

Urban Forest Management Plan

TECHNICAL APPENDICES

Final Draft

December 4, 2015



342 West 8th Avenue
Vancouver, BC
V5Y 3X2





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1 Streets Planting Program Outline

The planting program outlined is intended to guide the planting of 550 trees per year on public lands in Campbell River. The program relates predominantly to tree planting in roads given that this is where the City has the greatest opportunity to plant new trees that will provide public amenity and ecosystem services to the broader community. Opportunities for parks tree planting have been identified as part of Phase 1 and will be actioned by the City, and are outlined in Section 2 “Municipal Park Plantable Space” (prepared by the City).

1.1 Principles

- 1) When selecting the tree species, consider:
 - a. Neighbourhood character;
 - b. Streetscape objective (i.e., maximize future canopy while considering road users, pedestrians, long-range views and urban design objectives);
 - c. Species diversity:
 - i. Establish a hierarchy of streets most important to formally plant with continuous avenues and create greater diversity in areas that can be planted more informally;
 - ii. Use mixed avenues of two or more species of similar form and character where appropriate;
 - iii. Use asymmetrical treatments along some streets (e.g., streets where there are power lines on one side only so large trees may fit on one side and small ones, or none, on the other);
 - d. A single large canopy tree provides greater benefits in terms of cooling, rainwater interception and other ecosystem services than multiple small trees totalling the same canopy extent;
 - e. Planting site constraints, soil and moisture conditions;
 - f. Wind exposure;
 - g. Biodiversity (if within an area prioritized for native vegetation or other driver of biodiversity objectives).
- 2) Prioritise tree planting where benefits are most needed (e.g., over hard surfaces, places where people walk or sit, adjacent to buildings).
- 3) Create or exploit opportunities to create ‘green streets’ that target canopy cover > 40% (e.g., wide centre medians, nature strips each side, adjacent to parks and open spaces).
- 4) Where planting opportunities are limited but road widths allow, consider creating plantable space in roadways (e.g., in road pits with parking in between, new nature strips etc.).
- 5) Create or exploit opportunities for large canopy ‘feature’ trees in unique urban locations (e.g., curb bulges, roundabouts, small green spaces).

- 6) In Fire Hazard DP areas, choose species that are 'fire resistant' (i.e., deciduous trees).
- 7) Do not plant invasive trees.

1.2 Planting Plan

The planting plan identifies potential plantable spots on roads within Campbell River's Urban Containment Boundary. Road segments were assessed in GIS based on the criteria and assumptions defined below and using a 2012 orthophoto. Prior to planting, ground truthing will be required to identify below ground constraints, assess site conditions, ensure that planting has not already occurred, and to lay out planting locations consistent with the Subdivision and Development Servicing Bylaw No. 3419, 2010.

The actual number of planting opportunities is expected to fluctuate depending on these site constraints. In some locations, residents may reject tree planting in front of homes if the boundary between the public right of way and private front yards is unclear. The total estimated number plantable spots (and proposed timeframe based on ease of planting) is:

- First 3 years: 666 total tree opportunities.
- Year 2 onwards: 10,235 total tree opportunities.
- Year 10 onwards: 1,686 total tree opportunities.
- Subject to available funding or redevelopment: 787 total tree opportunities.

Where trees are dug up for infrastructure construction or maintenance purposes, that street should be a priority for planting street trees according to the planting plan and infrastructure in question.

Note: if planting under powerlines is considered, then the total number of potential locations increases by more than 8,000.

2.1.1.1 Criteria and Assumptions

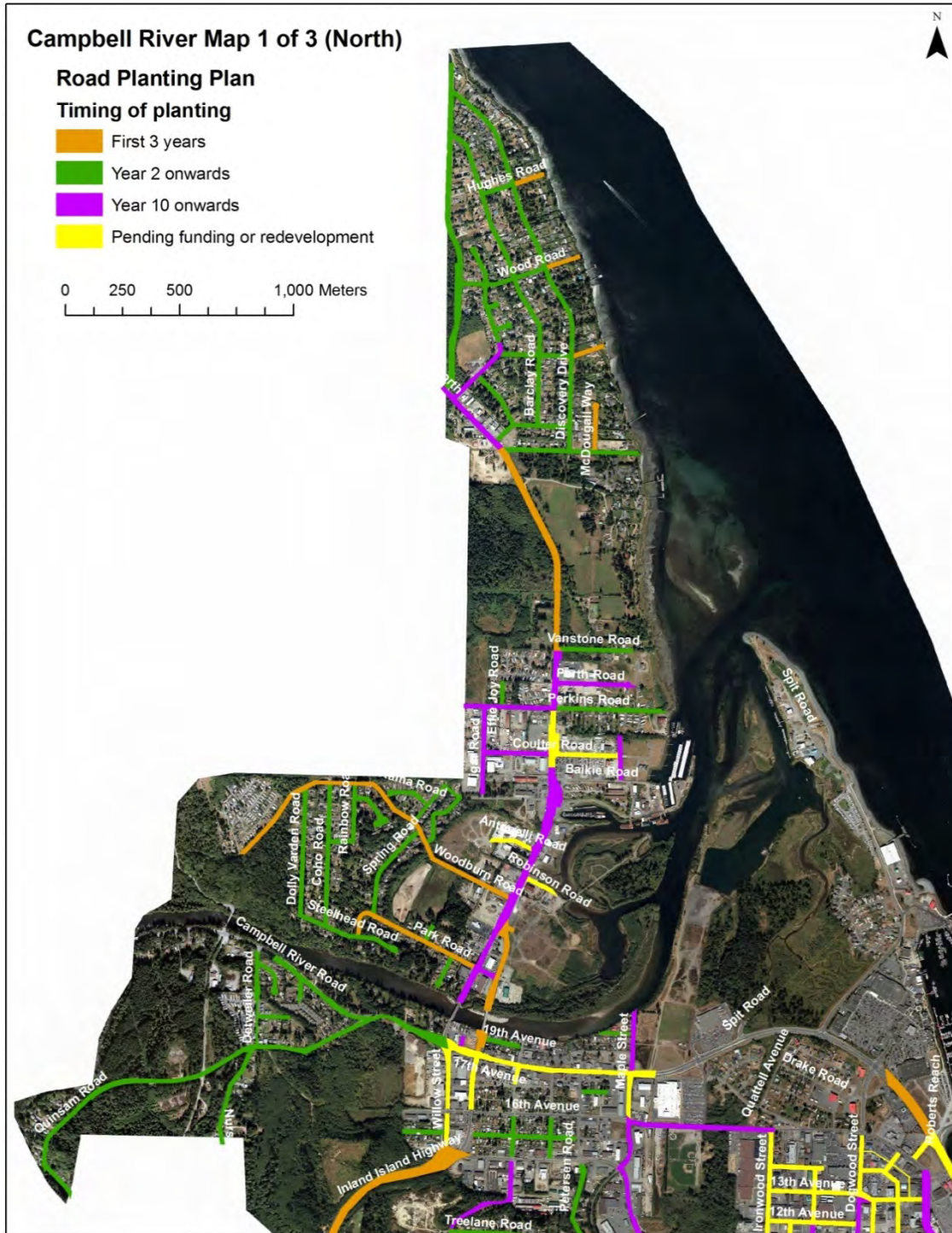
The desktop exercise assessed planting opportunities by road segment and the following assumptions apply:

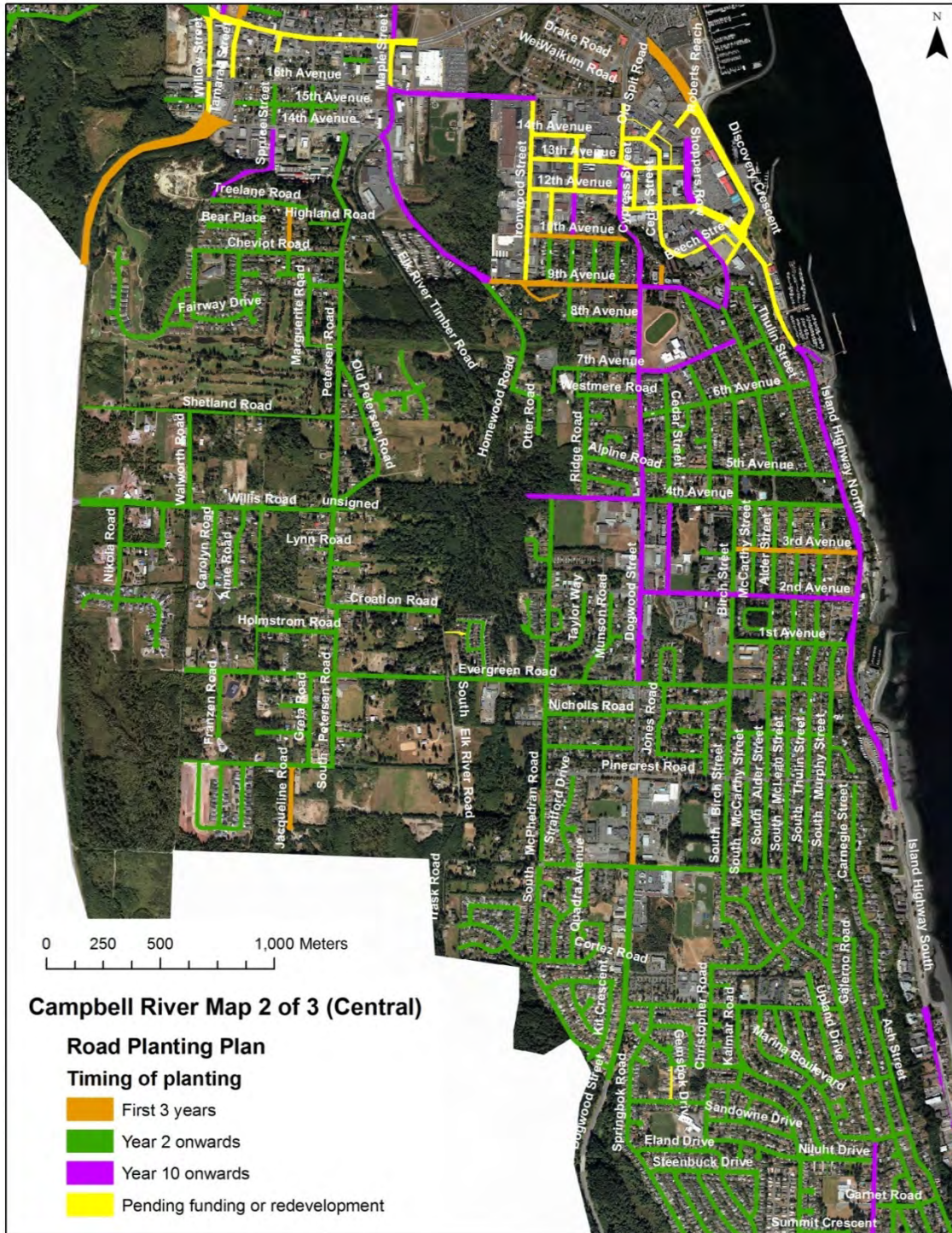
- 1) Inter-tree spacing for medium trees is 10 m, and 15 m for large trees.
- 2) No trees planted within 3 m of intersections.
- 3) No trees planted under powerlines (potential to plant under lines should be assessed on site).

