materials proposed to comply with the requirements of this section, and shall address the plant installation and maintenance requirements set forth in KZC 95.50 and 95.51. Plant materials shall be identified with both their scientific and common names. Any required irrigation system must also be shown.

(Ord. 4551 § 4, 2017; Ord. 4547 § 1, 2016; Ord. 4476 § 3, 2015; Ord. 4408 § 1, 2013; Ord. 4238 § 2, 2010; Ord. 4121 § 1, 2008; Ord. 4097 § 1, 2007; Ord. 4037 § 1, 2006; Ord. 4030 § 1, 2006; Ord. 4010 § 2, 2005)

95.41 Supplemental Plantings

1. General. The applicant shall provide the supplemental landscaping specified in subsection (2) of this section in any area of the subject property that:
 - a. Is not covered with a building, vehicle circulation area or other improvement; and
 - b. Is not a critical area, critical area buffer, or in an area to be planted with required landscaping; and
 - c. Is not committed to and being used for some specific purpose.
2. Standards. The applicant shall provide the following at a minimum:

- a. Living plant material which will cover 80 percent of the area to be landscaped within two (2) years. If the material to be used does not spread over time, the applicant shall re-plant the entire area involved immediately. Any area that will not be covered with living plant material must be covered with nonliving groundcover. Preference is given to using native plant species. See Kirkland Native Tree/Plant Lists.
- b. One (1) tree for each 1,000 square feet of area to be landscaped. At the time of planting, deciduous trees must be at least two (2) inches in caliper and coniferous trees must be at least five (5) feet in height.
- c. If a development requires approval through Process I, IIA or IIB as described in Chapters 145, 150 and 152 KZC, respectively, the City may require additional vegetation to be planted along a building facade if:
 - 1) The building facade is more than 25 feet high or more than 50 feet long; or
 - 2) Additional landscaping is necessary to provide a visual break in the facade.
- d. In RHBD varieties of rose shrubs or ground cover along with other plant materials shall be included in the on-site landscaping.
- e. If development is subject to Design Review as described in Chapter 142 KZC, the City will review plant choice and specific plant location as part of the Design Review approval. The City may also require or permit modification to the required plant size as part of Design Review approval.

(Ord. 4547 § 1, 2016; Ord. 4238 § 2, 2010)

95.42 Minimum Land Use Buffer Requirements

The applicant shall comply with the provisions specified in the following chart and with all other applicable provisions of this chapter. Land use buffer requirements may apply to the subject property, depending on what permitted use exists on the adjoining property or, if no permitted use exists, depending on the zone that the adjoining property is in.

LANDSCAPING CATEGORY	ADJOINING PROPERTY	*Public park or low density residential use or if no permitted use exists on the adjoining property then a low density zone.	Medium or high density residential use or if no permitted use exists on the adjoining property then a medium density or high density zone.	Institutional or office use or if no permitted use exists on the adjoining property then an institutional or office zone.	A commercial use or an industrial use or if no permitted use exists on the adjoining property then a commercial or industrial zone.
A	Must comply with subsection (1) (Buffering Standard 1)	Must comply with subsection (1) (Buffering Standard 1)	Must comply with subsection (1) (Buffering Standard 1)	Must comply with subsection (2) (Buffering Standard 2)	
B	Must comply with subsection (1) (Buffering Standard 1)	Must comply with subsection (1) (Buffering Standard 1)	Must comply with subsection (1) (Buffering Standard 1)		
C	Must comply with subsection (1) (Buffering Standard 1)	Must comply with subsection (1) (Buffering Standard 1)	Must comply with subsection (2) (Buffering Standard 2)		
D	Must comply with subsection (2) (Buffering Standard 2)				
E					
Footnotes:	*If the adjoining property is zoned Central Business District, Juanita Business District, North Rose Hill Business District, Rose Hill Business District, Finn Hill Neighborhood Center, Houghton/Everest Neighborhood Center, Business District Core or is located in TL 5, this section KZC 95.42 does not apply.				

This chart establishes which buffering standard applies in a particular case. The following subsections establish the specific requirement for each standard:

1. For standard 1, the applicant shall provide a 15-foot-wide landscaped strip with a 6-foot-high solid screening fence or wall. Except for public utilities, the fence or wall must be placed on the outside edge of the land use buffer or on the property line when adjacent to private property. For public utilities, the fence or wall may be placed either on the outside or inside edge of the landscaping strip. A fence or wall is not required when the land use buffer is adjacent and parallel to a public right-of-way that is improved for vehicular use. See KZC 115.40 for additional fence standards. The land use buffer must be planted as follows:
 - a. Trees planted at the rate of one (1) tree per 20 linear feet of land use buffer, with deciduous trees of two and one-half (2-1/2) inch caliper, minimum, and/or coniferous trees eight (8) feet in height, minimum. At least 70 percent of trees shall be evergreen. The trees shall be distributed evenly throughout the buffer, spaced no more than 20 feet apart on center.
 - b. Large shrubs or a mix of shrubs planted to attain coverage of at least 60 percent of the land use buffer area within two (2) years, planted at the following sizes and spacing, depending on type:
 - 1) Low shrub – (mature size under three (3) feet tall), 1- or 2-gallon pot or balled and burlapped equivalent;
 - 2) Medium shrub – (mature size from three (3) to six (6) feet tall), 2- or 3-gallon pot or balled and burlapped equivalent;
 - 3) Large shrub – (mature size over six (6) feet tall), 5-gallon pot or balled and burlapped equivalent.
 - c. Living ground covers planted from either 4-inch pot with 12-inch spacing or 1-gallon pot with 18-inch spacing to cover within two (2) years 60 percent of the land use buffer not needed for viability of the shrubs or trees.
2. For standard 2, the applicant shall provide a 5-foot-wide landscaped strip with a 6-foot-high solid screening fence or wall. Except for public utilities, the fence or wall must be placed on the outside edge of the land use buffer or on the property line when adjacent to private property. For public utilities, the fence or wall may be placed either on the outside or inside edge of the landscaping strip. A fence or wall is not required when the land use buffer is adjacent and parallel to a public right-of-way that is improved for vehicular use. See KZC 115.40 for additional fence standards. The landscaped strip must be planted as follows:
 - a. One (1) row of trees planted no more than 10 feet apart on center along the entire length of the buffer, with deciduous trees of 2-inch caliper, minimum, and/or coniferous trees at least six (6) feet in height, minimum. At least 50 percent of the required trees shall be evergreen.
 - b. Living ground covers planted from either 4-inch pot with 12-inch spacing or 1-gallon pot with 18-inch spacing to cover within two (2) years 60 percent of the land use buffer not needed for viability of the trees.
3. Plant Standards. All plant materials used shall meet the most recent American Association of Nurserymen Standards for nursery stock: ANSI Z60.1.
4. Location of the Land Use Buffer. The applicant shall provide the required buffer along the entire common border between the subject property and the adjoining property.
5. Multiple Buffering Requirement. If the subject property borders more than one (1) adjoining property along the same property line, the applicant shall provide a gradual transition between different land use buffers. This transition must occur totally within the area which has the less stringent buffering requirement. The specific design of the transition must be approved by the City.
6. Adjoining Property Containing Several Uses. If the adjoining property contains several permitted uses, the applicant may provide the least stringent land use buffer required for any of these uses.

7. Subject Property Containing Several Uses. If the subject property contains more than one (1) use, the applicant shall comply with the land use buffering requirement that pertains to the use within the most stringent landscaping category that abuts the property to be buffered.

8. Subject Property Containing School. If the subject property is occupied by a school, land use buffers are not required along property lines adjacent to a street.

9. Encroachment into Land Use Buffer. Typical incidental extensions of structures such as chimneys, bay windows, greenhouse windows, cornices, eaves, awnings, and canopies may be permitted in land use buffers as set forth in KZC 115.115(3)(d); provided, that:

- a. Buffer planting standards are met; and
- b. Required plantings will be able to attain full size and form typical to their species.

(Ord. 4637 § 3, 2018; Ord. 4636 § 3, 2018; Ord. 4495 § 2, 2015; Ord. 4238 § 2, 2010)

95.43 Outdoor Use, Activity, and Storage

Outdoor use, activity, and storage (KZC 115.105(2)) must comply with required land use buffers for the primary use, except that the following outdoor uses and activities, when located in commercial or industrial zones, are exempt from KZC 115.105(2)(c)(1) and (2)(c)(2) as stated below:

1. That portion of an outdoor use, activity, or storage area which abuts another outdoor use, activity, or storage area which is located on property zoned for commercial or industrial use.
2. Outdoor use, activity, and storage areas which are located adjacent to a fence or structure which is a minimum of six (6) feet above finished grade, and do not extend outward from the fence or structure more than five (5) feet; provided, that the total horizontal dimensions of these areas shall not exceed 50 percent of the length of the facade or fence (see Plate 11).
3. If there is an improved path or sidewalk in front of the outdoor storage area, the outdoor use, activity or storage area may extend beyond five (5) feet if a clearly defined walking path at least three (3) feet in width is maintained and there is adequate pedestrian access to and from the primary use. The total horizontal dimension of these areas shall not exceed 50 percent of the length of the facade of the structure or fence (see Plate 11).
4. Outdoor dining areas.
5. That portion of an outdoor display of vehicles for sale or lease which is adjacent to a public right-of-way that is improved for vehicular use; provided, that it meets the buffering standards for driving and parking areas in KZC 95.45(1); and provided further, that the exemptions of KZC 95.45(2) do not apply unless it is fully enclosed within or under a building, or is on top of a building and is at least one (1) story above finished grade.
6. Outdoor Christmas tree lots and fireworks stands if these uses will not exceed 30 days, and outdoor amusement rides, carnivals and circuses, and parking lot sales which are ancillary to the indoor sale of the same goods and services, if these uses will not exceed seven (7) days.

(Ord. 4547 § 1, 2016; Ord. 4238 § 2, 2010)

95.44 Internal Parking Lot Landscaping Requirements

The following internal parking lot landscape standards apply to each parking lot or portion thereof containing more than eight (8) parking stalls.

1. The parking lot must contain 25 square feet of landscaped area per parking stall planted as follows:
 - a. The applicant shall arrange the required landscaping throughout the parking lot to provide landscape islands or peninsulas to separate groups of parking spaces (generally every eight (8) stalls) from one another and each row of spaces from any adjacent driveway that runs perpendicular to the row. This island or peninsula

must be surrounded by a 6-inch-high vertical curb and be of similar dimensions as the adjacent parking stalls. Gaps in curbs are allowed for stormwater runoff to enter landscape island.

b. Landscaping shall be installed pursuant to the following standards:

- 1) At least one (1) deciduous tree, two (2) inches in caliper, or a coniferous tree five (5) feet in height.
- 2) Groundcover shall be selected and planted to achieve 60 percent coverage within two (2) years.
- 3) Natural drainage landscapes (such as rain gardens, bio-infiltration swales and bioretention planters) are allowed when designed in compliance with the stormwater design manual adopted in KMC 15.52.060. Internal parking lot landscaping requirements for trees still apply. Refer to Public Works Pre-Approved Plans.

c. Exception. The requirements of this subsection do not apply to any area that is fully enclosed within or under a building.

2. Rooftop Parking Landscaping. For a driving or parking area on the top level of a structure that is not within the CBD zone or within any zone that requires design regulation compliance, one (1) planter that is 30 inches deep and five (5) feet square must be provided for every eight (8) stalls on the top level of the structure. Each planter must contain a small tree or large shrub suited to the size of the container and the specific site conditions, including desiccating winds, and is clustered with other planters near driving ramps or stairways to maximize visual effect.

3. If development is subject to Design Review as described in Chapter 142 KZC, the City will review the parking area design, plant choice and specific plant location as part of the Design Review approval. The City may also require or permit modification to the required landscaping and design of the parking area as part of Design Review approval.

(Ord. 4547 § 1, 2016; Ord. 4350 § 1, 2012; Ord. 4238 § 2, 2010)

95.45 Perimeter Landscape Buffering for Driving and Parking Areas

1. Perimeter Buffering – General. Except as specified in subsection (2) of this section, the applicant shall buffer all parking areas and driveways from abutting rights-of-way and from adjacent property with a 5-foot-wide strip along the perimeter of the parking areas and driveways planted as follows (see Figure 95.45.A):

- a. One (1) row of trees, two (2) inches in caliper and planted 30 feet on center along the entire length of the strip.
- b. Living groundcover planted to attain coverage of at least 60 percent of the strip area within two (2) years.
- c. Natural drainage landscapes (such as rain gardens, bio-infiltration swales and bioretention planters) are allowed when designed in compliance with the stormwater design manual adopted in KMC 15.52.060. Perimeter landscape buffering requirements for trees in driving and parking areas still apply. Refer to Public Works Pre-Approved Plans.

2. Exception. The requirements of this section do not apply to any parking area that:

- a. Is fully enclosed within or under a building; or
- b. Is on top of a building and is at least one (1) story above finished grade; or
- c. Serves detached dwelling units exclusively; or
- d. Is within any zone that requires design regulation compliance. See below for Design District requirements.

3. Design Districts. If subject to Design Review, each side of a parking lot that abuts a street, through-block pathway or public park must be screened from that street, through-block pathway or public park by using one (1) or a combination of the following methods (see Figures 95.45.A, B, and C):
 - a. By providing a landscape strip at least five (5) feet wide planted consistent with subsection (1) of this section, or in combination with the following. In the RHBD Regional Center (see KZC Figure 92.05.A) a 10-foot perimeter landscape strip along NE 85th Street is required planted consistent with subsection (1) of this section.
 - b. The hedge or wall must extend at least two (2) feet, six (6) inches, and not more than three (3) feet above the ground directly below it.
 - c. The wall may be constructed of masonry or concrete, if consistent with the provisions of KZC 92.35(1)(g), in building material, color and detail, or of wood if the design and materials match the building on the subject property.
 - d. In JBD zones:
 - 1) If the street is a pedestrian-oriented street, the wall may also include a continuous trellis or grillwork, at least five (5) feet in height above the ground, placed on top of or in front of the wall and planted with climbing vines. The trellis or grillwork may be constructed of masonry, steel, cast iron and/or wood.
 - 2) If the wall abuts a pedestrian-oriented street, the requirements of this subsection may be fulfilled by providing pedestrian weather protection along at least 80 percent of the frontage of the subject property.
 - e. If development is subject to Design Review as described in Chapter 142 KZC, the City will review plant choice and specific plant location as part of the Design Review approval. The City may also require or permit modification to the required plant size as part of Design Review approval.
4. Overlapping Requirements. If buffering is required in KZC 95.42, Land Use Buffering Standards, and by this subsection, the applicant shall utilize the more stringent buffering requirement.

Perimeter Parking Lot Landscaping

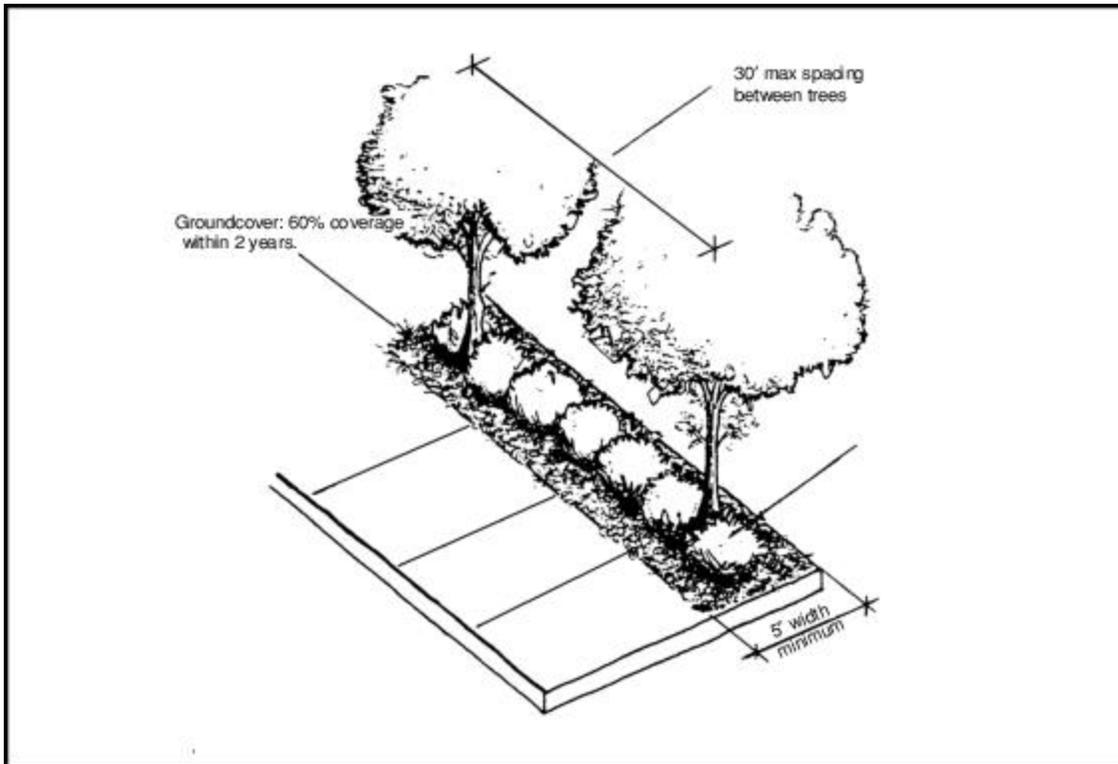


FIGURE 95.45.A

Perimeter Parking – Examples of Various Screen Wall Designs

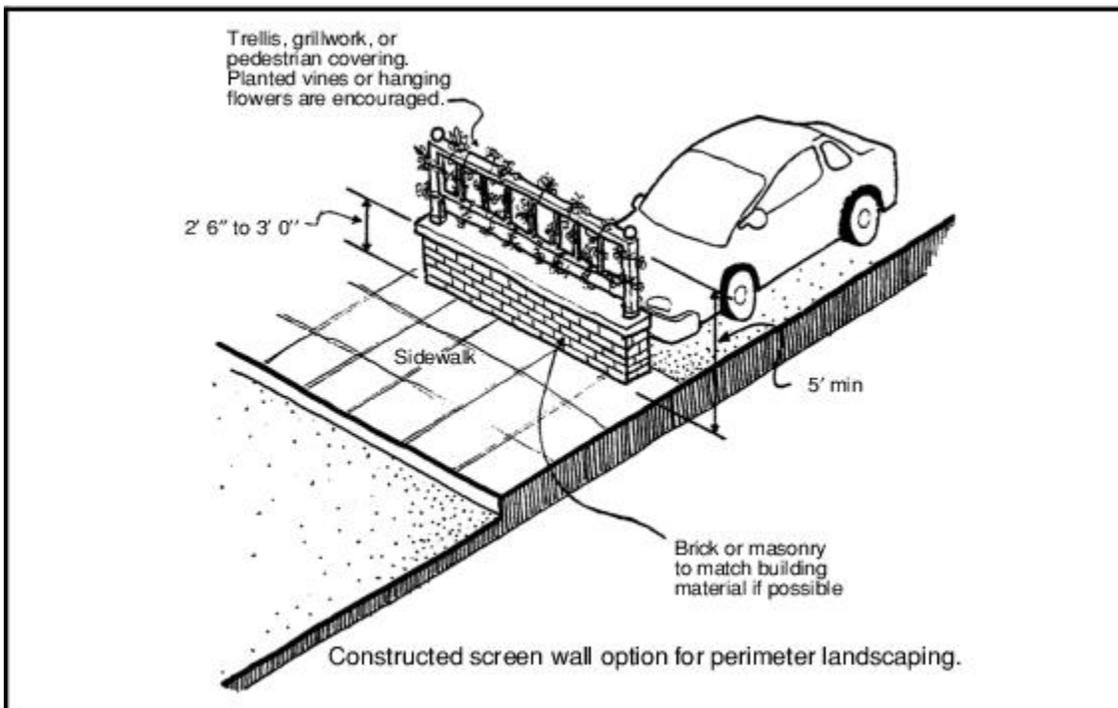


FIGURE 95.45.B

Perimeter Parking – Examples of Various Screen Wall Designs

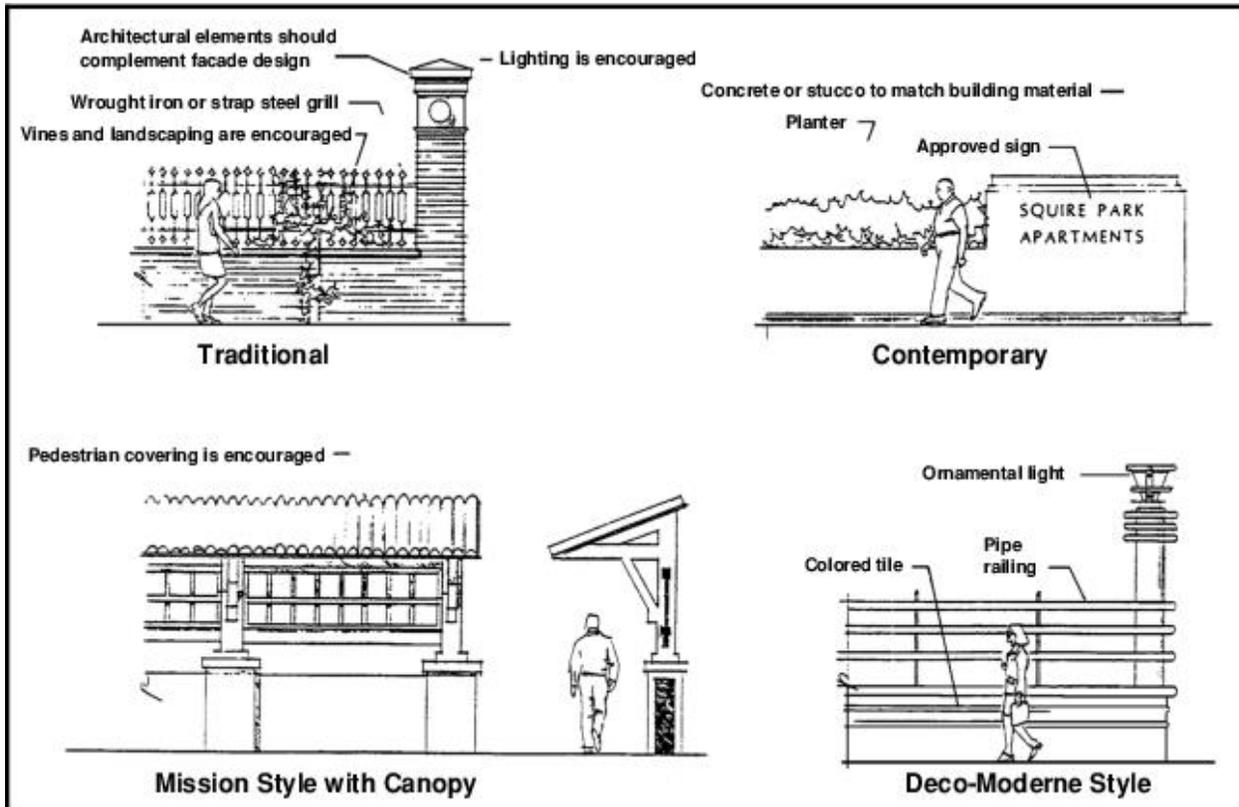


FIGURE 95.45.C

(Ord. 4547 § 1, 2016; Ord. 4238 § 2, 2010; Ord. 4010 § 2, 2005)

95.46 Modifications to Landscaping Standards

1. Modification to Land Use Buffer Requirements. The applicant may request a modification of the requirements of the buffering standards in KZC 95.42. The Planning Official may approve a modification if:

- a. The owner of the adjoining property agrees to this in writing; and
- b. The existing topography or other characteristics of the subject property or the adjoining property, or the distance of development from the neighboring property decreases or eliminates the need for buffering; or
- c. The modification will be more beneficial to the adjoining property than the required buffer by causing less impairment of view or sunlight; or
- d. The Planning Official determines that it is reasonable to anticipate that the adjoining property will be redeveloped in the foreseeable future to a use that would require no, or a less intensive, buffer; or
- e. The location of pre-existing improvements on the adjoining site eliminates the need or benefit of the required landscape buffer.

2. Modifications to General Landscaping Requirements.

a. Authority to Grant and Duration. If the proposed development of the subject property requires approval through Design Review or Process I, IIA, or IIB, described in Chapters 142, 145, 150, and 152 KZC, respectively, a request for a modification will be considered as part of that process under the provisions of this section. The City must find that the applicant meets the applicable criteria listed in subsections (2)(b) and (2)(c) of this section. If granted under Design Review or Process I, IIA, or IIB, the modification is binding on the City for all development permits issued for that development under the building code within five (5) years of the granting of the modification.

If the above does not apply, the Planning Official may grant a modification in writing under the provisions of this section.

b. Internal Parking Lot Landscaping Modifications. For a modification to the internal parking lot landscaping requirements in KZC 95.44, the landscape requirements may be modified if:

- 1) The modification will produce a landscaping design in the parking area comparable or superior to that which would result from adherence to the adopted standard; or
- 2) The modification will result in increased retention of significant existing vegetation; or
- 3) The purpose of the modification is to accommodate low impact development techniques as approved by the Planning Official.

c. Perimeter parking lot and driveway landscaping. For a modification to the perimeter landscaping for parking lots and driveways, the buffering requirements for parking areas and driveways may be modified if:

- 1) The existing topography of or adjacent to the subject property decreases or eliminates the need for visual screening; or
- 2) The modification will be of more benefit to the adjoining property by causing less impairment of view or sunlight; or
- 3) The modification will provide a visual screen that is comparable or superior to the buffer required by KZC 95.45; or
- 4) The modification eliminates the portion of the buffer that would divide a shared parking area serving two (2) or more adjacent uses, but provides the buffer around the perimeter of the shared parking area.

(Ord. 4547 § 1, 2016; Ord. 4238 § 2, 2010)

95.47 Nonconforming Landscaping and Buffers

1. The landscaping requirements of KZC 95.41, Supplemental Plantings, KZC 95.43 Outdoor Use, Activity and Storage, KZC 95.44, Internal Parking Lot Landscaping, and KZC 95.45, Perimeter Landscape Buffering for Driving and Parking Areas, must be brought into conformance as much as is feasible, based on available land area, in either of the following situations:

- a. An increase of at least 10 percent in gross floor area of any structure; or
 - b. An alteration to any structure, the cost of which exceeds 50 percent of the replacement cost of the structure.
2. Land use buffers must be brought into conformance with KZC 95.42 in either of the following situations:
- a. An increase in gross floor area of any structure (the requirement to provide conforming buffers applies only where new gross floor area impacts adjoining property); or
 - b. A change in use on the subject property and the new use requires larger buffers than the former use.

(Ord. 4547 § 1, 2016; Ord. 4238 § 2, 2010)

95.50 Installation Standards for Required Plantings

All required trees, landscaping and soil shall be installed according to sound horticultural practices in a manner designed to encourage quick establishment and healthy plant growth. All required landscaping shall be installed in the ground and not in above-ground containers, except for landscaping required on the top floor of a structure.

When an applicant proposes to locate a subterranean structure under required landscaping that appears to be at grade, the applicant will: (1) provide site-specific documentation prepared by a qualified expert to establish that the design will adequately support the long-term viability of the required landscaping; and (2) enter into an agreement with the City, in a form acceptable to the City Attorney, indemnifying the City from any damage resulting from development activity on the subject property which is related to the physical condition of the property. The applicant shall record this agreement with the King County Recorder's Office.

1. Compliance. It is the applicant's responsibility to show that the proposed landscaping complies with the regulations of this chapter.
2. Timing. All landscaping shall be installed prior to the issuance of a certificate of occupancy, except that the installation of any required tree or landscaping may be deferred during the summer months to the next planting season, but never for more than six (6) months. Deferred installation shall be secured with a performance bond pursuant to Chapter 175 KZC prior to the issuance of a certificate of occupancy.
3. Grading. Berms shall not exceed a slope of two (2) horizontal feet to one (1) vertical foot (2:1).
4. Soil Specifications. Soils in planting areas shall have soil quality equivalent to Washington State Department of Ecology BMP T5.13. The soil quality in any landscape area shall comply with the soil quality requirements of the Public Works Pre-Approved Plans. See subsection (9) of this section for mulch requirements.
5. Plant Selection.
 - a. Plant selection shall be consistent with the Kirkland Plant List, which is produced by the City's Natural Resource Management Team and available in the Planning and Building Department.
 - b. Plants shall be selected and sited to produce a hardy and drought-resistant landscape area. Selection shall consider soil type and depth, the amount of maintenance required, spacing, exposure to sun and wind, the slope and contours of the site, and compatibility with existing native vegetation preserved on the site. Preservation of existing vegetation is strongly encouraged.
 - c. Prohibited Materials. Plants listed as prohibited in the Kirkland Plant List are prohibited in required landscape areas. Additionally, there are other plants that may not be used if identified in the Kirkland Plant List as potentially damaging to sidewalks, roads, underground utilities, drainage improvements, foundations, or when not provided with enough growing space.
 - d. All plants shall conform to American Association of Nurserymen (AAN) grades and standards as published in the "American Standard for Nursery Stock" manual.
 - e. Plants shall meet the minimum size standards established in other sections of the KZC.
 - f. Multiple-stemmed trees may be permitted as an option to single-stemmed trees for required landscaping provided that such multiple-stemmed trees are at least 10 feet in height and that they are approved by the Planning Official prior to installation.
6. Fertilization. All fertilizer applications to turf or trees and shrubs shall follow Washington State University, National Arborist Association or other accepted agronomic or horticultural standards.
7. Irrigation. The intent of this standard is to ensure that plants will survive the critical establishment period when they are most vulnerable due to lack of watering. All required plantings must provide an irrigation system, using either Option 1, 2, or 3 or a combination of those options. For each option irrigation shall be designed to conserve water by using the best practical management techniques available. These techniques may include, but not be

limited to: drip irrigation to minimize evaporation loss, moisture sensors to prevent irrigation during rainy periods, automatic controllers to ensure proper duration of watering, sprinkler head selection and spacing designed to minimize overspray, and separate zones for turf and shrubs and for full sun exposure and shady areas to meet watering needs of different sections of the landscape.

Exceptions, as approved by the Planning Official, to the irrigation requirement may be approved xeriscape (i.e., low water usage plantings), plantings approved for low impact development techniques, established indigenous plant material, or landscapes where natural appearance is acceptable or desirable to the City. However, those exceptions will require temporary irrigation (Option 2 and/or 3) until established.

- a. Option 1. A permanent built-in irrigation system with an automatic controller designed and certified by a licensed landscape architect as part of the landscape plan.
- b. Option 2. An irrigation system designed and certified by a licensed landscape architect as part of the landscape plan, which provides sufficient water to ensure that the plants will become established. The system does not have to be permanent if the plants chosen can survive adequately on their own, once established.
- c. Option 3. Irrigation by hand. If the applicant chooses this option, an inspection will be required one (1) year after final inspection to ensure that the landscaping has become established.

8. Drainage. All landscapes shall have adequate drainage, either through natural percolation or through an installed drainage system. A percolation rate of one-half (1/2) inch of water per hour is acceptable.

9. Mulch.

- a. Required plantings, except turf or areas of established ground cover, shall be covered with two (2) inches or more of organic mulch to minimize evaporation and runoff. Mulch shall consist of materials such as yard waste, sawdust, and/or manure that are fully composted.
- b. All mulches used in planter beds shall be kept at least six (6) inches away from the trunks of shrubs and trees.

10. Protection. All required landscaped areas, particularly trees and shrubs, must be protected from potential damage by adjacent uses and development, including parking and storage areas. Protective devices such as bollards, wheel stops, trunk guards, root guards, etc., may be required in some situations.

(Ord. 4551 § 4, 2017; Ord. 4547 § 1, 2016; Ord. 4491 §§ 3, 11, 2015; Ord. 4350 § 1, 2012; Ord. 4238 § 2, 2010; Ord. 4010 § 2, 2005)

95.51 Tree and Landscape Maintenance Requirements

The following maintenance requirements apply to all trees, including street trees, and other vegetation required to be planted or preserved by the City:

1. Responsibility for Regular Maintenance. Required trees and vegetation, fences, walls, and other landscape elements shall be considered as elements of the project in the same manner as parking, building materials, and other site details. The applicant, landowner, or successors in interest shall be responsible for the regular maintenance of required landscaping elements. Plants that die must be replaced in kind. It is also the responsibility of the property owner to maintain street trees abutting their property pursuant to KZC 95.21.
2. Maintenance Duration. Maintenance shall be ensured in the following manner except as set forth in subsections (3), (4) and (5) of this section:
 - a. All required landscaping shall be maintained throughout the life of the development. Prior to issuance of a certificate of occupancy, the proponent shall provide a final as-built landscape plan and an agreement to maintain and replace all landscaping that is required by the City.

b. Any existing tree or other existing vegetation designated for preservation in a tree retention plan shall be maintained for a period of five (5) years following issuance of the certificate of occupancy for the individual lot or development. After five (5) years, all trees on the property are subject to KZC 95.23 unless:

- 1) The tree and associated vegetation are in a grove that is protected pursuant to subsection (3) of this section; or
- 2) The tree or vegetation is considered to be a public benefit related to approval of a planned unit development; or
- 3) The tree or vegetation was retained to partially or fully meet requirements of KZC 95.40 through 95.45, required landscaping.

3. Maintenance of Preserved Grove. Any applicant who has a grove of trees identified for preservation on an approved Tree Retention Plan pursuant to KZC 95.30(2) shall provide prior to occupancy the legal instrument acceptable to the City to ensure preservation of the grove and associated vegetation in perpetuity, except that the agreement may be extinguished if the Planning Official determines that preservation is no longer appropriate.

4. Maintenance in Holmes Point Overlay Zone. Vegetation in designated Protected Natural Areas in the Holmes Point Overlay Zone is to be protected in perpetuity pursuant to KZC 70.15(8)(a). Significant trees in the remainder of the lot shall be protected in perpetuity pursuant to KZC 70.15(8)(b).

5. Nonnative Invasive and Noxious Plants. It is the responsibility of the property owner to remove nonnative invasive plants and noxious plants from the vicinity of any tree or other vegetation that the City has required to be planted or protected. Removal must be performed in a manner that will not harm the tree or other vegetation that the City has required to be planted or protected.

6. Landscape Plans and Utility Plans. Landscape plans and utility plans shall be coordinated. In general, the placement of trees and large shrubs should adjust to the location of required utility routes both above and below ground. Location of plants shall be based on the plant's mature size both above and below ground. See the Kirkland Plant List for additional standards.

(Ord. 4551 § 4, 2017; Ord. 4437 § 1, 2014; Ord. 4238 § 2, 2010)

95.52 Prohibited Vegetation

Plants listed as prohibited in the Kirkland Plant List shall not be planted in the City or required to be retained.

For landscaping not required under this chapter, this prohibition shall become effective on February 14, 2008. The City may require removal of prohibited vegetation if installed after this date. Residents and property owners are encouraged to remove pre-existing prohibited vegetation whenever practicable.

(Ord. 4450 § 1, 2014; Ord. 4238 § 2, 2010; Ord. 4121 § 1, 2008)

95.55 Enforcement and Penalties

Upon determination that there has been a violation of any provision of this chapter, the City may pursue code enforcement and penalties in accordance with the provisions of Chapter 1.12 KMC, Code Enforcement.

(Ord. 4286 § 1, 2011; Ord. 4281 § 1, 2011; Ord. 4238 § 2, 2010; Ord. 4010 § 2, 2005)

95.57 City Forestry Account

1. Funding Sources. All civil penalties received under this chapter and all money received pursuant to KZC 95.33(3)(c) shall be used for the purposes set forth in this section. In addition, the following sources may be used for the purposes set forth in this section:

- a. Agreed upon restoration payments imposed under KZC 95.55 or settlements in lieu of penalties;

- b. Sale of trees or wood from City property where the proceeds from such sale have not been dedicated to another purpose;
 - c. Donations and grants for tree purposes;
 - d. Sale of seedlings by the City; and
 - e. Other monies allocated by the City Council.
2. Funding Purposes. The City shall use money received pursuant to this section for the following purposes:
- a. Acquiring, maintaining, and preserving wooded areas within the City;
 - b. Planting and maintaining trees within the City;
 - c. Establishment of a holding public tree nursery;
 - d. Urban forestry education;
 - e. Implementation of a tree canopy monitoring program; or
 - f. Other purposes relating to trees as determined by the City Council.

(Ord. 4238 § 2, 2010)

URBAN TREE CANOPY ASSESSMENT

KIRKLAND,
WASHINGTON
OCTOBER | 2018





AN ASSESSMENT OF
URBAN TREE CANOPY

KIRKLAND, WASHINGTON



**Someone is
sitting in the
shade today
because someone
planted a tree a
long time ago.**

-Warren Buffet



PREPARED BY

Plan-It Geo, LLC, Arvada, Colorado

PREPARED FOR

City of Kirkland, Washington

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4,361
ACRES OF TREE CANOPY

EXECUTIVE **SUMMARY**

PURPOSE OF THIS ANALYSIS

The City of Kirkland is located within King County, Washington, in the Seattle metropolitan area (Figure 1). It is approximately 18.2 square miles or 11,671 acres, of which 11,394 are land acres. Across the city, trees along streets, in parks, yards, and natural areas constitute a valuable urban and community forest. This resource is a critical element of the region's green infrastructure, contributing to environmental quality, public health, water supply, local economies and aesthetics. The primary goal of this assessment is to provide an updated baseline and benchmark of the City's tree canopy and interpret the results across a range of geographic boundaries. Canopy change since 2010 is also assessed to determine the extent and location of growth or decline in Kirkland's urban forest to better inform future management actions.

URBAN TREE CANOPY IN KIRKLAND

Results of this study indicate that in 2017, the city of Kirkland contains 37 percent urban tree canopy (or 4,361 of the city's 11,671 total acres); 20 percent non-canopy vegetation (2,392 acres); 2 percent soil/dry vegetation (244 acres); 38 percent impervious surfaces (4,398 acres); and 2 percent water (277 acres). In further subdividing the impervious areas, 12 percent (1,421 acres) of Kirkland's total area are buildings, 8 percent (973 acres) are roads, 5 percent (585 acres) are parking lots, 3 percent (326 acres) are driveways, 1 percent (159 acres) are sidewalks, and 8

percent (933 acres) are "other impervious" areas such as trails, medians, etc.

Existing urban tree canopy covers 38 percent of Kirkland's land area (4,361 of the city's 11,394 land acres). Of the city's 62 percent of land area not presently occupied by tree canopy, 30 percent (3,421 acres) are suitable for future tree plantings, and 32 percent (3,612 acres) are unsuitable due to its current land use or other restraint. In further dividing the city's urban tree canopy, 12 percent are overhanging impervious surfaces. A change analysis shows that the city's canopy has decreased by approximately 2 percent, down from 41 percent when it was last assessed based on 2010 imagery.

ASSESSMENT BOUNDARIES

This study assesses urban tree canopy (UTC), possible planting areas (PPA), and change at multiple geographic scales in order to provide actionable information to a diverse range of audiences. By identifying what resources and opportunities exist at these scales, the City can be more proactive in their approach to protect and expand their urban tree canopy. Metrics are available at the following geographic boundaries: the citywide boundary; the citywide boundary prior to annexation of the Finn Hill, North Juanita, and Kingsgate neighborhoods; HUC-12 watersheds (2); King County comprehensive plan land



Figure 1. | Kirkland occupies approximately 18.2 square miles in King County, Washington.

use classes (10); neighborhoods (14); drainage basins (15); U.S. census block groups (80); the Holmes Point overlay (1); rights-of-way (1); a buffer around the City’s critical area buffers (1); park and open space classes (4); and shoreline jurisdiction areas (48). Canopy change since 2010 was also assessed for all geographic boundaries. Additionally, the city’s urban tree canopy is delineated as overhanging impervious surfaces or not.