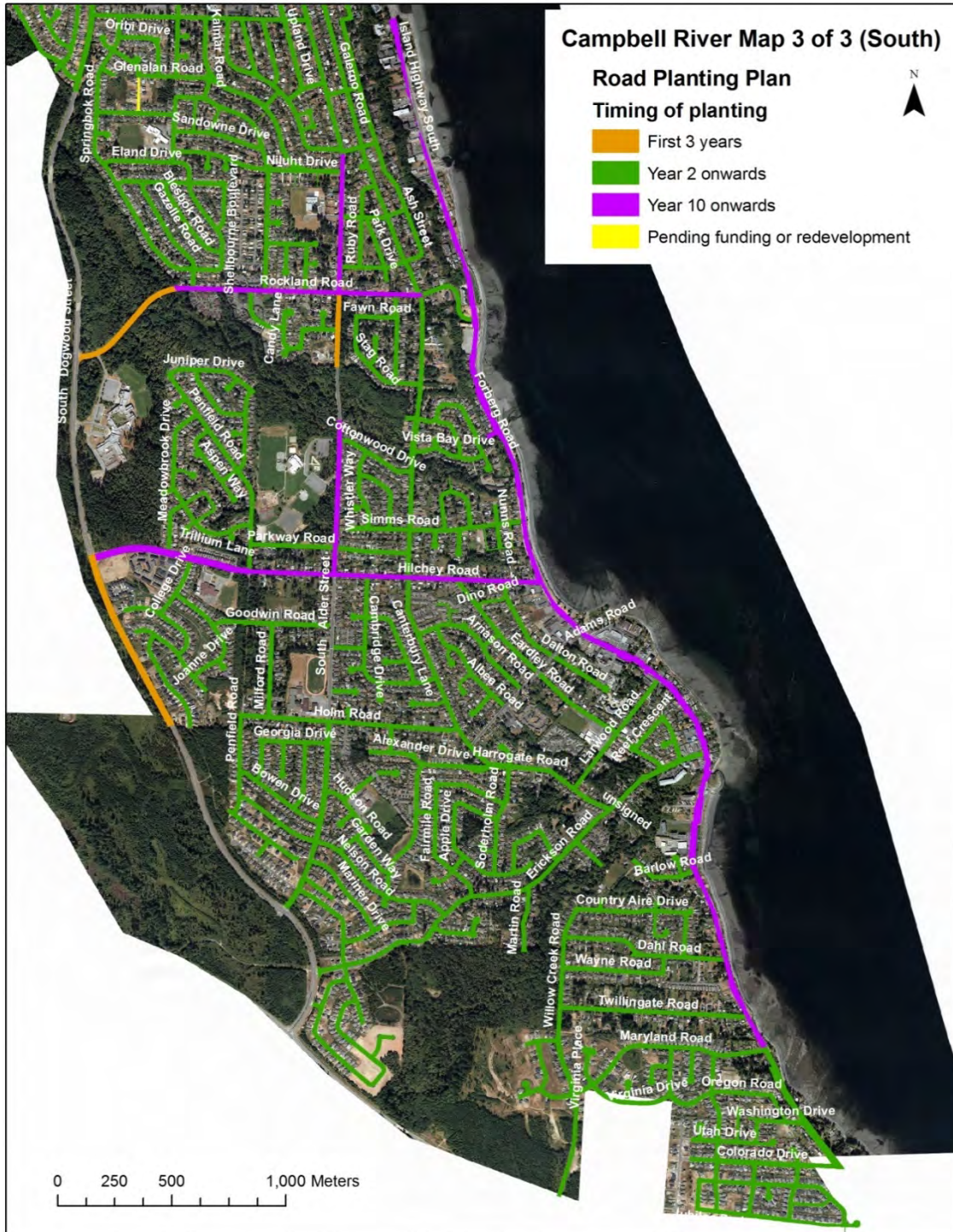
4) The planting ‘base’ was assessed to classify opportunities, difficulty and timing. The matrix below shows how these factors inform planting timing:

Planting Surface	Planting Opportunity	Planting Difficulty		Planting Timing	
Softscape: plantable surface; least constrained	Plant	Very easy	Moderate: Combination of all 3 surfaces	First 3 years: planting can begin as soon as practical	Year 10 onwards: moderate planting difficulty (preparation will be required to address variable planting opportunities; in some cases, redevelopment may be the trigger to enable planting a consistent streetscape)
Frontyard: public right-of-ways merge with front yards; property boundaries are difficult to discern	Consult and plant: resident must accept tree planting in front of house OR consider planting in the road to achieve consistent tree-scape if width allows).	Easy		Year 2 onwards: consultation required in year 1 then planting can begin	
Hardscape: not plantable; space exists but planting site would need to be created (e.g., construct tree pit, boulevard, nature strip etc.)	Redesign to create new plantable space	Hard		Subject to available funding or redevelopment: creation of new plantable space will be made possible by a new funding source (e.g., grant or ‘green fund’) or redevelopment enabling a consistent streetscape to be planted.	

The maps below delineate the proposed timing of planting based on point 8. The data described above will be provided to the City in ESRI ArcGIS shapefile format in NAD83 UTM 10.







2 Municipal Park Plantable Space

CITY OF CAMPBELL RIVER: MUNICIPAL PARK PLANTABLE SPACE

Prepared by Claire Cameron, Co-op Student, Parks Department

December 17, 2014

This list was adapted from a plantable space report prepared by Irv Penner for the Urban Forest Management Plan Phase 1: Urban Forest Inventory (2014). The percent plantable space in each park was either confirmed or updated in November 2014 by Grant Parker, and the recommended tree type column was completed by Tom Clarke. The recommended tree types are largely based on species that are already present in each area, as they are already known to do well in the conditions found in the park.

A total of 9.31 ha of plantable space is available in the City's Parks. Using an estimate of 126 m² (0.0126 ha) canopy cover per medium sized tree this area could be planted with approximately 722 trees, 3.2% of the 22,500 trees that will need to be planted to reach the City's canopy cover target of 40%¹.

Park	Area (ha)	Plantable %	Plantable area (ha)
Willow Point Park	28.1	8	2.25
Baikie Island	16.3	8	1.30
Dick Murphy Park	4.4	18	0.79
Robron Park	4.1	18	0.74
Nunns Creek Park	5.7	8	0.46
Raven Trail/Baikie Park Access	5.4	8	0.43
Charstate Park	1.03	35	0.36
Ruby Park	0.64	48	0.31
Lileana Park	0.42	48	0.20
Cambridge Park	0.7	28	0.20
Robert Ostler Park	2.1	8	0.17
Bowen Park	0.39	43	0.17
Raven Trail Park	5.4	3	0.16
Maryland (Palmer)-Part A	0.8	20	0.16
Foreshore	0.55	28	0.15
Sequoia Park	0.97	15	0.15
Centennial Park	1.63	8	0.13
Gazelle Park	0.23	48	0.11
Maryland (Palmer)-Part B	0.8	13	0.10
Jubilee Welcome Sign	0.29	33	0.10

¹ Diamond Head Consulting Ltd. (2014). Urban Forest Management Plan 2014-2035. *The Urban Forest Management Plan for Campbell River.*

Park	Area (ha)	Plantable %	Plantable area (ha)
Ellis Park	0.43	22	0.09
Edgewood Park	1.16	8	0.09
Maritime Centre/Fishing Pier	0.98	8	0.08
Pinecrest Park	2.3	3	0.07
College Drive Park-Part A	1.19	5	0.06
Big Rock Park South & North	0.17	33	0.06
Jaycee Park	0.17	27	0.05
Apple Park	0.9	5	0.05
McCallum Park	0.22	20	0.04
Washington Park	0.12	33	0.04
Frank James Park	0.19	18	0.03
Campbellton Park	0.14	23	0.03
Barclay Park	0.19	13	0.02
Campbell River Community Centre	0.77	3	0.02
Coronation Park	0.68	3	0.02
Hilchey Park	0.08	23	0.02
Hidden Harbour Park South & North	0.2	8	0.02
Cedric Jones Park	0.15	10	0.02
Seventeenth Avenue Park	0.03	48	0.01
Adams	0.09	13	0.01
Harrogate Park	0.07	13	0.01
Rotary Beach Park North	0.44	2	0.01
Lift Station No. 7	0.13	3	0.00
Larwood Park	0.07	4	0.00
Westgate Park	0.06	3	0.00
Simms Park	0.08	0	0.00
South Dogwood Boulevard 1,2, & 3	0.07	0	0.00
City hall	N/A	5	N/A