RECOMMENDATIONS

The results of this analysis can be used to develop a

continued strategy to protect and expand Kirkland’s urban forest. The UTC, PPA, and change metrics should be used as a guide to determine where the city has succeeded in protecting and expanding its urban forest resource, while also targeting the best areas to concentrate future efforts based on needs, benefits, and available planting space. Existing tree canopy in single-family residential areas and rights-of-way have decreased in the last seven years. Increased tree planting activities are recommended in these areas to expand Kirkland’s urban forest.



Figure 2. | Based on an analysis of 2017 high-resolution imagery, Kirkland contains 38% tree canopy, 30% areas that could support canopy in the future, and 38% total impervious areas.

PROJECT METHODOLOGY

This section describes the methods through which land cover, urban tree canopy, and possible planting areas were mapped. These datasets provide the foundation for the metrics reported at the selected target geographies, as well as the change in canopy over time.

DATA SOURCES

This assessment utilized 2017 high-resolution (1-meter) multispectral imagery from the U.S. Department of Agriculture's National Agriculture Imagery Program (NAIP) and 2016 LiDAR data from King County, Washington to derive the land cover data set. The NAIP imagery is used to classify all types of land cover, whereas the LiDAR is most useful for distinguishing tree canopy from other types of vegetation. Additional GIS layers provided by the City of Kirkland were also incorporated into the analysis, such as the impervious surfaces layers (buildings, roads, parking lots, etc.) and the 2010 urban tree canopy data which provided the basis of the change analysis.

MAPPING LAND COVER

An initial land cover dataset was to be created prior to mapping tree canopy and assessing change. The land cover data set is the most fundamental component of an urban tree canopy assessment. An object-based image analysis (OBIA) software program called Feature Analyst was used to classify features through an iterative approach. In this process, objects' spectral signatures across four bands (blue, green, red, and near-infrared), textures, pattern relationships, and object height were considered. This remote sensing process used the NAIP imagery and LiDAR to derive five initial land cover classes. These classes are shown in Figure 3. After manual classification improvement and quality control were performed on the remote sensing products, additional data layers from the city (such as buildings, roads, and other impervious surfaces) were utilized to capture finer feature detail and further categorize the land cover dataset. Using those impervious surface data provided by the city (buildings, roads, parking lots, etc.), the amount of urban tree canopy overhanging impervious surfaces was also quantified to assist with hydrologic modeling.

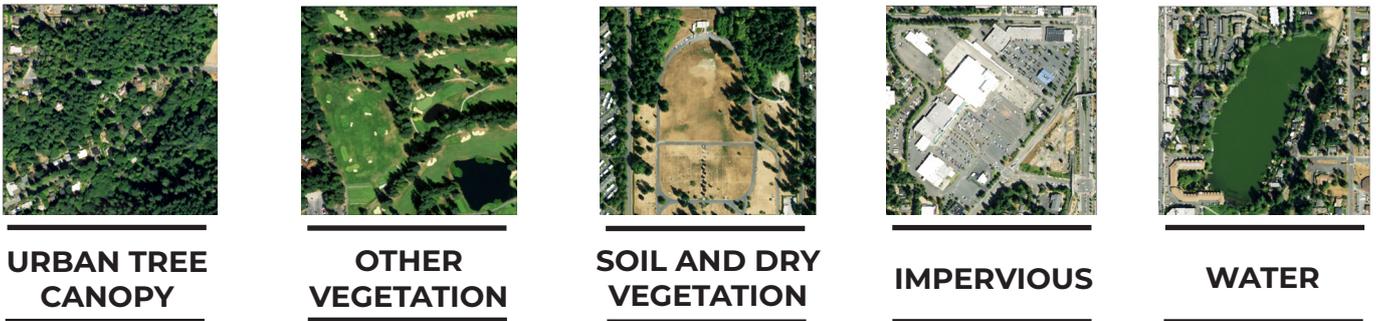


Figure 3. | Five (5) distinct land cover classes were identified in the 2017 tree canopy assessment: urban tree canopy, non-canopy vegetation, bare soil and dry vegetation, impervious (paved) surfaces, and water.

IDENTIFYING POSSIBLE PLANTING AREAS AND UNSUITABLE AREAS FOR PLANTING

In addition to quantifying Kirkland's existing tree canopy cover, another metric of interest in this assessment was the area where tree canopy could be expanded. To assess this, all land area in Kirkland that was not existing tree canopy coverage was classified as either possible planting area (PPA) or unsuitable for planting. Possible planting areas were derived from the non-canopy vegetation and impervious classes that could be modified or have trees planted adjacent to them (e.g. parking lots, driveways, and sidewalks) to provide aesthetic value as well as localized shading and cooling. Unsuitable areas, or areas where it was not feasible to plant trees due to biophysical or land use restraints (e.g. airport runways, recreation fields, etc.), were manually delineated and overlaid with the existing land cover data set (Figure 4). The final results were reported as PPA Vegetation, PPA Impervious, Total PPA (vegetation and impervious), Unsuitable Vegetation, Unsuitable Impervious, Unsuitable Soil, and Total Unsuitable.



Figure 4. | Vegetated areas where it would be biophysically feasible for tree plantings but undesirable based on their current usage (left) were delineated in the data as “Unsuitable” (right). These areas included recreational sports fields and other open space.

DEFINING ASSESSMENT LEVELS

In order to best inform the City Council and all of Kirkland’s various stakeholders, urban tree canopy and other associated metrics were tabulated across a variety of geographic boundaries (Figure 5). These boundaries include the city boundary; the pre-annexation city boundary; HUC-12 watersheds; King County comprehensive plan land use classes; neighborhoods; drainage basins; U.S. census block groups; the Holmes Point overlay; rights-of-way; critical area buffers; parks and open spaces; and shoreline jurisdiction areas.

- The City of Kirkland’s citywide boundary is the one (1) main area of interest over which all metrics are summarized.
- Metrics were also calculated for the City of Kirkland’s area prior to its annexation of the Finn Hill, North Juanita, and Kingsgate neighborhoods (approximately 4,601 acres), which became effective in 2011.
- Two (2) HUC-12 watersheds were assessed to interpret differences in urban tree canopy across a naturally occurring geographic boundary.
- Ten (10) King County comprehensive plan land use classes were analyzed to assess differences in tree canopy across different human uses of land.
- Fourteen (14) neighborhoods were assessed to quantify tree canopy at an easily-conceptualized scale for local residents.
- Fifteen (15) drainage basins make up the city of Kirkland. Since trees play an important role in regulating stormwater runoff and preventing flooding, the basins were analyzed to explore differences in tree canopy across the City’s drainage areas.
- Eighty (80) census block groups were assessed. Census block groups (CBGs) are used by the U.S. Census Bureau to assure statistical consistency when tracking populations across the United States and can be valuable indicators of environmental justice as they are directly linked with demographic and socioeconomic data.
- Metrics were assessed for Kirkland’s heavily-wooded, coastal region of Holmes Point.
- Right-of-way (ROW) was also assessed. ROW refers to the areas that are publicly maintained, such as streets, sidewalks, and medians, and is helpful for quantifying the city’s street trees.
- Trees also provide many environmental benefits such as preventing erosion, offering a habitat for wildlife species, and improving air and water quality. For this reason, a 100’ buffer was applied to all of the City’s critical areas and urban tree canopy was assessed within this area.
- Four (4) different classes of parks and open spaces were assessed to determine how tree canopy is distributed in the city’s green spaces.
- Forty-eight (48) shoreline jurisdiction areas were assessed to determine how tree canopy is distributed in the City’s coastal regions.

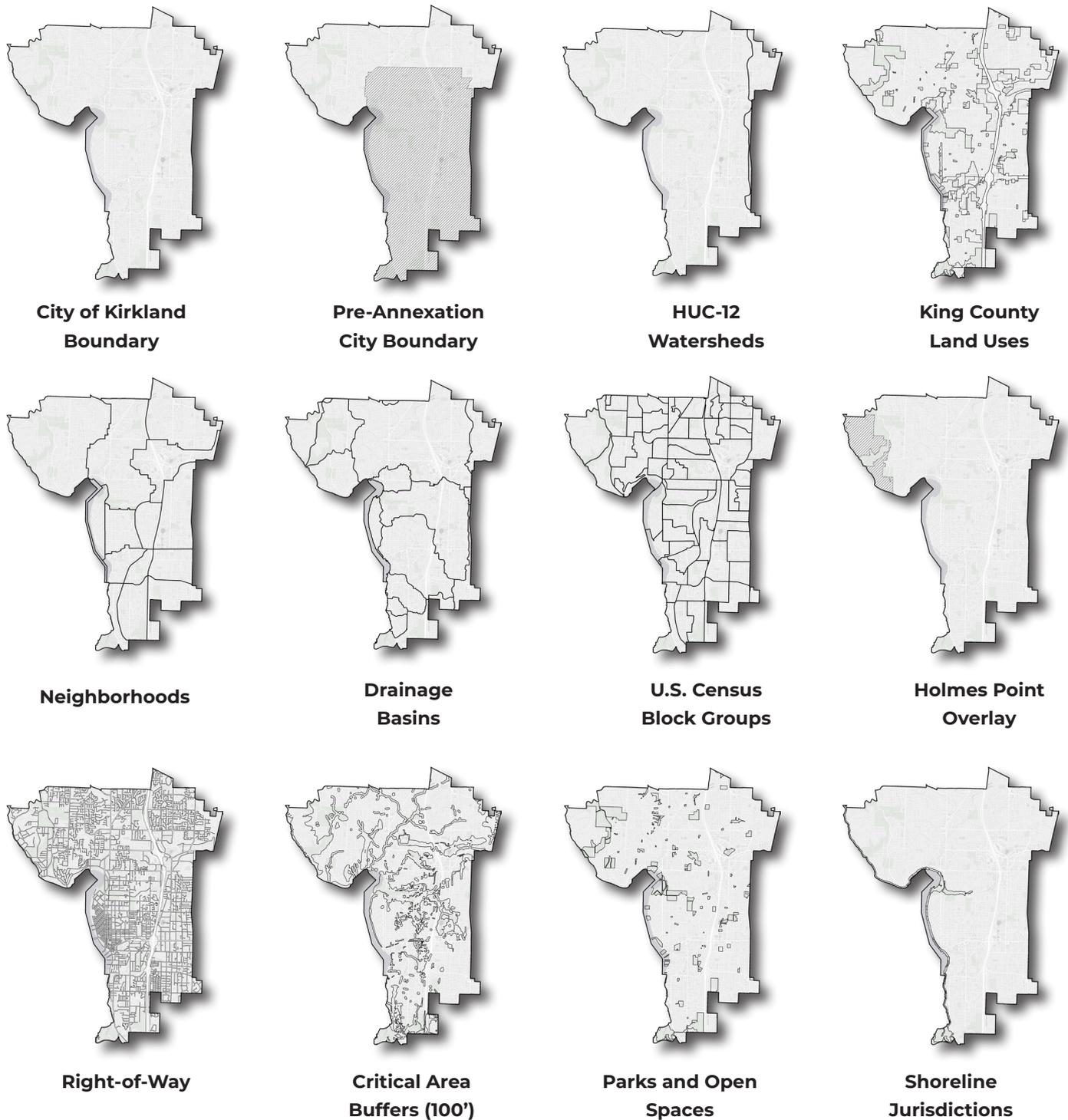


Figure 5. | Twelve (12) distinct geographic boundaries were explored in this analysis: the full city boundary, the pre-annexation city boundary, watersheds, land use classes, neighborhoods, drainage basins, U.S. Census block groups, the Holmes Point overlay, right-of-way, critical area buffers, parks and open spaces, and shoreline jurisdictions.

STATE OF THE CANOPY AND KEY FINDINGS



This section presents the key findings of this study including the land cover base map, canopy analysis, and change analysis results which were analyzed across various geographic assessment boundaries. These results, or metrics, help inform a strategic approach to identifying existing canopy to preserve and future planting areas. Land cover percentages are based on the total area of interest while urban tree canopy, possible planting area, and unsuitable percentages are based on land area. Water bodies are excluded from land area because they are typically unsuitable for planting new trees without significant modification.

CITYWIDE LAND COVER

In 2017, tree canopy constituted 37 percent of Kirkland’s land cover; non-canopy vegetation was 20 percent; soil/dry vegetation was 2 percent; impervious was 38 percent; and water was 2 percent. These generalized land cover results are presented below in Table 1.

The impervious land cover class was then subdivided into more specific classifications. Approximately 12 percent was buildings, 8 percent was roads, 5 percent was parking lots, 1 percent was sidewalks, 3 percent was driveways, and 8 percent was “other impervious” (all other paved surfaces not included in the previous classes). Parking lots and sidewalks may offer opportunities for new tree plantings and additional canopy cover, but the data for these opportunistic impervious land classifications would require further analyses to determine their planting suitability. The detailed land cover results, including impervious classifications, are presented in Figure 6.

Table 1. | Generalized land cover classification results.

City Boundary	Total Area	Tree Canopy	Non-Canopy Vegetation	Impervious Surfaces	Soil & Dry Vegetation	Water
Acres	11,671	4,361	2,392	4,398	244	277
% of Total	100%	37%	20%	38%	2%	2%

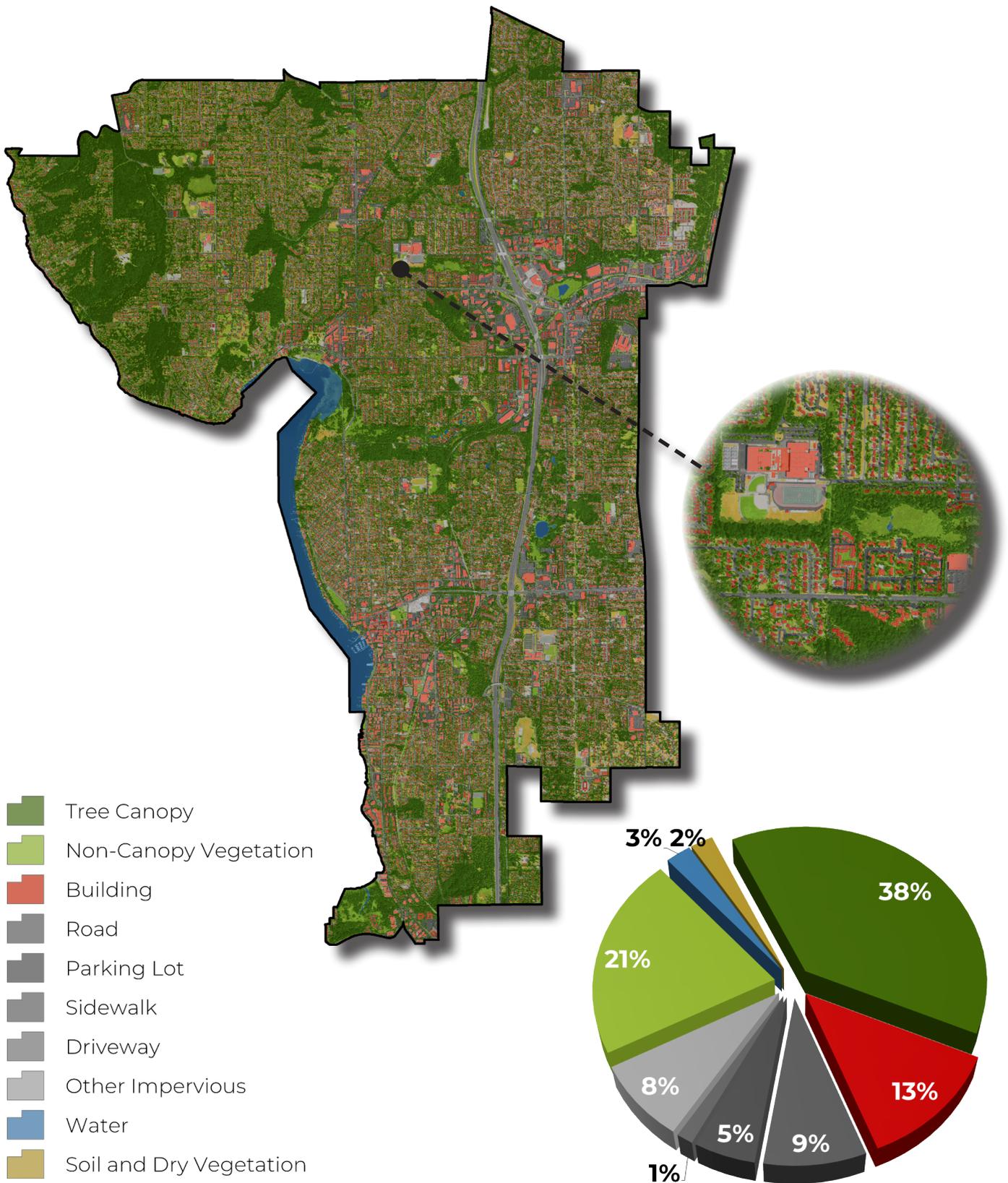


Figure 6. | Detailed land cover classes for Kirkland, Washington based on 2017 NAIP imagery and 2016 PSLC LiDAR data. (Percentages based on land acres.)

CITYWIDE URBAN TREE CANOPY

This urban tree canopy assessment utilized the land cover map as a foundation to determine Possible Planting Areas throughout the City. Additional layers and information regarding land considered unsuitable for planting were also incorporated into the analysis. Note that the results of this study are based on land area as opposed to total area (note the difference between Total Acres and Land Acres in Table 2).

Results of this study indicate that within the City of Kirkland, 4,631 acres are covered with urban tree canopy, making up 38 percent of the city's 11,394 land acres; 3,421 acres are covered with other vegetation or impervious surfaces (parking lots, driveways, and sidewalks) where it would be possible to plant trees (PPA), making up 30 percent of the city; and the other 3,612 acres were considered unsuitable for tree planting, making up 32 percent of the city. The unsuitable areas include recreational sports fields, buildings, roads, other impervious surfaces, and areas of bare soil and dry vegetation. Bare soil and dry vegetation are considered unsuitable as these areas would require modification through irrigation or other methods to support healthy trees.

Table 2. | Urban tree canopy assessment results, by acres and percent. (Percentages based on land acres.)

City of Kirkland	Acres	%
Total Area	11,671	100%
Land Area	11,394	98%
Urban Tree Canopy	4,361	38%
Possible Planting Area - Vegetation	2,351	21%
Possible Planting Area - Impervious	1,070	9%
Total Possible Planting Area	3,421	30%
Unsuitable Vegetation	40	<1%
Unsuitable Impervious	3,330	29%
Unsuitable Soil	242	2%
Total Unsuitable Areas	3,612	32%

Urban Tree Canopy and Possible Planting Area in the City of Kirkland

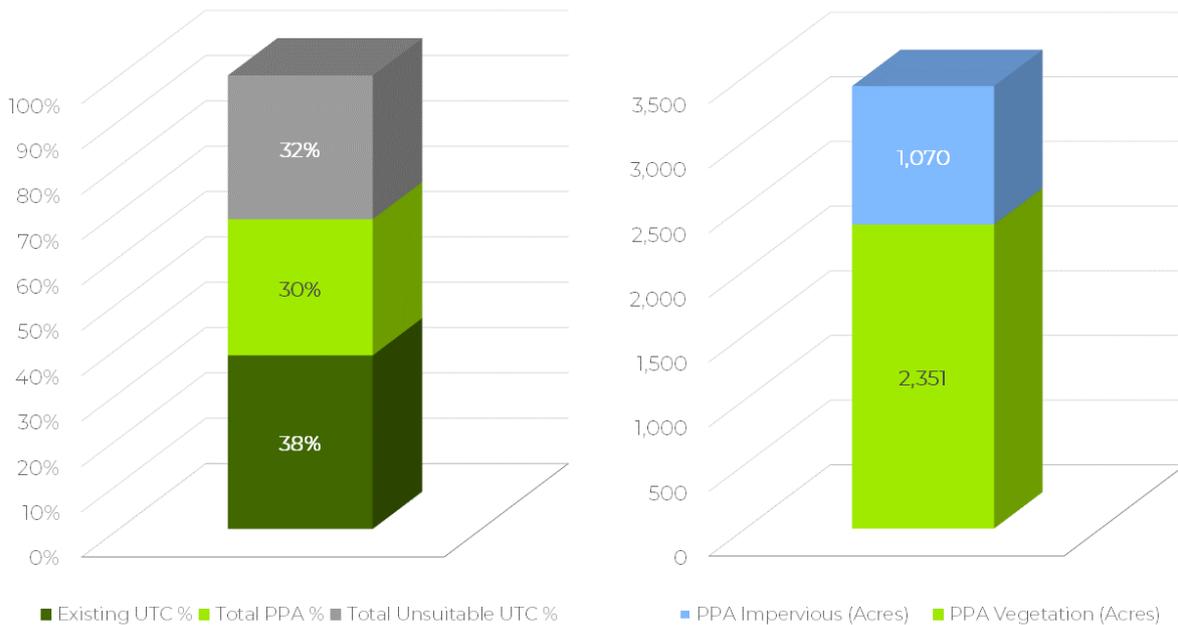


Figure 7. | Urban tree canopy, potential planting area, and area unsuitable for UTC by percentage (left) and types of possible planting area by acreage (right) in the City of Kirkland.

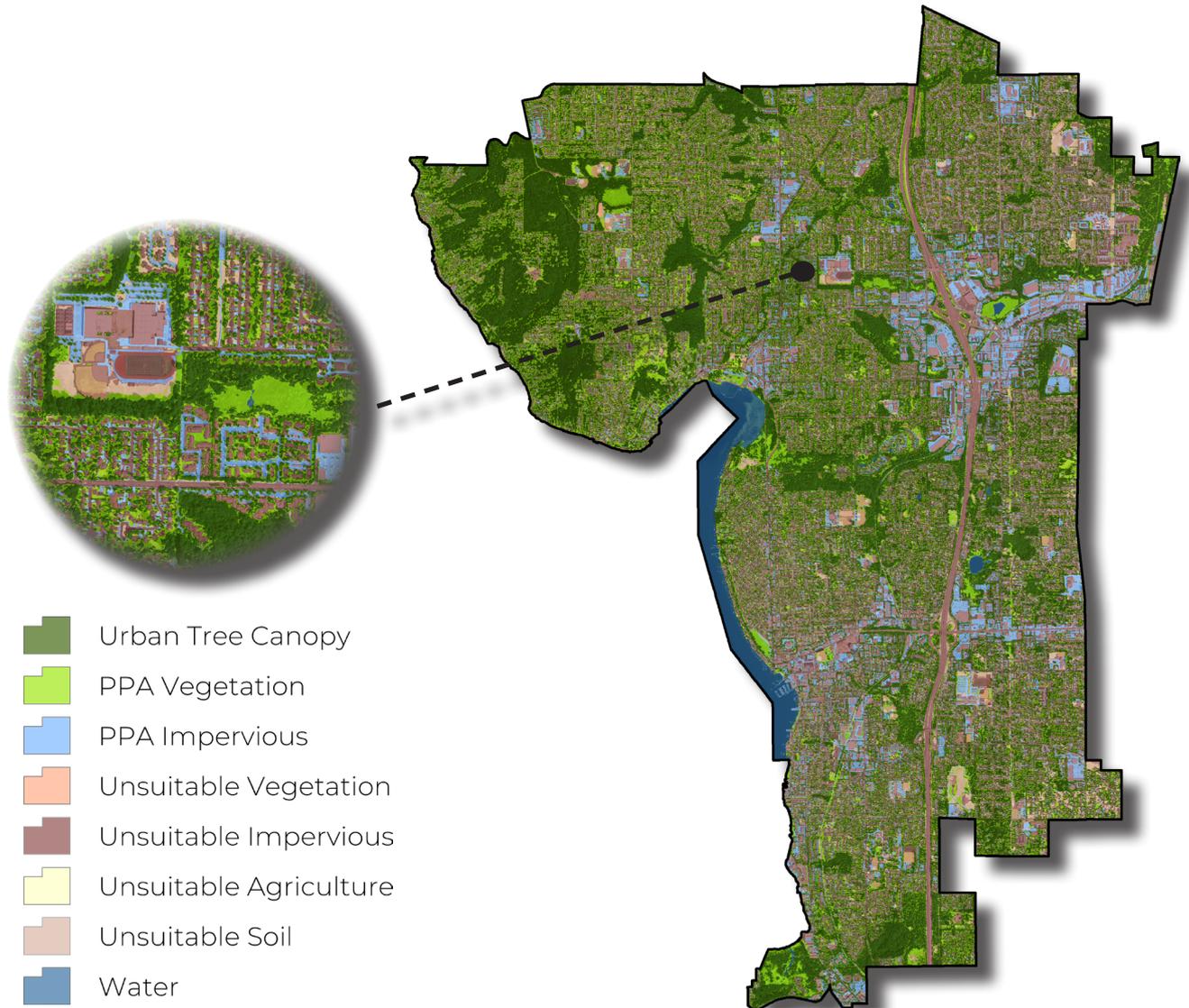


Figure 8. | Urban tree canopy, possible planting area, and area unsuitable for UTC in the city of Kirkland.

The city’s 4,631 acres of urban tree canopy were further divided into subcategories based on whether the trees’ canopy had an impervious understory or pervious understory. Tree canopy overhanging an impervious surface can provide many benefits through ecosystem services such as localized cooling provided by shading of impervious surfaces and increased stormwater absorption. Results indicated that in Kirkland, 540 acres or 12 percent of urban tree canopy had an impervious understory.

Table 3. | Urban tree canopy classification for the City of Kirkland by acres and percent.

City of Kirkland	Acres	%
Tree Canopy with Pervious Understory	3,821	88%
Tree Canopy with Impervious Understory	540	12%

URBAN TREE CANOPY BY PRE-ANNEXATION CITY BOUNDARY

Prior to its annexation of three additional neighborhoods in 2011 (Finn Hill, North Juanita, and Kingsgate), the City of Kirkland was composed of approximately 11 square miles or 7,071 acres, of which 6,802 (96 percent) were land acres. In 2017, this pre-annexation boundary contained 35 percent UTC (2,371 acres), 30 percent total PPA (2,040 acres), and 35 percent total unsuitable acres (2,391 acres). The annexation of these three neighborhoods had a large impact on the total amount of tree canopy within the current city boundary: over 50% of all canopy is found in these neighborhoods.

Table 4. | Urban tree canopy assessment results by pre-annexation boundary. UTC and PPA results include acres, percent of area covered by UTC or PPA (%), and distribution of the city's total UTC or PPA within the boundary (dist.).

City of Kirkland	Land Area		Urban Tree Canopy			Possible Planting Area		
	Acres	Dist.	Acres	%	Dist.	Acres	%	Dist.
Pre-Annexation Boundary	6,802	60%	2,371	35%	54%	2,040	30%	60%

Urban Tree Canopy Compared to Total Area and Land Area, Post- and Pre-Annexation

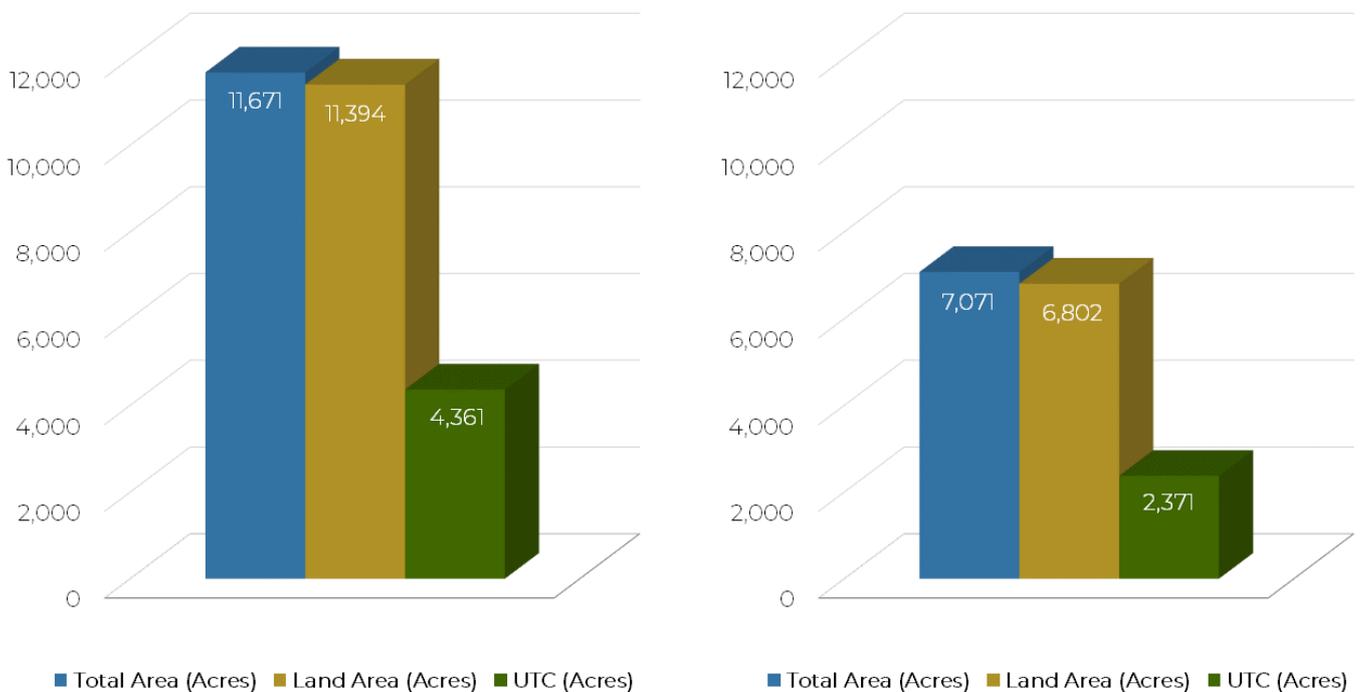


Figure 9. | Urban tree canopy, land acres, and total acres in the City of Kirkland's current boundary (left) and pre-annexation boundary (right).

URBAN TREE CANOPY BY WATERSHEDS

UTC and PPA were assessed for the two HUC-12 watersheds that intersect the City of Kirkland. The Lake Washington-Sammamish River watershed occupies the vast majority of the City’s area (94 percent), while the Bear Creek-Sammamish River watershed intersects a small portion of its northern and eastern edges. The larger of the two watersheds closely reflected the citywide metrics with 38 percent UTC and 30 percent total PPA, while the smaller watershed had slightly less of each with 36 percent UTC and 27 percent total PPA. However, the smaller watershed contained a higher percentage of PPA-Impervious than its counterpart with 12 percent compared to 9 percent.

Table 5. | Urban tree canopy assessment results by HUC-12 watershed. UTC and PPA results include acres, percent of area covered by UTC or PPA (%), and distribution of the city’s total UTC or PPA within each watershed (dist.).

Watersheds	Land Area		Urban Tree Canopy			Possible Planting Area		
	Acres	Dist.	Acres	%	Dist.	Acres	%	Dist.
Bear Creek-Sammamish River	699	6%	252	36%	6%	189	27%	6%
Lake Washington-Sammamish River	10,695	94%	4,108	38%	94%	3,232	30%	94%
Totals	11,394	100%	4,361	38%	100%	3,421	30%	100%

URBAN TREE CANOPY BY LAND USES

UTC and PPA were assessed for the ten different land uses found within the King County comprehensive plan land use data layer. UTC ranged from 17 percent in General Commercial areas to 70 percent in Park/Golf Course/Trail/Open Space areas, with the majority of other land uses having between 25-35 percent UTC. Although General Commercial areas had the lowest existing UTC, they contained the greatest percentages of all types of plantable space with 41 percent total PPA, 41 percent PPA-Vegetation, and 35 percent PPA-Impervious. Single-family residential areas contributed the most to the City’s total UTC and PPA, with 37 percent UTC making up 69 percent of the City’s total canopy and 30 percent total PPA making up 72 percent of the City’s total plantable space.

Urban Tree Canopy and Possible Planting Area by Land Use

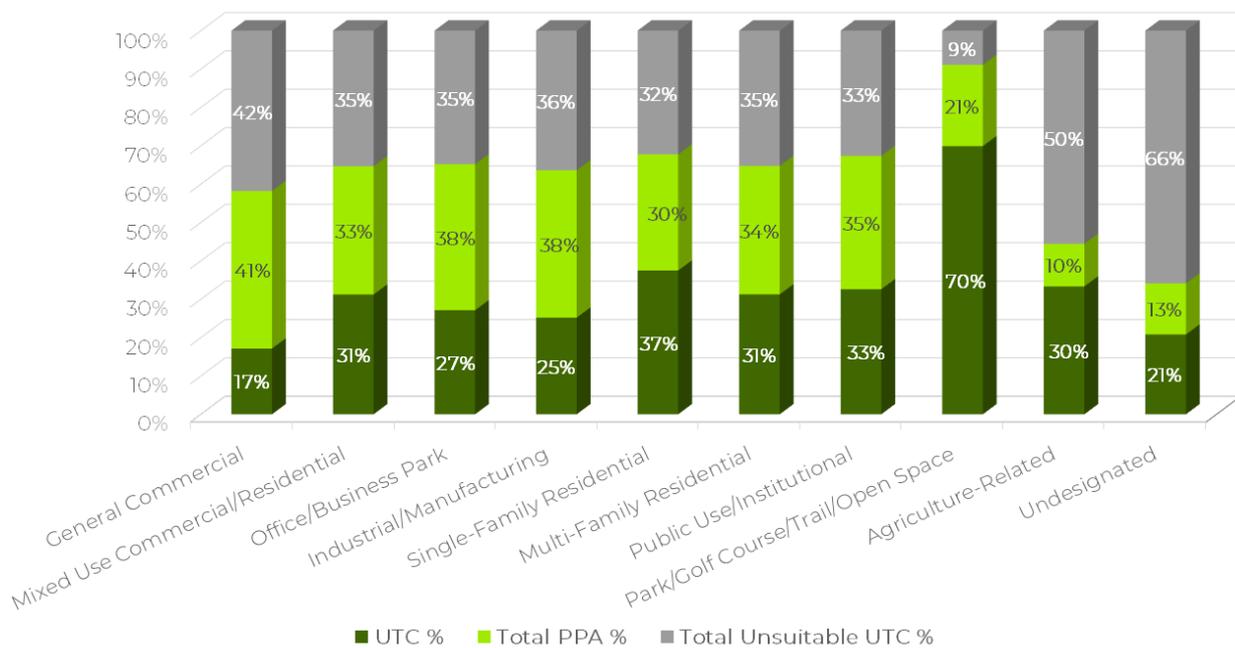


Figure 10. | Urban tree canopy, potential planting area, and area unsuitable for UTC by county land uses.

Table 6. | Urban tree canopy assessment results by King County land use. UTC and PPA results include acres, percent of area covered by UTC or PPA (%), and distribution of the city's total UTC or PPA within each land use (dist.).

Land Use	Land Area		Urban Tree Canopy			Possible Planting Area		
	Acres	Dist.	Acres	%	Dist.	Acres	%	Dist.
General Commercial	602	5%	103	17%	2%	247	41%	7%
Industrial/Manufacturing	285	2%	72	25%	2%	109	38%	3%
Mixed Use Commercial/Residential	226	2%	71	31%	2%	76	33%	2%
Multi-Family Residential	414	4%	129	31%	3%	139	34%	4%
Office/Business Park	178	2%	48	27%	1%	68	38%	2%
Park/Golf Course/Trail/Open Space	1,132	10%	791	70%	18%	240	21%	7%
Public Use/Institutional	154	1%	50	33%	1%	53	35%	2%
Single-Family Residential	8,081	71%	3,029	37%	69%	2,446	30%	72%
Undesignated	323	3%	67	21%	2%	43	13%	1%
Totals	11,394	100%	4,360	38%	100%	3,421	30%	100%

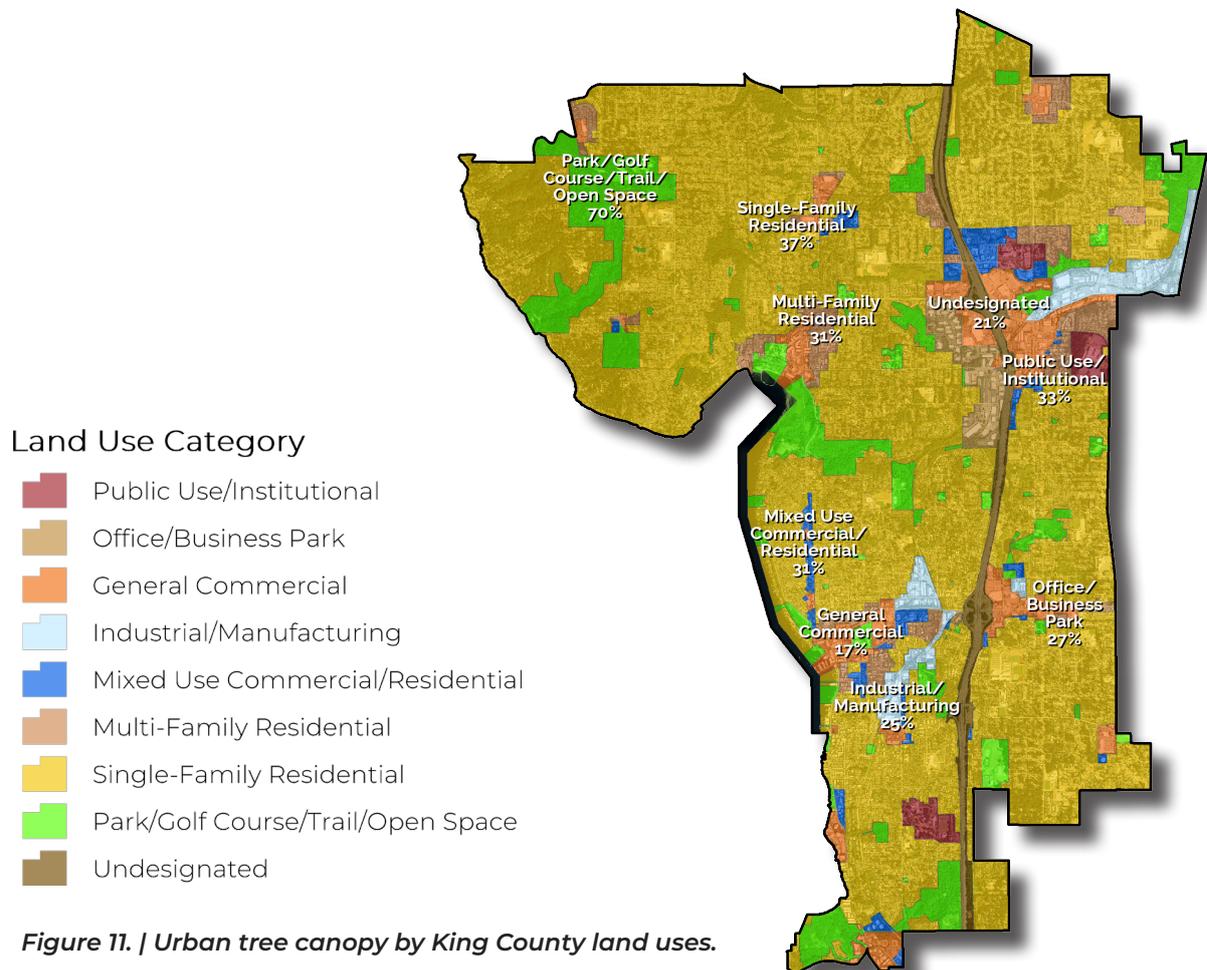


Figure 11. | Urban tree canopy by King County land uses.

URBAN TREE CANOPY BY NEIGHBORHOODS

UTC and PPA were assessed for Kirkland's 14 neighborhoods. The neighborhoods with the least existing UTC included Moss Bay with 22 percent, South Rose Hill with 27 percent, and Totem Lake with 29 percent. All other neighborhoods had a canopy cover of 30 percent or greater, and Highlands and Finn Hill contained the greatest percentage of UTC with 40 and 50 percent, respectively. Finn Hill, which was one of the three neighborhoods annexed by the City in 2011, also contained the greatest proportion of the City's total UTC, comprising 30 percent of all canopy in Kirkland. In terms of plantable space, the Highlands neighborhood offered the least PPA (25 percent) while Totem Lake offered the greatest (36 percent), indicating that PPA within Kirkland's neighborhoods tends to be inversely related to their existing UTC.