Park/Green spaces without plantable space

Park/Green space

Mclvor Lake

Haig-Brown Kingfisher Creek

Myrt Thompson Trail

The Museum at Campbell River

Undeveloped parks

Georgia Park

Franzen Park

Ken Forde Boat Ramp Park

Superior Park

Vallejo

Dolly Varden Park

Un-named Willow Pt. South Park

College Drive Park-Part B

Walkways

Lift Station No.7

Simms Creek Gateway

Willow Point South Greenway

Willow Creek Greenway

3 Planting Standards, Tree Protection and Soil Volume Guidance

These sections are provided as guidance only and it is recommended that the City use this as the starting point for developing its own Tree Protection and Street Tree Planting Guidelines.

The following guidance is adapted from:

- City of Surrey's Park Construction Standards
(http://www.surrey.ca/files/Surrey_Parks_Construction_Standards_-_Winter_2010_11.24.pdf)
- City of Vancouver's Street Tree Guidelines for the Public Realm
(<http://vancouver.ca/files/cov/StreetTreeGuidelines.pdf>)
- City of Toronto's Tree Planting Solutions in Hard Boulevard Surfaces Best Practices Manual
(https://www1.toronto.ca/city_of_toronto/parks_forestry_recreation/urban_forestry/files/pdf/TreePlantingSolutions_BestPracticesManual.pdf)

3.1 Public Realm Boulevard Tree Planting Standards

The following are recommended as guidance only and site specific exceptions may be made by the City. In general, aim to maximize tree canopy cover while balancing the available soil volume and constraints for sight lines, utilities or other relevant considerations.

3.1.1 Minimum Spacing and Soil Volume

Both soil volume and the permeability of the soil surface area around a planting site in hardscape (i.e., the "tree pit") influence urban tree growth. Where possible, soil volume should meet the specifications below and permeability should be maximized to support a tree reaching its size potential and optimal life span in an urban environment. While it is possible to plant a larger tree in less than the minimum soil volume, the trade-off is a shortened life span for the tree and an increased potential for infrastructure conflict as the resources within the provided planting site become inadequate to support tree growth.

Tree size category	Average Spacing	Per-tree Minimum Soil Volume*
Large (>10 m canopy spread)	9 - 11 m	45 m ³ /30 m ³ shared
Medium (~10 m canopy spread)	8 - 10 m	30 m ³ /20 m ³ shared
Small (~6 m canopy spread)	6 - 10 m	10 m ³ /5 m ³ shared
Very Small (~3 m spread)	3 - 6 m	5 m ³

*Soil volume should be a depth of 1 m. The soil volumes quoted should be considered as minimums for the size categories listed and are based on a minimum of 0.3m³ of soil per 1 m² of canopy area recommended by Lindsey, P. and Bassuk, N.L. 1992. [Redesigning the Urban Forest from the Ground Below: A New Approach to Specifying Adequate Soil Volumes for Street Trees](#). Arboricultural Journal. 16(1) 25-39.

For options regarding meeting soil volume requirements in hardscape, refer to the City of Toronto's Tree Planting Solutions in Hard Boulevard Surfaces Best Practices Manual (https://www1.toronto.ca/city_of_toronto/parks_forestry_recreation/urban_forestry/files/pdf/TreePlantingSolutions_BestPracticesManual.pdf)

To increase root zone volume, engineered/structural soils under hardscape may sometimes be used, though they provide less actual soil volume than solutions that support quality soil under hard boulevard surfaces. The City of Vancouver's Street Tree Guidelines for the Public Realm (<http://vancouver.ca/files/cov/StreetTreeGuidelines.pdf>) provides specifications for Engineered Soils.

3.1.2 Distance from Services*

Lamp standards	1.5 – 4.5 m
Electrical/Communication/Trolley Poles	1.5 m
Driveways/Crossings	1.8 m
Fire Hydrants	1.8 m
Catch Basins/Valve Boxes	1.5 m
Corner Clearance	3 m
Stop Signs	6 m
Parking Meters	Clear of tree pit/surround
Buildings – spreading trees	3 m
Buildings – columnar trees	2 m
Gas	No root ball above intersection of main and lateral gas lines and within 2m of this intersection. Root ball can be placed above main and lateral lines outside of the 2m radial clearance zone
Back of curb	Local roads 1 m minimum Collectors and arterials contact...
Underground service locations (i.e., Gas, Hydro, Water, Sewer) to be determined prior to planting; tree locations shall avoid underground services and utilities where possible to prevent future conflicts. Where unavoidable, decisions to plant above services should be dependent on the depth of service (i.e., acceptable if service is below root zone) and the understanding that tree removal may be required for future service maintenance.	
Tree planting should, where possible, be offset to avoid overhead electrical conductors and/or species selection must consider required clearance distances from electrical conductors. Tree placement or species selection that would result in ongoing, long-term clearance pruning requirements should be avoided.	

2.1.1.2 Do not plant trees:

- In sidewalk below overhead building encroachments or overpasses
- Under canopies, awnings or overhead signs
- In bus zones, except in bus bulges in line with other trees on block
- In loading or passenger zones
- In front of doorways, entrances, walkways

2.1.1.3

3.1.3 Tree stock

The City Arborist, or designate, must authorize all tree species selections prior to the planting of any street trees. Diversity adds resilience to the urban forest. The urban forest management plan suggests that the street tree population consist of no more than 20% of any one genus and no more than 10% of any one species (Action 25).

For tree stock, use the standards for trees described in Canadian Standards for Nursery stock 8th edition. The full description of which can be found at <http://www.canadanursery.com/Page.asp?PageID=122&ContentID=868>

Additional specifics, all trees must be:

1. nursery field grown (exception must be pre-approved)
2. be on a single leader, with the lowest branch being at least 2 metres high on the stem.
3. of 6 cm caliper or greater if deciduous
4. of 2.5 metres height or greater if coniferous
5. free of pest and disease
6. free of pernicious weeds in the root ball
7. free of injury, or other defects
8. free of girdling roots

Where planting projects require more than 10 trees, the City reserves the right to select and tag optimal specimens at the source or wholesale nursery.

3.1.4 Tree Installation

Trees should be dug and moved during the dormant season, in a well-watered condition, and in accordance with the Canadian standards for Nursery Stock, current edition.