Table 7. | Urban tree canopy assessment results by neighborhood. UTC and PPA results include acres, percent of area covered by UTC or PPA (%), and distribution of the city's total UTC or PPA within each neighborhood (dist.).

Neighborhood	Land Area		Urban Tree Canopy			Possible Planting Area		
	Acres	Dist.	Acres	%	Dist.	Acres	%	Dist.
Bridle Trails	610	5%	213	35%	5%	182	30%	5%
Central Houghton	610	5%	233	38%	5%	172	28%	5%
Everest	220	2%	81	37%	2%	60	27%	2%
Finn Hill	2,609	23%	1,313	50%	30%	802	31%	23%
Highlands	363	3%	147	40%	3%	92	25%	3%
Juanita	1,865	16%	712	38%	16%	609	33%	18%
Kingsgate	1,279	11%	438	34%	10%	340	27%	10%
Lakeview	363	3%	142	39%	3%	115	32%	3%
Market	291	3%	96	33%	2%	89	31%	3%
Moss Bay	314	3%	70	22%	2%	89	28%	3%
Norkirk	511	4%	162	32%	4%	139	27%	4%
North Rose Hill	978	9%	361	37%	8%	276	28%	8%
South Rose Hill	508	4%	139	27%	3%	144	28%	4%
Totem Lake	874	8%	254	29%	6%	310	36%	9%
Totals	11,394	100%	4,360	38%	100%	3,421	30%	100%

Urban Tree Canopy and Possible Planting Area by Neighborhoods

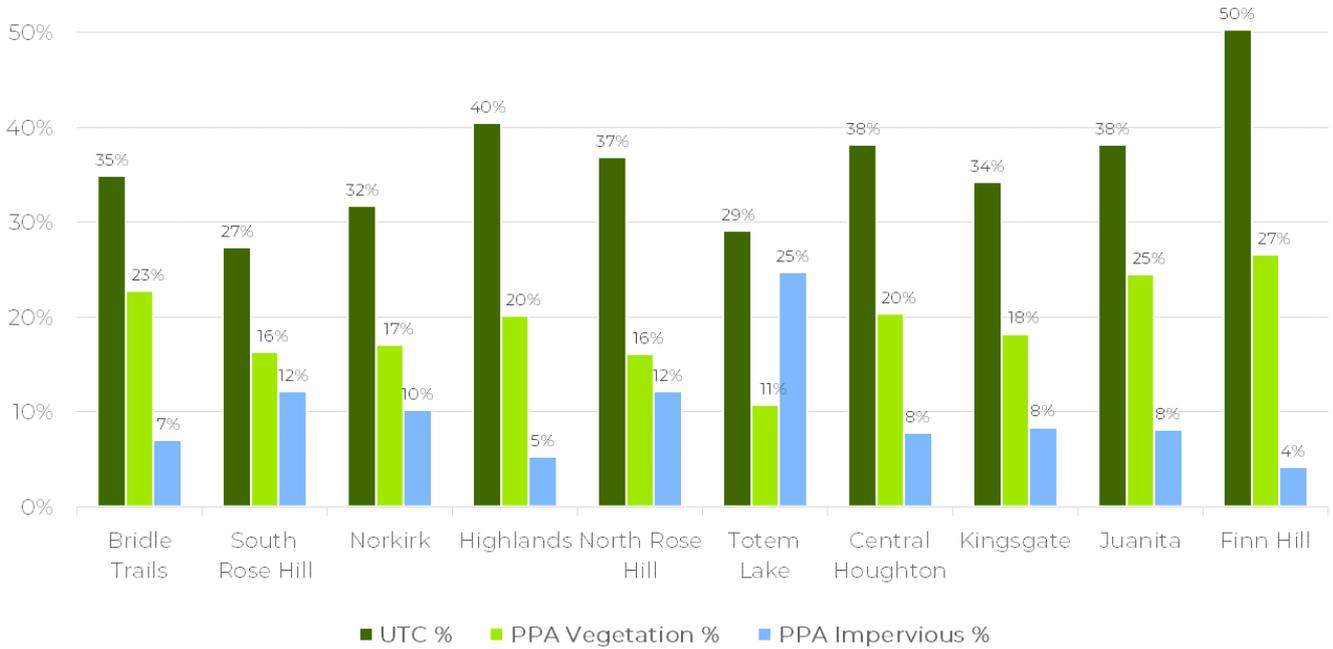


Figure 12. | Urban tree canopy and potential planting area in Kirkland neighborhoods.

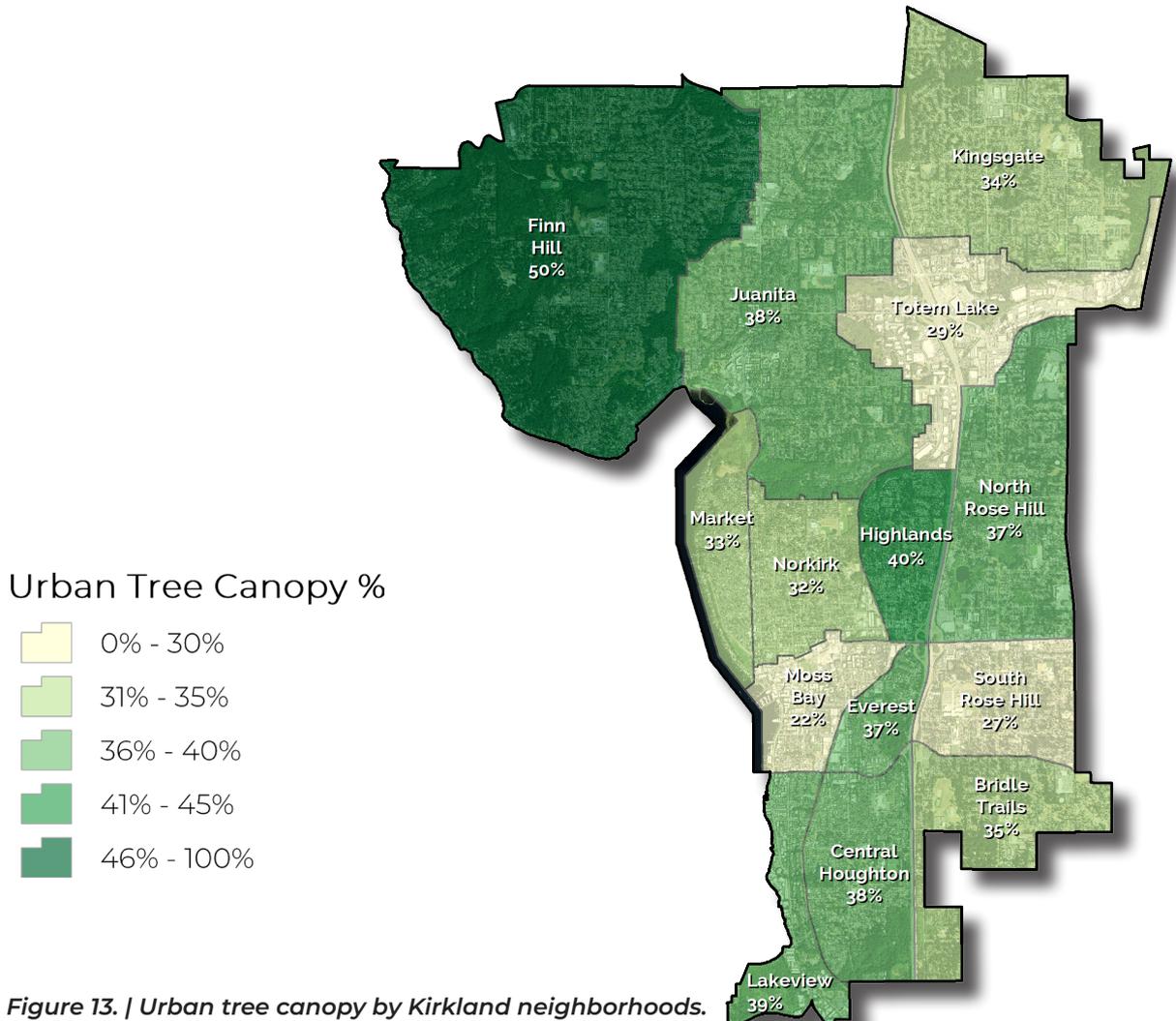


Figure 13. | Urban tree canopy by Kirkland neighborhoods.

URBAN TREE CANOPY BY DRAINAGE BASINS

Because trees play an important role in stormwater management, UTC and PPA were assessed for the 15 local drainage basins found within Kirkland. Houghton Slope A and To Redmond had the lowest percentages of existing UTC with 26 and 28 percent, while Yarrow Creek, Denny Creek, and Holmes Point had the greatest with 50, 53, and 60 percent respectively. PPA was varied less and ranged from 26 percent in Kingsgate Slope to 36 percent in South Juanita Slope. The largest drainage basin, Juanita Creek, contributed the most to the City's totals with 32 percent UTC contributing 29 percent of the City's total canopy and 32 percent total PPA contributing 35 percent of the City's total PPA.

Table 8. | Urban tree canopy assessment results by drainage basins. UTC and PPA results include acres, percent of area covered by UTC or PPA (%), and distribution of the city's total UTC or PPA within each basin (dist.).

Drainage Basin	Land Area		Urban Tree Canopy			Possible Planting Area		
	Acres	Dist.	Acres	%	Dist.	Acres	%	Dist.
Carillon Creek	106	1%	36	34%	1%	35	33%	1%
Champagne Creek	621	5%	281	45%	6%	218	35%	6%
Denny Creek	803	7%	429	53%	10%	231	29%	7%
Forbes Creek	1,824	16%	715	39%	16%	515	28%	15%
Holmes Point	457	4%	276	60%	6%	130	28%	4%
Houghton Slope A	376	3%	99	26%	2%	117	31%	3%
Houghton Slope B	134	1%	44	33%	1%	45	33%	1%
Juanita Creek	3,615	32%	1,279	35%	29%	1,153	32%	34%
Kingsgate Slope	562	5%	212	38%	5%	145	26%	4%
Kirkland Slope	210	2%	66	31%	2%	62	30%	2%
Lower Sammamish River Valley	24	0%	10	43%	0%	8	33%	0%
Moss Bay	1,486	13%	444	30%	10%	405	27%	12%
South Juanita Slope	287	3%	94	33%	2%	105	36%	3%
To Redmond	303	3%	84	28%	2%	92	31%	3%
Yarrow Creek	577	5%	287	50%	7%	158	27%	5%
Totals	11,385	100%	4,356	38%	100%	3,419	30%	100%

URBAN TREE CANOPY BY CENSUS BLOCK GROUPS

UTC and PPA were assessed for the 80 U.S. census block groups (CBG) found within Kirkland. CBGs are delineated by the U.S. Census Bureau and tied to all population and demographic census data. This makes them helpful for assessing environmental equity. 6 percent of CBGs had less than 20 percent UTC; 28 percent had 20-30 percent UTC; 40 percent had 30-40 percent UTC; and the other 26 percent had 40 percent of greater. For the complete results by CBG, refer to the UTC Results spreadsheet.

Urban Tree Canopy and Possible Planting Area by Census Block Groups

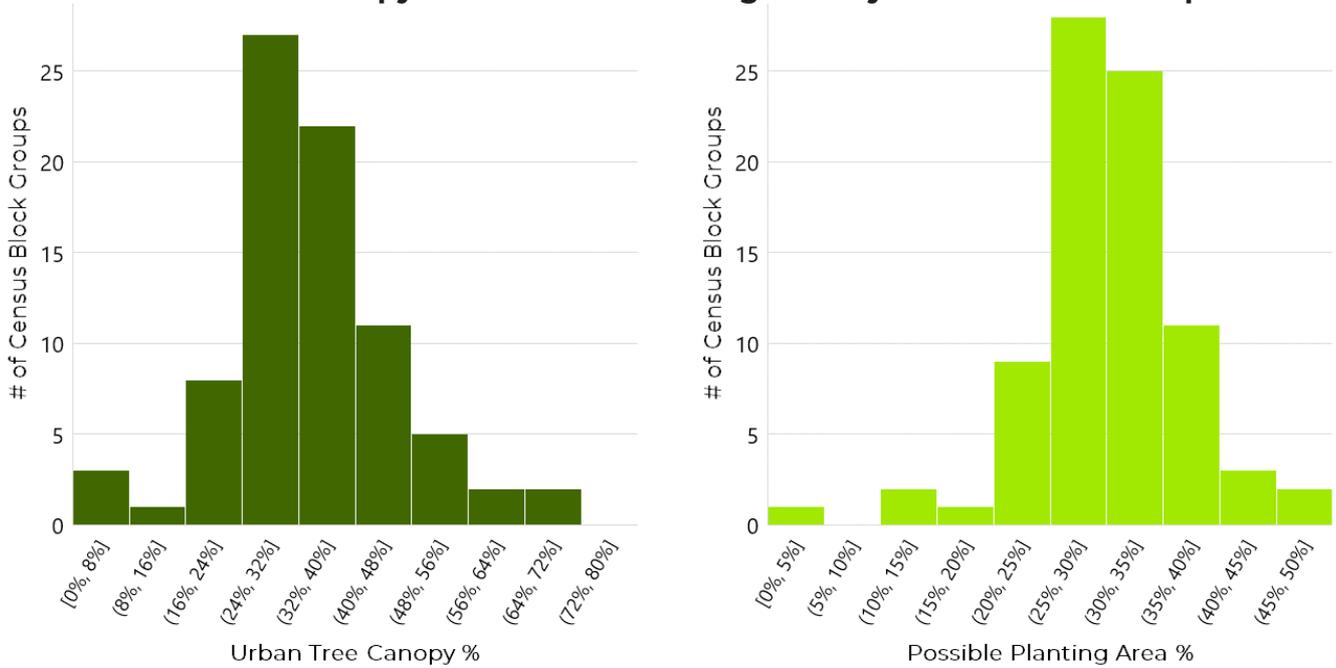


Figure 14. | Number of census block groups within urban tree canopy (left) and possible planting area (right) ranges.

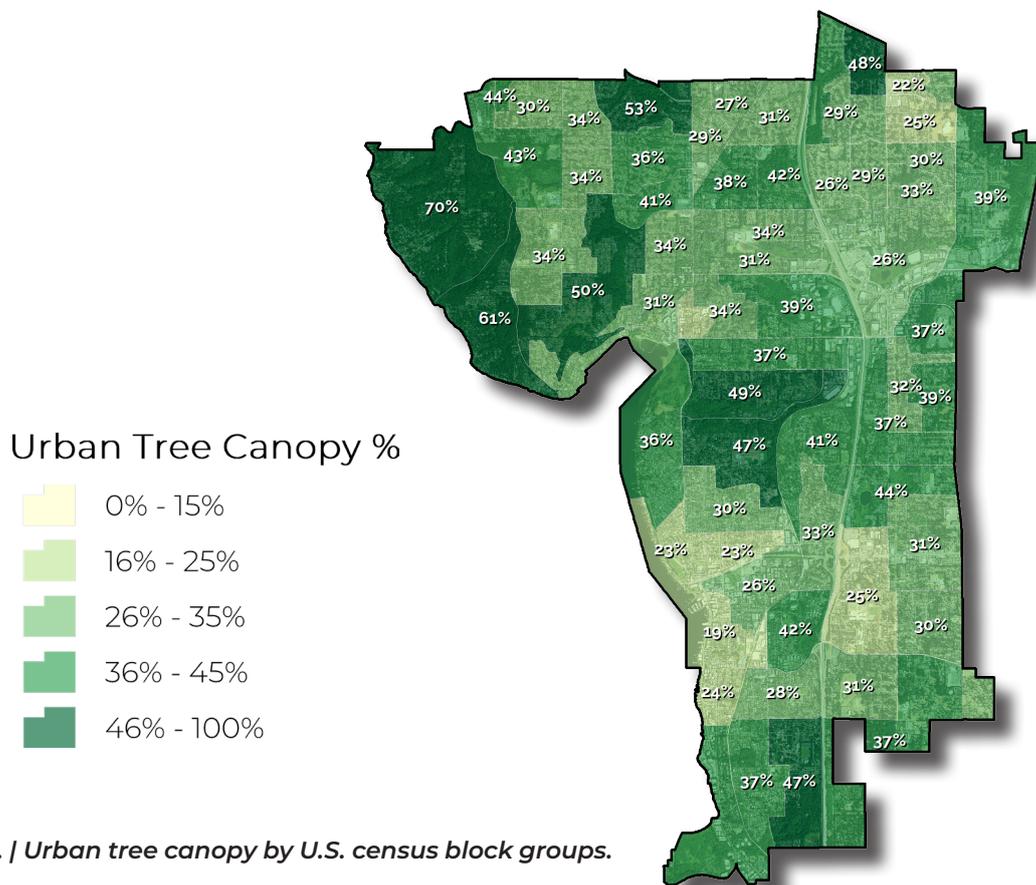


Figure 15. | Urban tree canopy by U.S. census block groups.

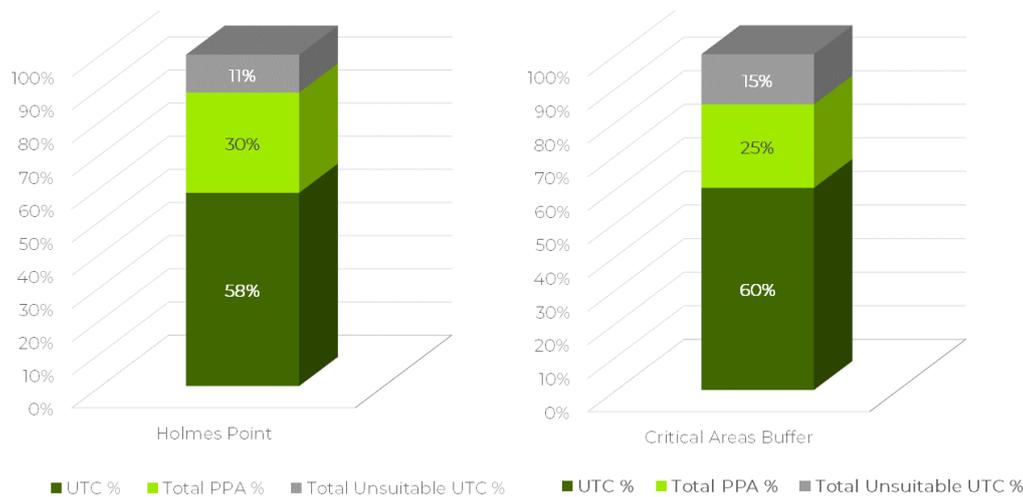
URBAN TREE CANOPY BY HOLMES POINT OVERLAY

UTC and PPA were assessed within the Holmes Point Overlay boundary. Historically, this area is one of the City's most densely forested areas. In 2017, this region contained over 58 percent UTC, 30 percent total PPA (of which 28 percent was PPA-Vegetation and only 2 percent was PPA-Impervious), and 11 percent total unsuitable areas. With 380 acres of canopy, the Holmes Point Overlay contains 9 percent of Kirkland's tree canopy, despite comprising only 6 percent of its land area.

Table 9. | Urban tree canopy in Kirkland's Holmes Point region. UTC and PPA results include acres, percent of area covered by UTC or PPA (%), and distribution of the city's total UTC or PPA within the overlay (dist.).

City of Kirkland	Land Area		Urban Tree Canopy			Possible Planting Area		
	Acres	Dist.	Acres	%	Dist.	Acres	%	Dist.
Holmes Point Overlay	651	6%	380	58%	9%	197	30%	6%

Urban Tree Canopy Potential by Holmes Point Overlay and Citywide Critical Area Buffers



Figures 16 and 17. | Urban tree canopy, possible planting area, and unsuitable areas for UTC in Kirkland's Holmes Point Overlay (left) and citywide 100' critical area buffers (right).

URBAN TREE CANOPY BY CRITICAL AREA BUFFERS

Trees in critical and sensitive environmental areas are also a valuable part of Kirkland's urban forest resource. A buffer of 100 feet was applied to Kirkland's streams, lakes, wetlands, and landslide areas and UTC and PPA metrics were assessed within this area. Results indicated that Kirkland's critical area buffers contained 60 percent existing UTC, 25 percent total PPA (predominantly vegetation), and 15 percent total unsuitable areas. With 2,872 land acres and 1,729 acres of canopy, this region contains 40 percent of Kirkland's citywide canopy while occupying just 25 percent of its land area.

Table 10. | Urban tree canopy in Kirkland's critical area buffers. UTC and PPA results include acres, percent of area covered by UTC or PPA (%), and distribution of the city's total UTC or PPA within the buffer (dist.).

City of Kirkland	Land Area		Urban Tree Canopy			Possible Planting Area		
	Acres	Dist.	Acres	%	Dist.	Acres	%	Dist.
Critical Area Buffers (100')	2,873	25%	1,729	60%	40%	715	25%	21%

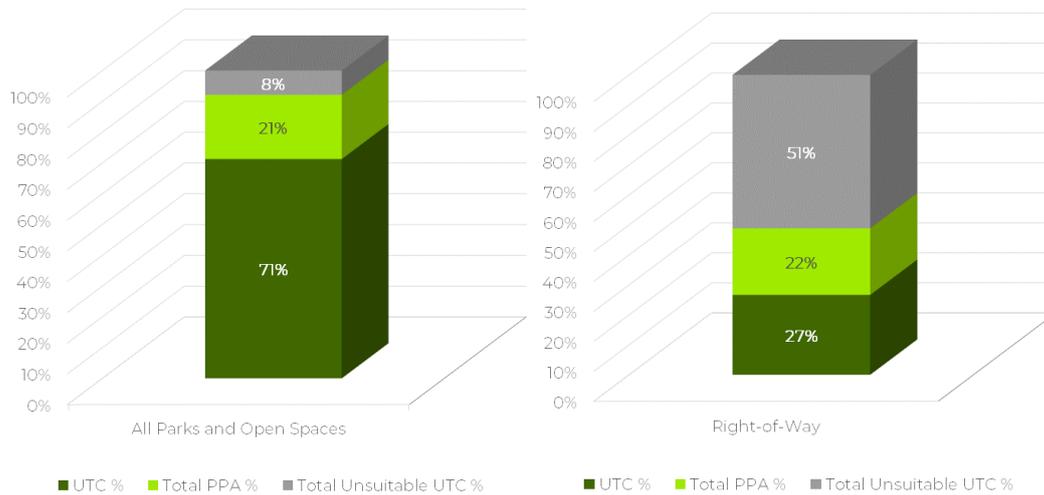
URBAN TREE CANOPY BY PARKS AND OPEN SPACES

UTC and PPA were assessed within Kirkland’s various classes of parks and open spaces: general parks (consisting of parks, swimming pool facilities, and cemeteries), open spaces, and all parks. UTC was 85 percent in open spaces, 70 percent in general parks, and 71 percent overall. General parks contained the majority of total UTC within this assessment scale with 70 percent canopy cover contributing 91 percent of the total canopy. PPA ranged from 13 percent in open spaces to 22 percent in general parks, which also contributed the most to the citywide total with 21 contributing 95 percent of all plantable space in these areas.

Table 11. | Urban tree canopy in Kirkland’s parks and open spaces. UTC and PPA results include acres, percent of area covered by UTC or PPA (%), and distribution of the city’s total UTC or PPA within the area (dist.).

Parks and Open Spaces	Land Area		Urban Tree Canopy			Possible Planting Area		
	Acres	Dist.	Acres	%	Dist.	Acres	%	Dist.
General Parks	943	93%	661	70%	91%	203	22%	95%
Open Spaces	75	7%	63	85%	9%	10	13%	5%
Totals	1,017	100%	725	71%	100%	213	21%	100%

UTC, PPA, and Impervious Areas in Kirkland’s Parks/Open Spaces and Right-of-Way



Figures 18 and 19. | Urban tree canopy, possible planting area, and impervious areas in Kirkland’s Parks and Open Spaces (left) and right-of-way (right).

URBAN TREE CANOPY BY RIGHT-OF-WAY

UTC and PPA were assessed for Kirkland’s right-of-way or publicly-maintained sidewalk and street areas. Trees in the ROW are especially valuable components of a city’s urban forest in terms of air pollution control, shading, and even social benefits. Within these areas, UTC was 27 percent, PPA-Vegetation was 14 percent, PPA-Impervious was 8 percent, and unsuitable areas were 50 percent. UTC and total PPA (22 percent) were lower in the ROW than the citywide average, but much of this area consists of sidewalks or roads where it would be impossible to plant trees.

Table 12. | Urban tree canopy in Kirkland’s right-of-way. UTC and PPA results include acres, percent of area covered by UTC or PPA (%), and distribution of the city’s total UTC or PPA within the ROW (dist.).

City of Kirkland	Land Area		Urban Tree Canopy			Possible Planting Area		
	Acres	Dist.	Acres	%	Dist.	Acres	%	Dist.
Right-of-Way	2,166	19%	576	27%	13%	481	22%	14%

URBAN TREE CANOPY BY SHORELINE JURISDICTIONS

UTC and PPA were assessed within Kirkland's shoreline jurisdictions. The results were aggregated for reporting. Shoreline jurisdictions in Kirkland had 46% canopy cover or 4% of all canopy citywide. These areas also contained 116 acres of possible planting area (35%) with a majority of that on vegetated surfaces.

Table 13. | Shoreline jurisdiction urban tree canopy assessment results by acres and percent. UTC and PPA results include acres, percent of area covered by UTC or PPA (%), and distribution of the city's total UTC or PPA within Kirkland's shoreline jurisdictions (dist.).

City of Kirkland	Land Area		Urban Tree Canopy			Possible Planting Area		
	Acres	Dist.	Acres	%	Dist.	Acres	%	Dist.
Shoreline Jurisdictions	332	3%	153	46%	4%	116	35%	3%

UTC, PPA, and Impervious Areas by Shoreline Jurisdictions

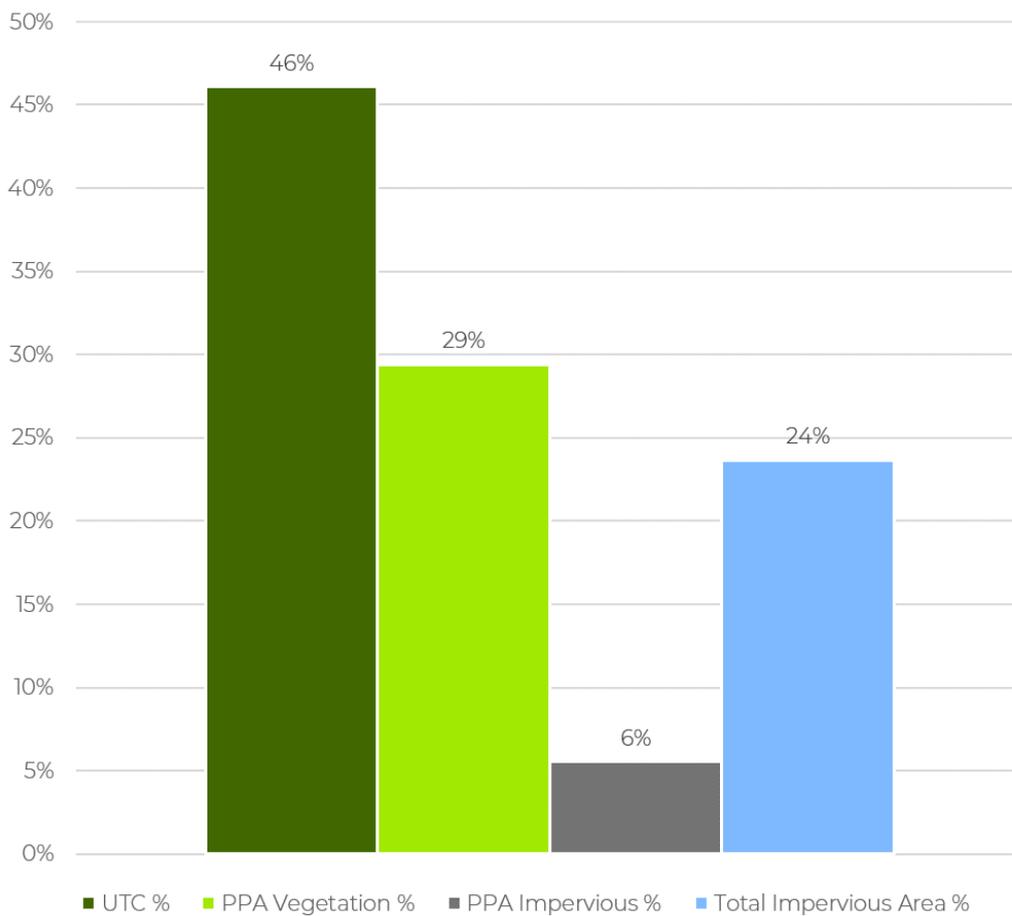


Figure 20. | Urban tree canopy, possible planting area, and impervious areas in Kirkland's shoreline jurisdictions.

URBAN TREE CANOPY CHANGE ANALYSIS

This section presents the change analysis results which were analyzed across the same geographic assessment boundaries described above. In addition to assessing Kirkland's urban tree canopy using 2017 imagery, this study also quantified changes in urban tree canopy since it was last assessed by AMEC Environmental & Infrastructure, Inc. using 2010 Worldview-2 satellite imagery. Although the exact methods used to map land cover varied between the 2017 and 2010 studies, the resulting land cover data are comparable. Both studies used leaf-on, high-resolution aerial imagery as their primary source. The spatial resolution of the imagery in 2010 was 1.5-feet while this study used 1-meter NAIP imagery. Both studies also utilized Feature Analyst remote sensing software and an object-based image analysis (OBIA) as their primary method. To ensure an even comparison, the 2010 land cover data were reanalyzed using the current boundaries of the city, land use, census block groups, etc., and changes since 2010 were assessed at the same geographic assessment scales. Similar to the UTC and PPA assessment above, the urban tree canopy change percentages are based on land area only.

CITYWIDE URBAN TREE CANOPY CHANGE

There was a slight decrease in Kirkland's tree canopy over the 7-year study period from 2010-2017. Throughout the city, the average canopy cover decreased from 40.7 percent in 2010 to 38.3 percent in 2017. Tree canopy decreased by approximately 272 acres, yielding a 2.4 percent raw or 6 percent relative decrease since 2007. New development throughout the city was responsible for a majority of the losses in tree canopy. Some overestimation in the previous assessment was also observed.

Table 14. | Urban tree canopy change results for the City of Kirkland by acres and percent. UTC results include acres and percent of area covered by UTC in 2010 and 2017, and change in acres and percent over the seven-year period.

City of Kirkland	Land Area		UTC 2010		UTC 2017		UTC Change	
	Acres	Dist.	Acres	%	Acres	%	Acres	%
City Boundary	11,394	100%	4,632	41%	4,361	38%	-272	-2%

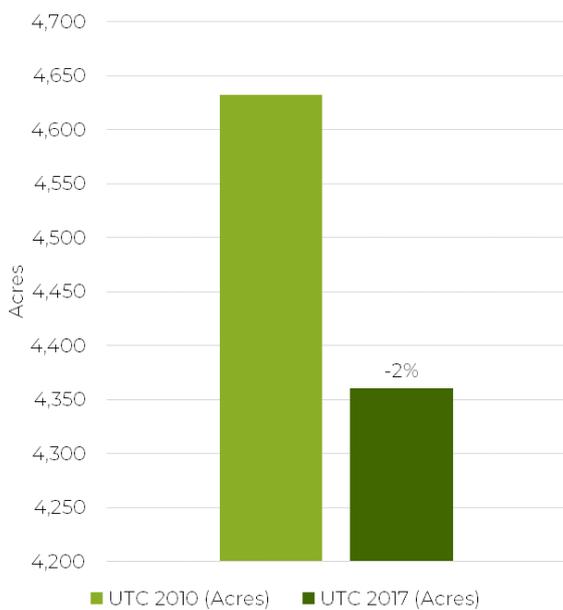


Figure 21. | Urban tree canopy change for the City of Kirkland, 2010-2017.



Figure 22. | Urban tree canopy in 2010 (yellow) compared to 2017 (green) in Downtown Kirkland.

URBAN TREE CANOPY CHANGE BY PRE-ANNEXATION CITY BOUNDARY

UTC within the pre-annexation city boundary decreased slightly. This region lost approximately 77 acres of canopy which equated to a 1 percent decrease from 36 percent to 35 percent between 2010 and 2017. This change result indicates that the majority of canopy lost in Kirkland over the study period (195 acres or 72 percent) occurred within the three annexed neighborhoods of Finn Hill, North Juanita, and Kingsgate, which were more heavily forested to begin with. The recent losses in canopy cover within the pre-annexation city boundary are a reversal of an increasing trend experienced from 2002-2010 when canopy cover increased by approximately 4 percent.

Table 15. | Urban tree canopy change results for the pre-annexation boundary by acres and percent. UTC results include acres and percent of area covered by UTC in 2010 and 2017, and change in acres and percent over the seven-year period.

City of Kirkland	Land Area		UTC 2010		UTC 2017		UTC Change	
	Acres	Dist.	Acres	%	Acres	%	Acres	%
Pre-Annexation Boundary	6,802	60%	2,448	36%	2,371	35%	-77	-1%

URBAN TREE CANOPY CHANGE BY WATERSHEDS

UTC change within the Lake-Washington Sammamish River watershed, which occupies 94 percent of the City’s land area, closely mirrored the City’s change result. This watershed lost approximately 239 acres of canopy which lowered its UTC by 2 percent from 41 percent in 2010 to 38 percent in 2017. The Bear Creek-Sammamish River watershed experienced a larger decrease in relation to its size. It lost approximately 33 acres of canopy, decreasing its UTC by 5 percent from 41 percent in 2010 to 36 percent in 2017. However, this watershed only occupies 6 percent of land area in Kirkland.

Table 16. | Urban tree canopy change results for Kirkland’s watersheds by acres and percent. UTC results include acres and percent of area covered by UTC in 2010 and 2017, and change in acres and percent over the seven-year period.

Watersheds	Land Area		UTC 2010		UTC 2017		UTC Change	
	Acres	Dist.	Acres	%	Acres	%	Acres	%
Bear Creek-Sammamish River	699	6%	285	41%	252	36%	-33	-5%
Lake Washington-Sammamish River	10,695	94%	4,347	41%	4,108	38%	-239	-2%
Totals	11,394	100%	4,632	41%	4,361	38%	-272	-2%

URBAN TREE CANOPY CHANGE BY LAND USES

UTC change varied slightly across Kirkland’s ten King County comprehensive plan land use classes. Undesignated areas, primarily the Interstate-405 corridor, experienced the greatest loss in canopy by percentage, decreasing by approximately 4 percent from 25 percent in 2010 to 21 percent in 2017. The greatest loss in citywide canopy by acreage occurred in the Single-Family Residential class, which lost 253 acres or approximately 3 percent of their canopy from 41 to 37 percent. However, several land use classes such as Industrial/Manufacturing, Public Use/Institutional, and Parks/Open Spaces had increases in their tree canopy over the seven-year time period, and several others had little to no change.

Table 17. | Urban tree canopy change results for Kirkland’s King County land use classes by acres and percent. UTC results include acres and percent of area covered by UTC in 2010 and 2017, and change in acres and percent over the seven-year period.

Land Uses	Land Area		UTC 2010		UTC 2017		UTC Change	
	Acres	Dist.	Acres	%	Acres	%	Acres	%
General Commercial	602	5%	109	18%	103	17%	-6	-1%
Industrial/Manufacturing	285	2%	67	23%	72	25%	5	2%
Mixed Use Commercial/Residential	226	2%	73	32%	71	31%	-2	-1%
Multi-Family Residential	414	4%	139	33%	129	31%	-9	-2%
Office/Business Park	178	2%	49	27%	48	27%	-0	-0%
Park/Golf Course/Trail/Open Space	1,132	10%	784	69%	791	70%	7	1%
Public Use/Institutional	154	1%	48	31%	50	33%	2	1%
Single-Family Residential	8,081	71%	3,282	41%	3,029	37%	-253	-3%
Undesignated	323	3%	82	25%	67	21%	-15	-5%
Totals	11,394	100%	4,632	41%	4,360	38%	-272	-2%

Urban Tree Canopy Change by Land Uses

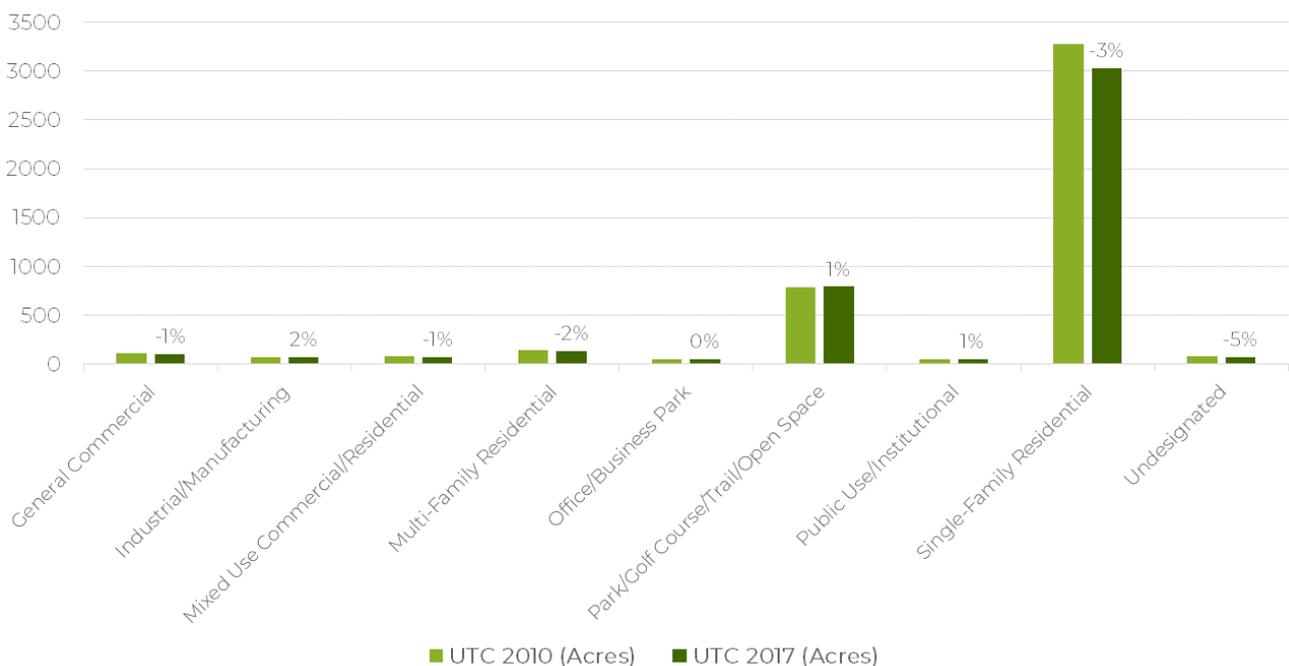


Figure 22. | Urban tree canopy change in Kirkland from 2010-2017 by county land use classes.