Tree roots should not be exposed to intense winter cold after they are lifted. Use mulch as protection. Excavation of the subgrade below shall be only as necessary to permit the bottom of the rootball to sit on undisturbed material or compacted fill such that the top of the rootball remains at the proper finished grade.

The tree should be installed such that the top of the root ball is even with the surrounding soil – after settlement. If there is a chance of some settling after planting, install such that the top of the root ball is 2 to 4 cm above the surrounding grade. Trees with bark buried beneath the soil line will not be accepted.

Wherever possible, the hole should be dug with sloping sides. Preferred angle is 45 degrees.

The tree should be lowered gently into position, not dropped. Trees should be as vertical as possible. If planting in a surround, the stem should be close enough to centre that at least some part of the tree is in dead centre.

Backfill should be a 50 /50 mixture of native soil and amending soil mix. The two mixes should be applied by shovel in alternating fashion, tamped gently with light boot pressure. When the backfill has been placed up to about 2/3's of the rootball height, basket ties should be cut and the top 1/3 of the burlap and basket folded back downwards. No burlap or wire should be showing above the finished grade. Ties must be pushed back into the lower portion of the hole.

A 10 cm raised saucer, of inside diameter equal to the outside diameter of the root ball, should be constructed around the perimeter of the rootball to enhance water infiltration. A mulch of organic material (other than cedar) should be placed inside the berms of the saucer, to a depth of 7 – 9 cm.

Trees should be immediately and adequately watered after planting.

Trees should not be staked and tied unless planted in a high pedestrian traffic area where they are prone to being knocked. If staked, use one tie and ensure that it is firm but not tight in a manner that will prevent the tree from developing its own stabilizing roots and good taper.

Root Barriers must be installed at the time of planting where specified on approved drawings. Barriers must be made commercially, produced for the purpose of deflecting roots downward, and be of a specification approved by City Engineering Department.

3.1.5 Soil Mix

When it is not possible to preserve native soil for planting on site, imported soil mix should be commercially prepared soil, or be City approved material from the planting site. It should be virtually free of invasive plant seeds of viable plant parts, subsoil, non-composting materials, non-composted wood, insect or fungal pest organisms, or other extraneous materials.

For developing soil textural guidelines, refer to the City of Vancouver's Street Tree Guidelines: <http://vancouver.ca/files/cov/StreetTreeGuidelines.pdf>

3.2 Tree Protection

2.2.1 Private Trees

A suggested tree bylaw (Action 13) should require protection of trees on private land. Protected trees and root systems must be protected from damage, compaction and contamination to the satisfaction of the City Arborist or designate prior to commencement of site activities.

Tree Protection Barriers should be installed to protect Critical Root Zones and permeable surface surrounding protected trees.

Site access should be planned with consideration for avoiding conflicts with street trees. Alternate access routes may be required to protect street trees.

Soil compaction reducing techniques such as weight displacement plates or thick wood mulch (20 – 30 cm) may be required by the City Arborist if the street tree rooting area is likely to be affected by vehicular movement.

Temporary storage sites of construction material or soil excavate should be as far from neighbouring trees as possible.

The City of Surrey's Parks Construction Standards provide useful guidance and standards for private tree protection:

http://www.surrey.ca/files/Surrey_Parks_Construction_Standards_-_Winter_2010_11.24.pdf

2.2.2 Boulevard Trees

A tree bylaw should require protection of trees on City land. Boulevard trees can be damaged or destroyed during construction or demolition processes, and a number of measures should be undertaken to protect tree. Any drawings submitted for Development Permit (DP) or crossing permit applications should have all street trees marked on the site plan, as well as any street trees within 2 m of either side of the property line.

Tree Protection Barriers should be installed to protect Critical Root Zones and permeable surface surrounding protected trees. Before a person commences demolition, excavation, or construction on a site, the owner of the site should install a protection barrier around all boulevard trees between the extension of the two side property lines across the boulevard; or within two metres on either side of the two lines.

The location of all underground services should be marked on the DP drawings. Alignments should be outside of the required protection zone, and as far as possible from large trees.

Site access should be planned with consideration for avoiding conflict with street trees. Alternate access routes may be required to protect street trees.

Where work or demolition is undertaken, plants and the limits of their root systems should be identified and preserved. Plants and root systems must be protected from damage, compaction and contamination to the satisfaction of the City Arborist or designate prior to commencement of site activities.

Soil compaction reducing techniques such as weight displacement plates or thick wood mulch (20 – 30 cm) should be required by the City Arborist if the street tree rooting area is likely to be affected by vehicular movement.

Temporary storage sites of construction material or soil excavate should be as far from neighbouring trees as possible.

Boulevard trees should not be removed, pruned, moved or otherwise impaired, interfered with, or injured without prior approval from the City Arborist. Should there be any conflict with a street tree and the normal enjoyment of one's property, or a permitted activity, the City Arborist (or designate) should determine if corrective action is warranted. Only arborists authorized by the City Arborist should prune or remove street trees.

The City of Surrey's Parks Construction Standards and the City of Vancouver's Street Tree Guidelines provide useful guidance and standards. For more guidance for identifying and protecting trees during construction:

http://www.surrey.ca/files/Surrey_Parks_Construction_Standards_-_Winter_2010_11.24.pdf

<http://vancouver.ca/files/cov/StreetTreeGuidelines.pdf>

3.3 Ornamental Lights or Hanging Baskets in Trees

The fixation of wires to trees can kill branches, pre-empt tree care, or possibly create a risk of electrocution. If ornamental lights are fixed in trees, light strings must not be attached to tree branches with wires, nails, tape or strapping of any kind, and should be placed near the centre of the tree, avoiding the ends of branches. Lights must be removed prior to pruning.

The City of Vancouver provides a useful example for regulation of ornamental lights in trees. For details on the City's program, refer to the Street Tree Guidelines:

<http://vancouver.ca/files/cov/StreetTreeGuidelines.pdf>

3.4 Tree Care Topics and Related Homeowner Brochures

The International Society of Arboriculture provides a number of free brochures to help explain the benefits and management of trees:

<http://www.treesaregood.com/treeowner/treeownerinformation.aspx>

3.5 CAD Standards

The University of Florida provides a number of CAD standards for details and specifications that follow ANSI 300 or other arboriculture best management practices. Drawings listed include standards for planting, staking, irrigation, tree protection and inspection. These details can be found at:

<http://hort.ifas.ufl.edu/woody/details-specs.shtml>

Local municipalities may also be willing to share CAD standards already developed locally for these purposes.