URBAN TREE CANOPY CHANGE BY LAND USES (CONTINUED)

Land Use Category

- Public Use/Institutional
- Office/Business Park
- General Commercial
- Industrial/Manufacturing
- Mixed Use Commercial/Residential
- Multi-Family Residential
- Single-Family Residential
- Park/Golf Course/Trail/Open Space
- Undesignated

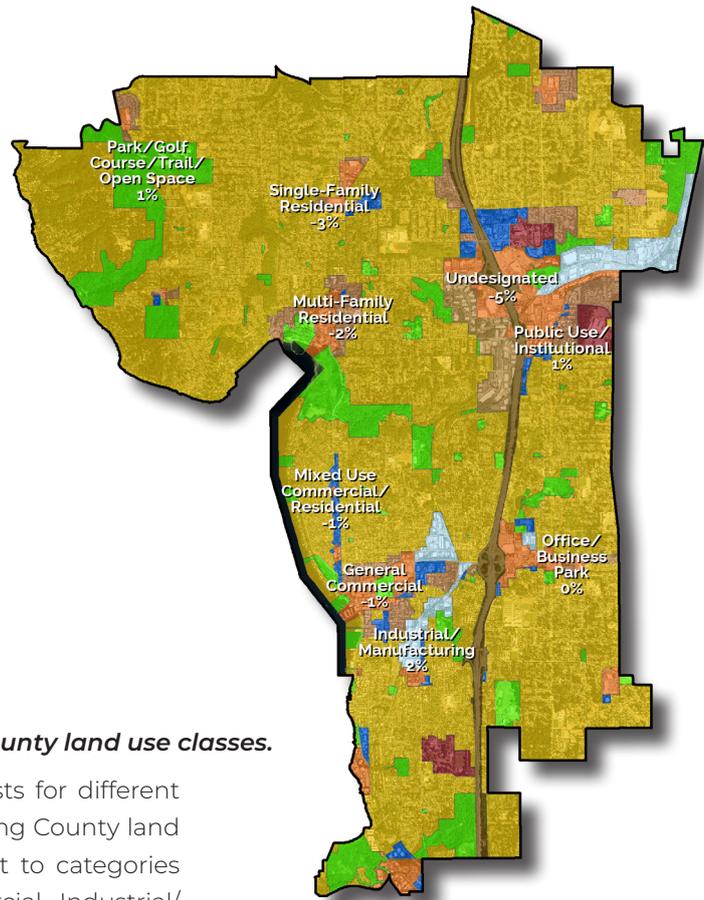


Figure 23. | Urban tree canopy change by King County land use classes.

Canopy goals were established by American Forests for different land uses in the Puget Sound region. Five of the King County land use classes analyzed in this study were equivalent to categories presented by American Forests: General Commercial, Industrial/Manufacturing, Single-Family Residential, Multi-Family Residential, and Park/Golf Course/Trail/Open Space. The City of Kirkland has not adopted American Forests' canopy goals for individual land use classes. However, comparisons between American Forests' individual land use classifications and Kirkland's UTC may provide some insight into future urban forest management decisions. In 2010, only the Park/Golf Course/Trail/Open Space category met or exceeded the American Forests' recommendations for the same land use class. Those areas had a UTC of 69 percent compared to a 25 percent standard. By 2017, another land use had exceeded American Forests' standard: Industrial areas increased from 23 percent UTC to the 25 percent standard. General Commercial, Single-Family Residential, and Multi-Family Residential areas all slightly decreased over the same time period, moving them farther away from the American Forests recommendations for the Puget Sound region. Single-Family Residential areas remained the furthest from the American Forests recommendations with 37 percent UTC compared to the target of 50 percent.

Urban Tree Canopy Change by Land Uses Compared with American Forests Goals

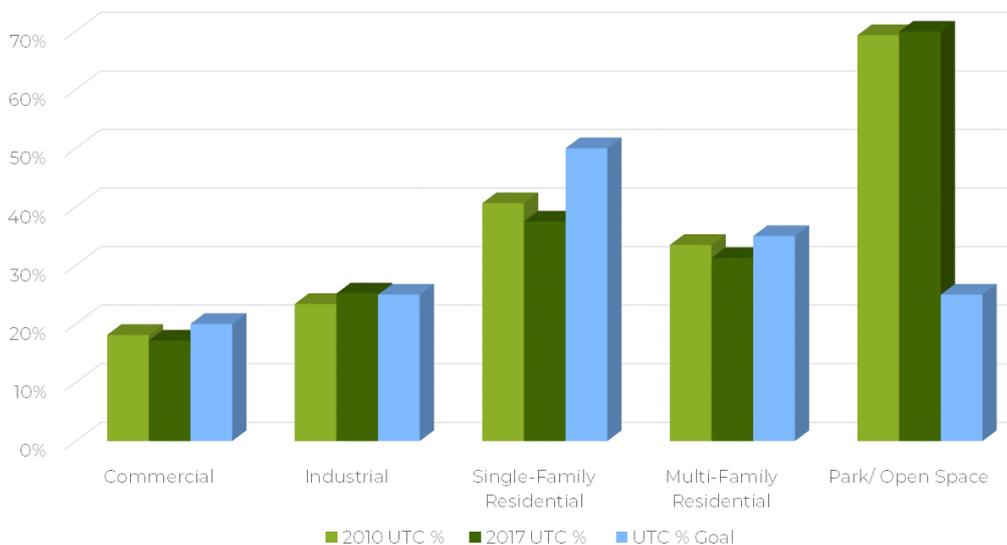


Figure 24. | Urban tree canopy change in Kirkland's five land use classes with UTC goals set in the 2010 study.

URBAN TREE CANOPY CHANGE BY NEIGHBORHOODS

Assessing Kirkland's UTC change by neighborhoods revealed more variation. Neighborhoods that experienced the greatest decreases in canopy included Kingsgate with a 6 percent loss, Juanita with 4 percent, and Finn Hill with 3 percent. Finn Hill also had the greatest decrease in canopy by acreage (85 acres) but maintained the highest UTC of any neighborhood in both 2010 (54 percent) and 2017 (50 percent). The Lakeview, Totem Lake, and Market neighborhoods all showed an increase in canopy by 2-3 percent.

Table 18. | Urban tree canopy change results for Kirkland's neighborhoods. UTC results include acres and percent of area covered by UTC in 2010 and 2017 and change in acres and percent over the seven-year period.

Neighborhoods	Land Area		UTC 2010		UTC 2017		UTC Change	
	Acres	Dist.	Acres	%	Acres	%	Acres	%
Bridle Trails	610	5%	225	37%	213	35%	-12	-2%
Central Houghton	610	5%	244	40%	233	38%	-12	-2%
Everest	220	2%	87	40%	81	37%	-6	-3%
Finn Hill	2,609	23%	1,398	54%	1,313	50%	-85	-3%
Highlands	363	3%	154	43%	147	40%	-7	-2%
Juanita	1,865	16%	793	43%	712	38%	-81	-4%
Kingsgate	1,279	11%	510	40%	438	34%	-71	-6%
Lakeview	363	3%	136	37%	142	39%	6	2%
Market	291	3%	89	31%	96	33%	8	3%
Moss Bay	314	3%	77	25%	70	22%	-7	-2%
Norkirk	511	4%	171	33%	162	32%	-9	-2%
North Rose Hill	978	9%	356	36%	361	37%	5	0%
South Rose Hill	508	4%	152	30%	139	27%	-13	-3%
Totem Lake	874	8%	239	27%	254	29%	15	2%
Totals	11,394	100%	4,632	41%	4,360	38%	-272	-2%

Urban Tree Canopy Change by Neighborhoods

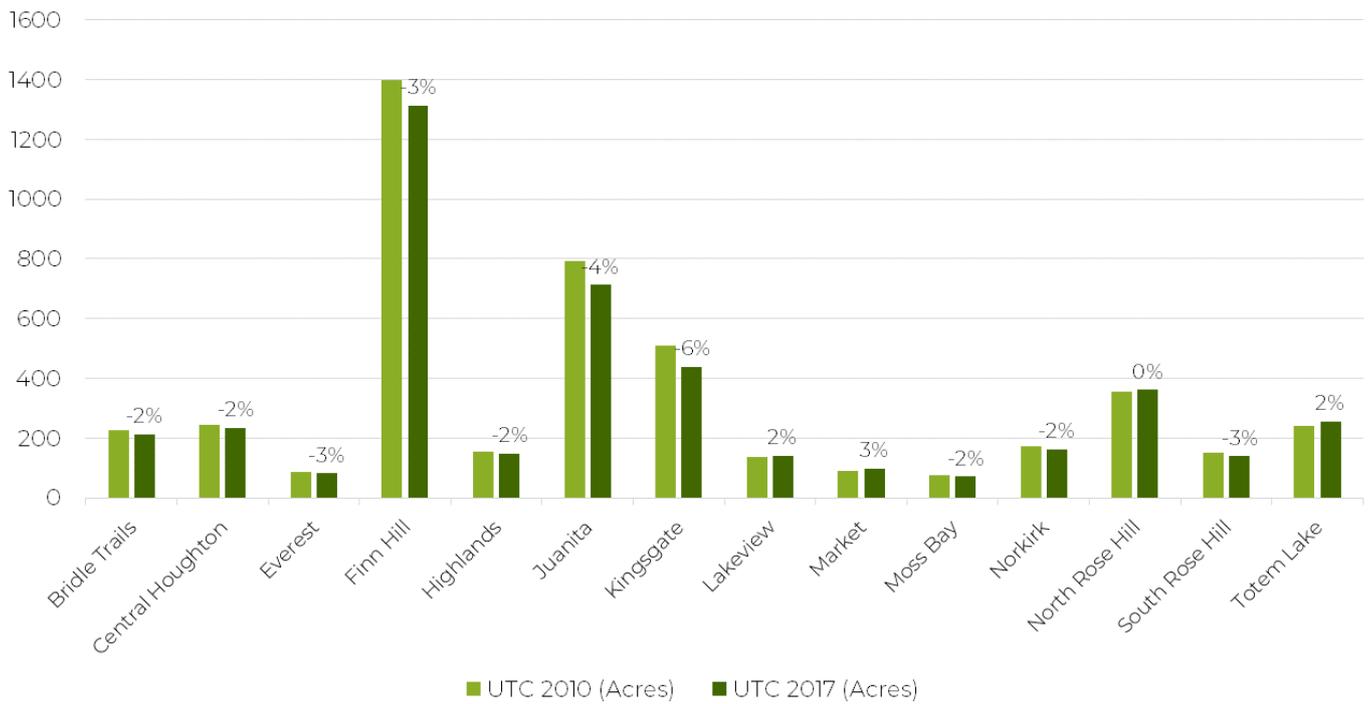


Figure 25. | Urban tree canopy change in Kirkland's neighborhoods.

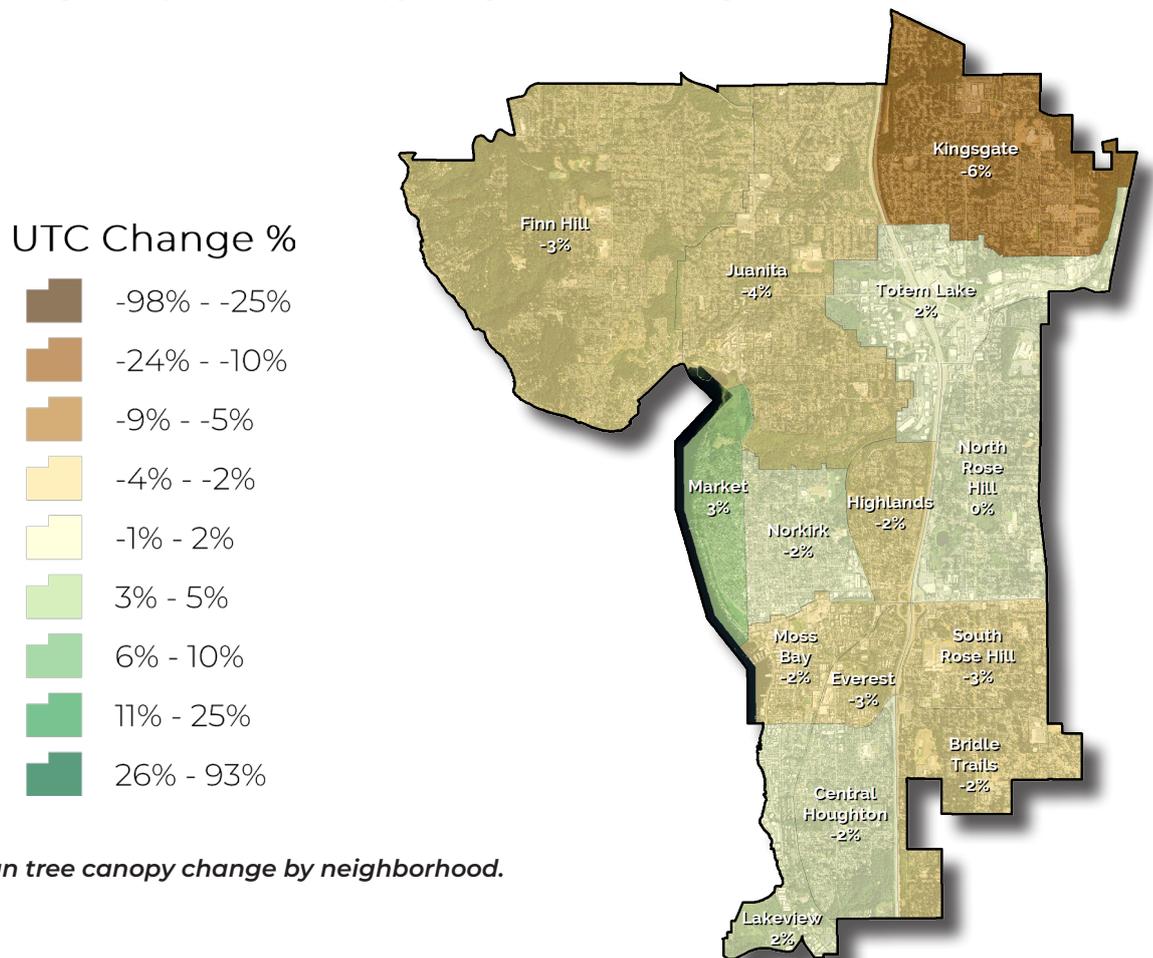


Figure 26. | Urban tree canopy change by neighborhood.

URBAN TREE CANOPY CHANGE BY DRAINAGE BASINS

Between 2010 to 2017, all of Kirkland's 15 drainage basins had a decrease in canopy except for Kirkland Slope which had no change. Holmes Point had the greatest decrease in canopy by percentage, dropping from 67 to 60 percent but maintained the highest UTC of all the drainage basins both years despite that loss. Juanita Creek had the greatest loss in UTC acres, losing 121 acres or 3 percent of its canopy.

Table 19. | Urban tree canopy change results for Kirkland's drainage basins by acres and percent. UTC results include acres and percent of area covered by UTC in 2010 and 2017, and change in acres and percent over the seven-year period.

Drainage Basins	Land Area		UTC 2010		UTC 2017		UTC Change	
	Acres	Dist.	Acres	%	Acres	%	Acres	%
Carillon Creek	106	1%	37	35%	36	34%	-1	-1%
Champagne Creek	621	5%	292	47%	281	45%	-11	-2%
Denny Creek	803	7%	449	56%	429	53%	-20	-3%
Forbes Creek	1,824	16%	717	39%	715	39%	-2	-0%
Holmes Point	457	4%	305	67%	276	60%	-30	-6%
Houghton Slope A	376	3%	102	27%	99	26%	-3	-1%
Houghton Slope B	134	1%	48	36%	44	33%	-4	-3%
Juanita Creek	3,615	32%	1,399	39%	1,279	35%	-121	-3%
Kingsgate Slope	562	5%	239	42%	212	38%	-27	-5%
Kirkland Slope	210	2%	66	31%	66	31%	0	0%
Lower Sammamish River Valley	24	0%	11	46%	10	43%	-1	-3%
Moss Bay	1,486	13%	474	32%	444	30%	-29	-2%
South Juanita Slope	287	3%	105	36%	94	33%	-10	-4%
To Redmond	303	3%	92	30%	84	28%	-7	-2%
Yarrow Creek	577	5%	293	51%	287	50%	-6	-1%
Totals	11,385	100%	4,629	41%	4,356	38%	-273	-2%

URBAN TREE CANOPY CHANGE BY CHANGE BY CENSUS BLOCK GROUPS

18 percent of Kirkland's 80 CBGs increased their tree canopy between 2010 and 2017 and the remaining 82 percent had decreases.

56 percent of all CBGs had canopy decreases of 5 percent or less, 17 percent had decreases between 5-10 percent, and 9 percent had decreases greater than 10 percent. UTC change ranged from +10 percent in the CBG with the greatest increase to -60 percent in the CBG with the greatest loss.

For the full change analysis results by CBG, refer to the UTC Results spreadsheet.

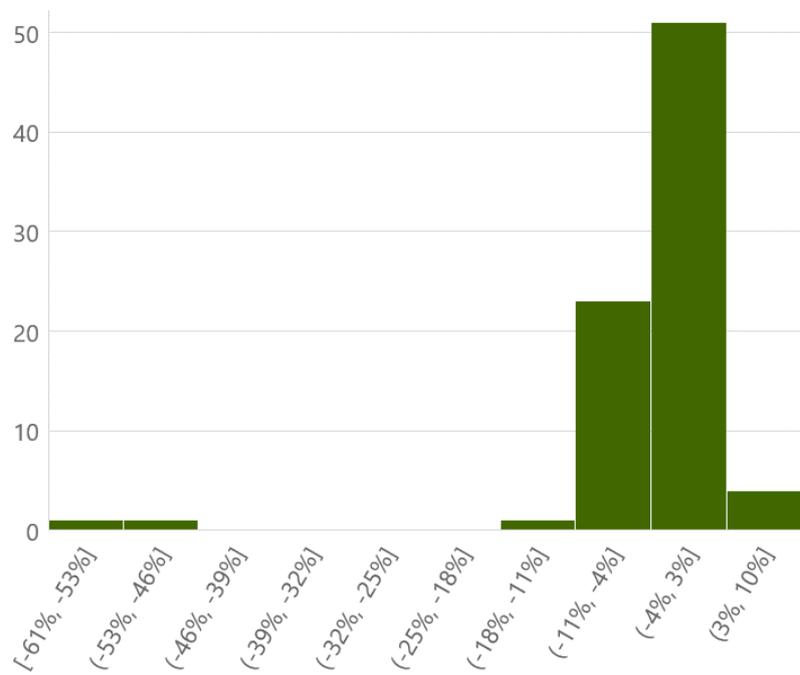


Figure 26. | Number of census block groups within UTC change ranges.

UTC Change %

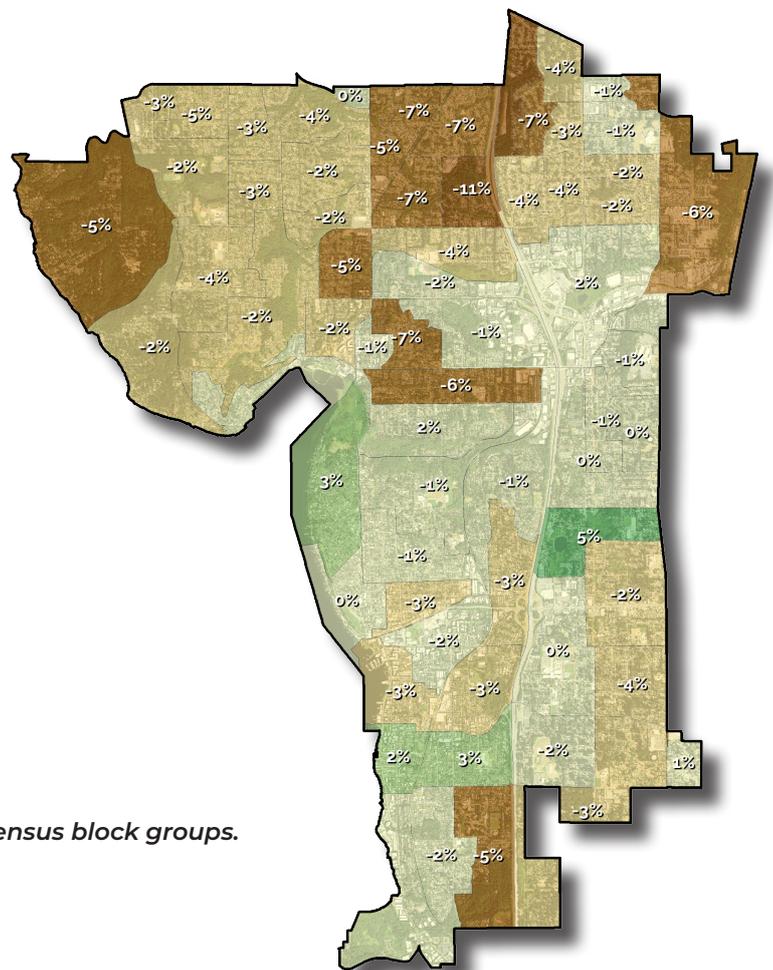
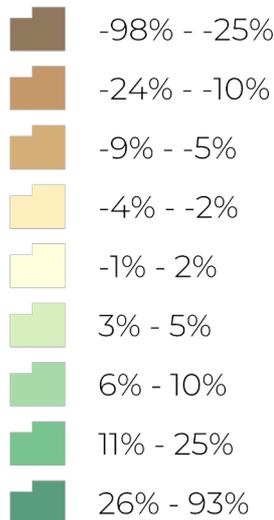


Figure 27. | Urban tree canopy change by U.S. census block groups.