4 Strategies for Minimizing Infrastructure Conflicts

4.1 Strategies for Minimizing Infrastructure Damage by Tree Roots

This section provides some explanation for why tree roots can damage infrastructure and presents some strategies for minimizing or addressing conflicts. It is not possible to entirely eliminate the potential for conflict; however, good planning, appropriate investment and an agreed way of working around tree roots will provide good outcomes for tree and utility managers.

Tree roots grow in response to available moisture, oxygen, nutrients and soil temperature. When the conditions are appropriate, roots grow by elongation from the root tip. Root hairs elongate from the outside edges of the root and these fine roots are the primary source of water and nutrient uptake (called absorbing roots). As roots age, the root hairs die off and the roots become woody and no longer elongate. These roots are no longer effective at absorbing and instead contribute to structural stability of the tree.

From an infrastructure perspective, focusing on private trees is a lower maintenance approach to the maintaining the City's infrastructure. However, growing a healthy urban forest requires strategic use of both private and public land opportunities. On-property solutions, such as the "Neighbourwoods" initiative, support tree canopy without the need for City management; however, on-street planting should be considered as a means to significantly increase the number of trees within an urban area, while beautifying streets in a way that tree planting on private lots cannot achieve.

4.1.1 Tree root interference with infrastructure

To avoid unnecessary damage to infrastructure, the following information drawn largely from Mark Hartley (The Arborist Network²) should be considered:

1. **Tree roots & water:** Tree roots do not sense and cannot detect water unless it is immediately adjacent to the root surface. Root growth is stimulated by the presence of water and stops when conditions are no longer ideal. Roots do not search for water when conditions are dry and cannot detect water in a sealed pipe.
2. **Tree roots & pipes:** All elongating roots start out as fine roots that exert very limited force, and are not capable of breaking into a sealed pipe. However it has been observed in Campbell River that root heave can occasionally fracture pipes, creating a fault through which roots may subsequently grow. Roots may enter pipes when:
 - a. old pipes have joints that fail, or soil movement causes joints to separate and the pipe begins to leak water into surrounding soils. When roots come into contact with moist soil they may start to grow more rapidly to take advantage of favourable conditions, and eventually will enter the fault. If conditions continue to be favourable roots will thrive and, over time, form a plug that blocks the pipe.

² Hartley M. 2012. Tree Root Damage to Pipes.

http://www.waverley.nsw.gov.au/__data/assets/pdf_file/0004/60790/Tree_Root_Damage_to_Pipes_Study_-_Mark_Hartley,_Arborist_Network2012.pdf

2. Pipe lining with a resin impregnated membrane is a preferable option because it seals the pipe entirely and eliminates the leak. Once the source of moisture into the soil is removed, root growth will cease in that location and the problem is eliminated.
3. Replacing leaking pipes with new pipes may be required if lining the pipe is not feasible. The service life of the pipes and any repairs should be considered when weighing the cost versus durability.

4.1.3 Roots and hardscape

Given that most roots grow close to the surface, curb and sidewalk damage can sometimes occur. Trees need adequate soil volume to maintain health and reach their growing potential. When soil volume is limited compared to the tree's requirements damage to hardscape can occur. Several strategies for reducing the potential for damage are outlined below; these strategies are sourced from the ISA publication 'Reducing Infrastructure Damage by Tree Roots'³ and more detail is provided in that resource.

1. Tree-based strategies
 - a. Species selection: Select tree species that appropriately sized for the available soil volume and with buttress appropriate to the pit width. However, avoid the overly conservative approach of selecting small trees for every location as canopy targets and tree benefits will be compromised.
 - b. Root pruning or root shaving: When conflicts do occur, or when excavation to access services is required, root pruning may be required. However, cutting roots can damage trees and cause whole tree failure, therefore ensure that root pruning is always performed by an ISA Certified Arborist.
2. Infrastructure-based strategies
 - a. Design: Provide appropriate sized planting spaces, encourage centre medians and nature strips in street design. Where the conflict already exists, build bridges over roots.
 - b. Materials: Use flexible pavement and/or permeable pavement and, where the conflict exists, temporarily wedge or grind pavement to reduce trip hazard.
3. Rootzone-based strategies
 - a. Root guidance systems: Root barriers can prevent or delay root conflicts. They are installed to a depth below which roots are not expected to grow. Root barriers have a limited service life.
 - b. Soil replacement, modification and management: Increase soil volume under hardscape using soil cells or structural soils.
 - c. Water management: Integrate passive water capture (e.g., direct water from gutters into tree pits, use permeable paving, integrate stormwater treatment under pavement etc.) to ensure that trees are regularly receiving soil moisture inputs from a desirable location.

³ Costello, L.R.; K.S. Jones. 2003. Reducing Infrastructure Damage by Tree Roots. Western Chapter of the International Society of Arboriculture. Porterville, CA.

4.2 Strategies for Managing Trees in Viewscapes

The City of Campbell River faces the sea, and people place a high value on their water views. Both views and trees are providing services in overlapping space and property owners sometimes perceive street trees to be detracting from their views. The most negative outcome of this perception is tree vandalism, which is a criminal offense.

Potential strategies for addressing management of existing trees and planting new trees in viewscapes are:

- a. Homeowner education regarding tree benefits; and,
- b. Homeowner consultation regarding tree species selection and tree placement so that it is sensitive to a highly valued view corridor (an entirely unobstructed ocean view is not a right and trees, just like any other City asset, should not be removed for views).
- c. Careful selection of planting locations by the City in viewscape streets to minimize view obstruction and reduce pressure for tree damage or removal, lawfully or otherwise.

5 Subdivision Bylaw Updates

The Subdivision and Development Servicing Bylaw No. 3419, 2010⁴ regulates the subdivision of land, requires the provision of works and services in the subdivision and development of land, and prescribes the standards for infrastructure works and services. Landscape design standards related to trees are included. These standards generally deal with selection, placement, and maintenance of trees on municipal streetscapes.

5.1 Justification

The landscape design standards require updating to align with the urban forest management plan, support increased tree planting and maximize canopy benefits while minimizing the potential for infrastructure conflicts associated with trees.

This review of the Subdivision Bylaw is intended to update existing regulations in recognition of current best management practices which support these four principles:

1. Urban forest management practices aim to maximize tree canopy as opposed to the number of trees;
2. Large, mature trees are preferred over small trees to take full advantage of environmental, economic, and social benefits;
3. Emphasis is placed on selecting the right tree for the right place to minimize infrastructure conflicts; and,
4. Management actions are undertaken in a cost-effective manner with the objective of maintaining tree health over the long-term.

⁴ City of Campbell River. 2010. Subdivision and Development Servicing Bylaw No. 3419, 2010. Online <http://www.campbellriver.ca/docs/default-source/Document-Library/bylaws/3419-subdivision-and-development-servicing-20105BBE7B7FA0F0.pdf?sfvrsn=2>. Available 09/17/14.

Current regulation	Recommended amendments/changes to regulation
<p>8.6 All landscape development shall be guaranteed for 1 year from the date of acceptance by the City. Plants or other materials that fail in the guarantee period shall be replaced at no cost to the City.</p>	<p>*AMENDMENT* 8.6 All landscape development shall be guaranteed for 2 years from the date of acceptance by the City. Plants or other materials that fail in the guarantee period shall be replaced at no cost to the City.</p> <p>*NEW* Retained trees shall be protected by establishing a root protection zone (RPZ). The RPZ shall be measured horizontally from the outside edge of the tree base, calculated by applying the formula: tree diameter in metres taken at breast height (1.4 m above ground) x 6; the minimum RPZ shall be 1.2 metres. In addition, retained trees shall be protected according to the protection measures defined within a Tree Management Plan prepared by a Certified Arborist and accepted by the City.</p>
<p>8.17 Drawings CR-L101 through CR-L107 shall specify the appropriate planting detail standard from the City of Campbell River Standard Details.</p>	<p>*AMENDMENT* Drawing CR-L101 Amend design standards to ensure minimum available soil volume of 30 m³ for medium to large trees with a target of providing 0.3-1 m³ of soil per 1 square metre of canopy projection. When trees are sharing soil volume, 20 m³ per tree is acceptable. Trees in hardscape will almost always require connected open planter strips, structural soil, or other soil volume expansion solutions, to meet this minimum.</p> <p>*RECOMMENDATION* Encourage use of open planter systems as a preferred simple, cost-efficient strategy to grow mature, healthy trees in the urban environment and help to manage stormwater.</p>
<p>8.22 All topsoil is to conform to MMCD Section 32 91 21. 8.23 Topsoil stock piles shall be tested with results complying MMCD Section 32 9 21 2.4.1 and submitted to the City for review. 8.24 Minimum topsoil depth shall be 0.1m in all applications.</p>	<p>*NEW* Retain unscreened native soils (not including mineral layers) for future landscape planting except when invasive plant species are present.</p>

Current regulation	Recommended amendments/changes to regulation
<p>8.25 All plant materials shall meet the following criteria:</p> <ul style="list-style-type: none"> Plants shall have the ability to withstand adverse conditions such as airborne pollutants, maximum sun exposure and reflected heat from pavements, high winds and abrasive forces, occasional snow loading and exposure to salt from road clearing operations, and limited root zone soil volumes. Plants shall be capable of reduced water demand following a one year establishment period. Plants shall have relatively low maintenance attributes including: fine to medium leaf size and canopy density; non-fruit bearing or having only berry-sized nonstaining and non-toxic fruits; low susceptibility to disfiguring or fatal diseases and infestations; infrequent demands for pruning, fertilizing and other cultural requirements. Plants shall be of appropriate size and form at maturity to meet criteria in Table 8-2 <p>Action 1.</p> <p>8.28 All street trees shall meet the following criteria:</p> <ul style="list-style-type: none"> Compact or upward branching structure. 	<p>*AMENDMENT* 8.25 Plants shall be adaptable to future climate change, which will likely mean warmer, drier summers and wetter, milder winters. Models have predicted British Columbia’s climate may be 3 to 4 degrees warmer by the end of century. Because this is well within the normal lifespan of trees, there is potential that some existing trees may become maladapted and exposed to additional risks ⁵.</p> <p>*AMENDMENT* 8.25 Plants shall be capable of reduced water demand following a two year establishment period.</p> <p>*AMENDMENT* 8.25 Accepting the higher maintenance requirement, permit use of fruit and nut-bearing trees on public land in appropriate locations to support local food systems and community engagement.</p> <p>*NEW* All tree stock shall be inspected by a City Arborist prior to planting to ensure it meets minimum quality requirements to promote growth of healthy, mature street trees and reduce maintenance.</p> <p>*AMENDMENT* 8.28 Remove requirement for compact or upward branching structure. Restricting trees to those with compact/upward branching structure may limit canopy cover potential. Modify selection criteria to permit use of trees with broader branching forms to maximize canopy cover where appropriate. Potential infrastructure conflicts resulting from larger crowns can be managed either through pruning or strategic placement of trees.</p>
<p>8. Landscape (8.29 Select street trees according to proposed site conditions either from: Table 8-1, Table 8-2, Table 8-4, or Table 8-5)</p>	<p>*AMENDMENT* 8.29 The provision of sufficient soil to maximize tree canopy is encouraged (1 m³ of soil supports 2.2 m² of canopy).⁶ A minimum soil volume of 30 m³ is required for medium trees, and a minimum of 50 m³ for large trees. When trees are sharing soil volume, 20 m³ per tree is acceptable.</p> <p>*AMENDMENT* 8.29 Remove cherry (overrepresented, short lifespan, small size) and Norway maple (invasive) from approved tree planting list. Prefer species other than maple and Katsura due to current overrepresentation in street tree inventory.</p>

⁵ <https://www.for.gov.bc.ca/hre/forgen/interior/AMAT.htm>

⁶ http://www1.toronto.ca/city_of_toronto/parks_forestry__recreation/urban_forestry/files/pdf/TreePlantingSolutions_BestPracticesManual.pdf