URBAN TREE CANOPY CHANGE BY HOLMES POINT OVERLAY

Kirkland’s Holmes Point Overlay region had a decrease in canopy, but its UTC remained among the highest in the City. This region lost 37 acres of canopy between 2010-2017 which decreased its UTC by 6 percent from 64 to 58 percent.

Table 20. | Urban tree canopy change results for the Holmes Point overlay by acres and percent. UTC results include acres and percent of area covered by UTC in 2010 and 2017, and change in acres and percent over the seven-year period.

City of Kirkland	Land Area		UTC 2010		UTC 2017		UTC Change	
	Acres	Dist.	Acres	%	Acres	%	Acres	%
Holmes Point Overlay	651	6%	416	64%	380	58%	-37	-6%

URBAN TREE CANOPY CHANGE BY RIGHT-OF-WAY

Kirkland’s ROW experienced very little change in canopy over the seven-year assessment period. These areas lost approximately 5 acres of canopy and had a UTC of 27 percent in both 2010 and 2017.

Table 21. | Urban tree canopy change results for Kirkland’s right-of-way by acres and percent. UTC results include acres and percent of area covered by UTC in 2010 and 2017, and change in acres and percent over the seven-year period.

City of Kirkland	Land Area		UTC 2010		UTC 2017		UTC Change	
	Acres	Dist.	Acres	%	Acres	%	Acres	%
Right of Way	2,166	19%	416	64%	380	58%	-37	-6%

URBAN TREE CANOPY CHANGE BY CRITICAL AREA BUFFERS

The 100-foot buffered region around Kirkland’s lakes, streams, wetlands, and landslide areas was one of the few areas of the City that experienced an increase in canopy between 2010 and 2017. This area had an increase of 13 acres, maintaining a UTC of 60 percent throughout both years.

Table 22. | Urban tree canopy change results for Kirkland’s critical area buffers by acres and percent. UTC results include acres and percent of area covered by UTC in 2010 and 2017, and change in acres and percent over the seven-year period.

City of Kirkland	Land Area		UTC 2010		UTC 2017		UTC Change	
	Acres	Dist.	Acres	%	Acres	%	Acres	%
Critical Area Buffers (100')	2,873	25%	1,716	60%	1,729	60%	13	0%

URBAN TREE CANOPY CHANGE BY PARKS AND OPEN SPACES

UTC change in Kirkland's park and open space classes varied. General parks had an increase of 1 percent from 69 to 70 percent UTC, while UTC in open spaces decreased by 2 percent from 87 to 85 percent. Overall, UTC in all of Kirkland's park and open space areas increased by approximately 12 acres or 1 percent.

Table 23. | Urban tree canopy change results for Kirkland's parks and open space classes by acres and percent. UTC results include acres and percent of area covered by UTC in 2010 and 2017, and change in acres and percent over the seven-year period.

Parks and Open Spaces	Land Area		UTC 2010		UTC 2017		UTC Change	
	Acres	Dist.	Acres	%	Acres	%	Acres	%
General Parks	943	93%	647	69%	661	70%	14	1%
Open Spaces	75	7%	65	87%	63	85%	-2	-2%
Totals	1,017	100%	712	70%	725	71%	12	1%

URBAN TREE CANOPY CHANGE BY SHORELINE JURISDICTIONS

In contrast to most of the City's area which had a slight decrease in UTC from 2010-2017, Kirkland's shoreline jurisdictions had an increase in canopy. In total, these areas gained 22 acres of canopy or 7 percent, increasing overall UTC from 39 to 46 percent.

Table 24. | Urban tree canopy change results for Kirkland's shoreline jurisdictions by acres and percent. UTC results include acres and percent of area covered by UTC in 2010 and 2017, and change in acres and percent over the seven-year period.

City of Kirkland	Land Area		UTC 2010		UTC 2017		UTC Change	
	Acres	Dist.	Acres	%	Acres	%	Acres	%
Shoreline Jurisdictions	332	3%	131	39%	153	46%	22	7%

RECOMMENDATIONS

It is clear that the City of Kirkland values its urban forest resource and wants to preserve, protect, and maintain it. One way to do this is to have a canopy assessment performed on a regular interval. The City of Kirkland has started this process by assessing their canopy in 2010 and again 2017. As the City changes, they will be able to use these recommendations to ensure that their urban forest policies and management practices continue to prioritize its maintenance, health, and growth.



**Tree canopy increased
in Kirkland's Industrial,
Parks, & Institutional
land use classes from
2010-2017.**

The City of Kirkland's 2013 Comprehensive Plan set a target of 40%. With its current canopy cover of 38%, Kirkland has fallen below this goal after reaching it in 2010. It is still within 75-100% of its citywide canopy goal which is an "optimal" indicator per the performance indicator model in the 2013 Urban Forestry Strategic Management Plan (UFSMP). The City's vegetated PPA of 21%, over 2,000 acres, provides many opportunities for future canopy expansion. Therefore, the City should put these results to work to preserve and promote its tree canopy in working towards that goal.

The results of this assessment can and should be used to encourage investment in forest monitoring, maintenance, and management; to inform codes and policies for tree retention and tree planting; to prepare supportive information for local budget requests/grant applications; and to develop targeted presentations for city leaders, planners, engineers, resource managers, and the public on the functional benefits of trees in addressing environmental issues. All data created by this study were collected and delivered in a manner that the City's GIS staff may use to conduct further analysis. The results by geographic area (such as census block group) may be particularly helpful for soliciting grant funding since they demonstrate which areas have the greatest need. The land cover data should be disseminated to diverse partners for urban forestry and other applications while the data is current and most useful for decision-making and implementation planning. The information from this study can help establish canopy cover goals for the short- and long-term. A hyperlink to this UTC report should be provided on the City's Urban Forest, Trees and Landscaping, GIS Maps, and Kirkland Green Links and Library webpages to help engage the public. The city should also continue to incorporate tree planting, tree maintenance, and invasive removals which can be supported by these data.

Additionally, the City and its various stakeholders can utilize the results of the UTC, PPA, and change analyses to identify the best locations to focus future tree planting and canopy expansion efforts. While the City has a decent canopy coverage throughout its entire area, breaking up the results by several different geographic boundaries demonstrated that this canopy is not evenly distributed. These results can be used as a guide to determine which

RIGHTS-OF-WAY IN KIRKLAND ARE PRIME AREAS FOR INCREASING URBAN TREE CANOPY

areas would receive the greatest benefits from the investment of valuable time and resources into Kirkland's urban forest.

In terms of expanding Kirkland's canopy, the City has several potential routes to take. For example, Single-family residential areas are a good place to target future canopy expansion as they hold a large amount of PPA (72 percent of the City's total plantable

space). Rights-of-way are also good areas to target because of the additional benefits of trees in these areas for stormwater runoff mitigation, air quality improvement, and shading. Meanwhile, the Moss Bay and South Rose Hill neighborhoods have the lowest existing UTC (22 and 27 percent respectively). Therefore, land use and/or ROW could be overlaid with neighborhoods to identify single-family residential areas and rights-of-way within those neighborhoods that are lacking canopy to identify planting opportunities. An approach to review these opportunity areas should be developed including on-the-ground assessments to gauge planting site suitability.

Kirkland must integrate these data into its larger citywide planning efforts and establish set policies and guidelines for the preservation of tree canopy amidst future development. Kirkland's urban forest provides the City with a wealth of environmental, social, and even economic benefits which relate back to greater community interest in citywide initiatives and priorities. The City should use these UTC, PPA, and change metrics in combination with the results of the recent i-Tree Hydro analysis that was also performed in Kirkland to interpret where these gains would be felt most significantly and where there is still work to be done in accordance with the city's broader goals and vision for its future.



The 2013 Urban Forestry Strategic Management Plan, 2014-2019 Urban Forest Work Plan (UFWP), and 2015 Forest and Natural Areas Restoration Plan (FNARP) should be updated to include the 2018 UTC and i-Tree Hydro results. The guidelines established in the existing UFSMP, UFWP, FNARP, and other 2018 pre-approved plans should be utilized and enforced to protect tree canopy. The updated results can also be used to meet the objectives of the existing UFSMP: for example, to identify the best locations for public outreach by comparing areas with low existing canopy and high PPA, or to quantify the values, functions, and benefits of trees. To slow the loss of canopy, Kirkland Zoning Code Chapter 95 can be updated, incentives could be developed, and changes to procedures could be made in response to this study’s findings.

Kirkland should also leverage its stormwater plans and regulations to promote and protect tree canopy whenever possible. Some of these include Municipal Codes 15.52.060, “Surface Water Management,” which can be used to incorporate trees as best management practices for water flow control and water quality, and 15.56.060, “Qualified Rainwater Harvesting Discount,” which can help to increase canopy on private property as an incentive to decrease stormwater utility fees. The UTC and i-Tree Hydro results should be incorporated into the City’s Comprehensive Water Plan as they relate to canopy cover, impervious surfaces, etc., and Surface Water Master Plan (SWMP) as they relate to stormwater regulation. The SWMP also states that tree preservation and planting may be used as a low-impact development stormwater management technique (section 2.F.1), and that stormwater utility funds may be used to care for and maintain trees in the public right-of-way, fund the City’s Urban Forester position, and implement of the UFMP (sections 5.B.6 and 5.C.8), so the City should continue these practices.

Comparing Tree Canopy in Nearby Communities

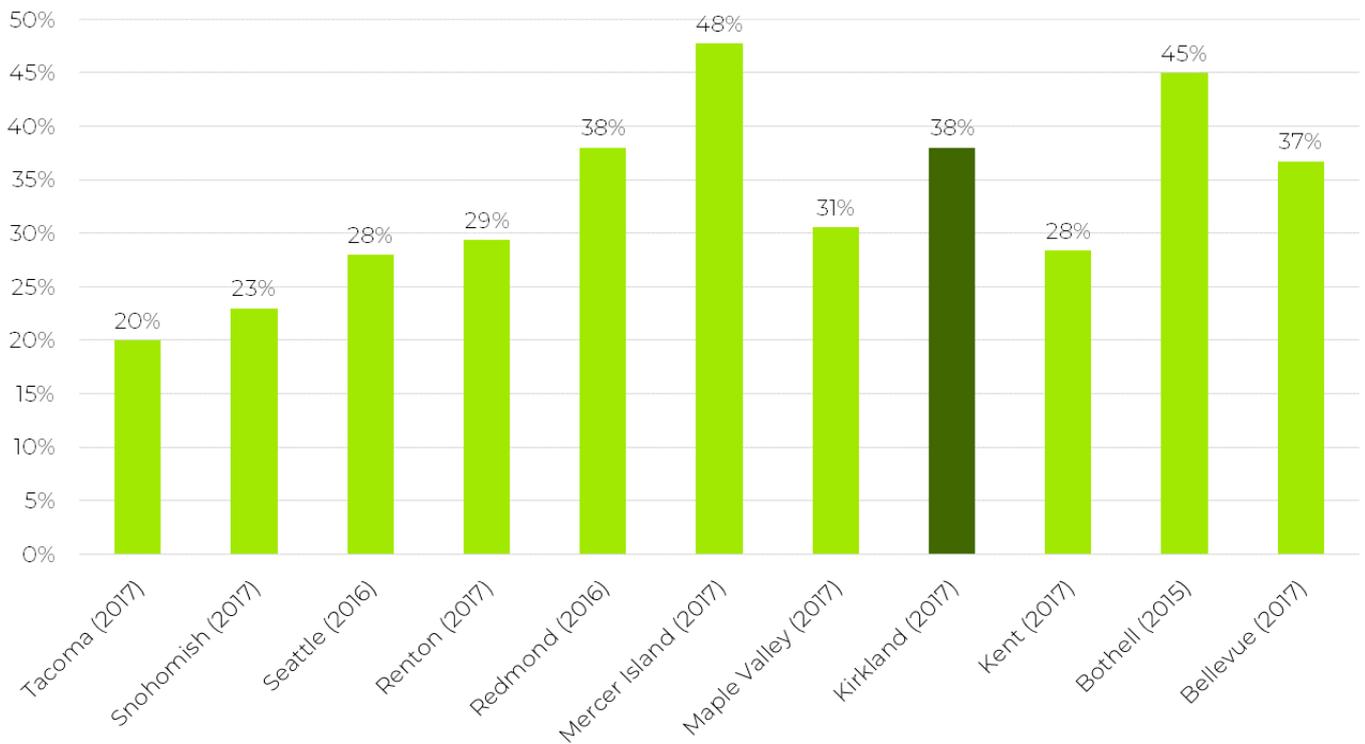


Figure 25. | A comparison of tree canopy in nearby communities.

APPENDIX

ACCURACY ASSESSMENT

Classification accuracy serves two main purposes. Firstly, accuracy assessments provide information to technicians producing the classification about where processes need to be improved and where they are effective. Secondly, measures of accuracy provide information about how to use the classification and how well land cover classes are expected to estimate actual land cover on the ground. Even with high resolution imagery, very small differences in classification methodology and image quality can have a large impact on overall map area estimations.

The classification accuracy error matrix illustrated in Table A1 contain confidence intervals that report the high and low values that could be expected for any comparison between the classification data and what actual, on the ground land cover was in 2017. This accuracy assessment was completed using high resolution aerial imagery, with computer and manual verification. No field verification was completed.

THE INTERNAL ACCURACY ASSESSMENT WAS COMPLETED IN THESE STEPS

1. Two hundred fifty (250) sample points, or approximately 15 points per square mile area in Kirkland (18.2 sq. miles), were randomly distributed across the study area and assigned a random numeric value.
2. Each sample point was then referenced using the NAIP aerial photo and assigned one of five generalized land cover classes ("Ref_ID") mentioned above by a technician.
3. In the event that the reference value could not be discerned from the imagery, the point was dropped from the accuracy analysis. In this case, no points were dropped.
4. An automated script was then used to assign values from the classification raster to each point ("Eval_ID"). The classification supervisor provides unbiased feedback to quality control technicians regarding the types of corrections required. Misclassified points (where reference ID does not equal evaluation ID) and corresponding land cover are inspected for necessary corrections to the land cover.¹

Accuracy is re-evaluated (repeat steps 3 & 4) until an acceptable classification accuracy is achieved.

SAMPLE ERROR MATRIX INTERPRETATION

Statistical relationships between the reference pixels (representing the true conditions on the ground) and the intersecting classified pixels are used to understand how closely the entire classified map represents Kirkland's landscape. The error matrices shown in Table A1 represent the intersection of reference pixels manually identified by a human observer (columns) and classification category of pixels in the classified image (rows). The gray boxes along the diagonals of the matrix represent agreement between the two-pixel maps. Off-diagonal values represent the

1 Note that by correcting locations associated with accuracy points, bias is introduced to the error matrix results. This means that matrix results based on a new set of randomly collected accuracy points may result in significantly different accuracy values.

number of pixels manually referenced to the column class that were classified as another category in the classification image. Overall accuracy is computed by dividing the total number of correct pixels by the total number of pixels reported in the matrix (82 + 35 + 101 + 3 + 9 = 230 / 250 = 92 percent), and the matrix can be used to calculate per class accuracy percent's. For example, 84 points were manually identified in the reference map as Tree Canopy, and 82 of those pixels were classified as Tree Canopy in the classification map. This relationship is called the "Producer's Accuracy" and is calculated by dividing the agreement pixel total (diagonal) by the reference pixel total (column total). Therefore, the Producer's Accuracy for Tree Canopy is calculated as: (82/84 = .98), meaning that we can expect that ~98 percent of all 2017 tree canopy in the Kirkland, WA study area was classified as Tree Canopy in the 2017 classification map.

Conversely, the "User's Accuracy" is calculated by dividing the total number of agreement pixels by the total number of classified pixels in the row category. For example, 82 classification pixels intersecting reference pixels were classified as Tree Canopy, but 6 pixels were identified as Vegetation in the reference map. Therefore, the User's Accuracy for Tree Canopy is calculated as: (82/88 = 0.93), meaning that ~93 percent of the pixels classified as Tree Canopy in the classification were actual tree canopy. It is important to recognize the Producer's and User's accuracy percent values are based on a sample of the true ground cover, represented by the reference pixels at each sample point. Interpretation of the sample error matrix results indicates this land cover, and more importantly, tree canopy, were accurately mapped in Kirkland in 2017. The largest sources of classification confusion exist between tree canopy and vegetation.

Table A1. | Error matrix for land cover classifications in Kirkland, WA (2017).

		Reference Data					
		Tree Canopy	Vegetation	Impervious	Soil / Dry Veg.	Water	Total Reference Pixels
Classification Data	Tree Canopy	82	6	0	0	0	88
	Vegetation	1	35	6	1	0	43
	Impervious	1	1	101	0	0	103
	Soil / Dry Veg.	0	0	4	3	0	7
	Water	0	0	0	0	9	9
	Total	84	42	111	4	9	250

Overall Accuracy = 92%

Producer's Accuracy		User's Accuracy	
Tree Canopy	98%	Tree Canopy	93%
Veg. / Open Space	83%	Veg. / Open Space	81%
Impervious	91%	Impervious	98%
Bare Ground / Soil	75%	Bare Ground / Soil	43%
Water	100%	Water	100%

ACCURACY ASSESSMENT RESULTS

Interpretation of the sample error matrix offers some important insights when evaluating Kirkland's urban tree canopy coverage and how land cover reported by the derived rasters and the human eye. The high accuracy of the 2017 data indicates that Kirkland's current tree canopy can be safely assumed to match the figures stated in this report (approximately 38 percent).

GLOSSARY/KEY TERMS

Land Acres: Total land area, in acres, of the assessment boundary (excludes water).

Non-Canopy Vegetation: Areas of grass and open space where tree canopy does not exist.

Possible Planting Area - Vegetation: Areas of grass and open space where tree canopy does not exist, and it is biophysically possible to plant trees.

Possible Planting Area - Impervious: Paved areas void of tree canopy, excluding buildings and roads, where it is biophysically possible to establish tree canopy. Examples include parking lots and sidewalks.

Possible Planting Area - Total: The combination of PPA Vegetation area and PPA Impervious area.

Shrub: Low-lying vegetation that was classified based on interpretation of shadows and texture in vegetation. Shrubs produce little to no shadow and appeared smooth in texture compared to tree canopy.

Soil/Dry Vegetation: Areas of bare soil and/or dried, dead vegetation.

Total Acres: Total area, in acres, of the assessment boundary.

Unsuitable Impervious: Areas of impervious surfaces that are not suitable for tree planting. These include buildings and roads.

Unsuitable Planting Area: Areas where it is not feasible to plant trees. Airports, ball fields, etc. were manually defined as unsuitable planting areas.

Unsuitable Soil: Areas of soil/dry vegetation considered unsuitable for tree planting. Irrigation and other modifiers may be required to keep a tree alive in these areas.

Unsuitable Vegetation: Areas of non-canopy vegetation that are not suitable for tree planting due to their land use.

Urban Tree Canopy (UTC): The "layer of leaves, branches and stems that cover the ground" (Raciti et al., 2006) when viewed from above; the metric used to quantify the extent, function, and value of Kirkland's urban forest. Tree canopy was generally taller than 10-15 feet tall.

Water: Areas of open, surface water not including swimming pools.

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OCTOBER | 2018

URBAN TREE CANOPY
ASSESSMENT

KIRKLAND, WASHINGTON