Current regulation	Recommended amendments/changes to regulation
<p>8.31 Minimum number of boulevard trees shall be calculated as follows:</p> <p>Tree Size Single Family</p> <ul style="list-style-type: none"> • Medium Trees (± 10 - 20m ht.) Greater of 1 per lot or 15m • Small Trees (Under 10m ht.) Greater of 1 per lot or 10m • Plantings of trees closer than 6m on centre shall require the written approval of the City. • Locate trees fronting on single family lots in locations that avoid all utility service alignments and driveways. Generally this will lead to tree placement in the half of the lot frontage away from the driveway side, and not at either the lot centerline or at a lot line. 	<p>* AMENDMENT* 8.31 Tree Size Single Family</p> <p>Large trees (> 12 m height or canopy diameter). Greater of 1 per lot or 15 m. Medium trees (8 – 12 m height or canopy diameter). Greater of 1 per lot or 10m Small trees (< 8 m height). 6 m spacing for locations with constrained soil volume or overhead power lines.</p> <p>*AMENDMENT* 8.31 Encourage planting of medium to large trees in single family neighbourhoods.</p> <p>*AMENDMENT* 8.31 Maintain a suitable inter-tree distance that will meet minimum soil volume requirements to maximize tree canopy size, health, and longevity.</p> <p>*AMENDMENT* 8.31 Permit integration of utilities into root zones to increase available soil volume to trees, provided that in the event of the utilities being accessed and repaired, it would not require removal of the tree.</p>
<p>8.34 Select and site urban trees in pavement to eliminate long term above-ground and below ground conflicts with utilities, buildings and structures, and pedestrian and vehicular traffic.</p>	<p>*AMENDMENT* 8.34 Permit integration of utilities into root zones to increase available soil volume to trees, provided that in the event of the utilities being accessed and repaired, it would not require removal of the tree.</p>
<p>8.38 Planting of street trees in the hot dry summer period of June, July and August is discouraged, due to the risk of failure of the planting caused by heat and drought.</p>	<p>*AMENDMENT* 8.38 Plant street trees outside of summer months (June, July, and August) to reduce risk of tree failure.</p>

6 Tree Protection, Removal and Replacement Bylaw Concepts

6.1 Justification

Urban forests are increasingly being recognized for the important economic, social, and environmental benefits and ecosystem services they provide. Within Campbell River, the urban forest canopy is particularly valued for the provision of services related to stormwater management, air quality improvement, habitat provision and recreation. Declining canopy cover within the City's UCB has emphasized a tremendous need to increase protection of trees to ensure the community benefits from its urban forest.

The Protection, Removal and Replacement Bylaw will reduce the number of trees removed, killed, cut or damaged, by improved protection and replanting requirements. The existing canopy will be protected using a balanced approach: saving the right tree in the right place while removing and replanting trees to maintain and increase future canopy cover. These measures will ensure a healthy and diverse urban forest that supports the prosperity and identity of the City of Campbell River for present and future generations.

6.2 Potential Bylaw Considerations

In general, tree bylaws are developed to:

1. Define where the bylaw applies and what constitutes a protected tree;
2. Prohibit the removal of protected trees without a permit;
3. Protect trees on private lands (and sometimes public lands) from damage;
4. Regulate and establish requirements for the pruning, removal, protection and replacement of protected trees through a permit process; and
5. Set forth inspection and enforcement provisions for protected tree removal, replacement and protection, and penalties for damaging or removing protected trees without a permit.

A range of bylaw tools exist to achieve these outcomes. Some target all trees based on minimum size, others target protecting trees on a minimum lots size, or based on canopy existing on the site. Some allow one tree to be removed within each specified time period. There are pros and cons to each of these options that need to be considered in the context of the community and reasons for tree canopy loss. It is also important to consider how retention and replacement can be best supported to achieve urban forest objectives. For example, providing for permeability targets and maximum lot coverage in zoning can support tree protection or the creation of opportunities for planting trees. The table below summarizes a range of tree bylaws with varying approaches in BC.

	Lands Bylaw Applies To (excluding lands or activities managed under specified Acts)*	Protected Tree Size	Replacement Trees
Abbotsford 2010	All lands in City (excluding Crown, or lands managed under specified Licences)	>20cm DBH and > 4 m tall. Any size tree within a tree retention area.	DBH-based replacement (i.e., <20cm = 0, 20-30cm = 2, >30cm= 3). Where space is limited, can plant on City property or provide cash-in-lieu.
Burnaby 1996	All lands in City	>20cm DBH on properties under development application, 30 cm DBH for conifers on all other properties, 45 cm for deciduous on all other properties, replacement trees, retained trees	DBH-based replacement (i.e., up to 30cm = 1, 30-60cm = 2, >60cm= 3). Where space is limited, can provide cash-in-lieu.
Comox 1994	Lands within the Tree Protection Area	>20cm DBH Standard Cut Limit is set at removal of 75% of original trees >20 cm DBH (i.e., permits won't generally be issued for cutting above that limit). Director may approve cutting of Excess Trees under some circumstances.	1:1 replacement
Courtenay 2006	Properties > 1 ha or in defined tree permit area, riparian assessment areas, significant trees, specific species and specific locations	Specific species of any size, significant trees as defined in a Schedule, or in defined locations trees with >20 cm DBH, or trees of any size riparian assessment areas	1:1 replacement. DBH-based replacement size. Director may exempt from tree replacement.
Coquitlam 2010	All lands in City except those subject to Development Application	Allows 2 protected trees to be cut per year on lots with less than 40 protected trees, and 5% cut per year on parcels with more than 40 protected trees. >20cm (or >5m tall on steep slopes), or any Replacement or landscape plan trees.	May be required at discretion of GM and, where space is limited, can plant on City property.

Delta 2015	All lands under jurisdiction of Corporation (excluding lands managed under specified Acts)	Allows 1 protected tree to be cut per 24 months. >20cm or any replacement tree	Requires minimum 2:1 replacement, also has discretionary clause. Where space is limited, can plant on approved alternative location or provide cash-in-lieu.
Nanaimo 2013	City lands and specific other (i.e., Development Permit Areas, covenants, significant trees, scientific value trees)	Protection of all tree or approved replacement plan but protection of at least 20% of trees on a development parcel.	Replacement of at least 1 tree per lot or as defined in the Bylaw Schedule or as per approved Landscape Plan.
Parksville 2012	All lands in City	>50 cm dbh, covenant trees, trees within 30 m of watercourse or top of slope (excludes Alder and Poplar)	Replacement may be required by the Director.
Saanich 2014	All lands in City (excluding Federal or Crown lands)	Ranges from 4 to 30cm depending on species and any species > 60 cm, replacement trees, significant trees	Replacement of 1:1 except when removed for development which is 2:1. Where space is limited, can provide cash-in-lieu.
Surrey 2006	All lands in city	Any tree >30cm., planted or retained tree, replacement tree, tree within ESA, specimen quality tree, significant tree, any size tree of list of 9 species.	Required, min. 2:1. Where space is limited, can provide cash-in-lieu.
Victoria 2005	All lands in city	Ranges from any size to 60 cm depending on species and any species > 80 cm, replacement trees, significant trees, steep slope trees, coventant trees.	Required, min. 2:1

****Acts such as the Pipeline Act, Hydro and Power Authority Act, Private Managed Forest Land Act etc. that provide alternative authority to cut trees.***

7 Zoning Bylaw Update

The Zoning Bylaw No. 3250, 2006 establishes land use regulations for the City.

7.1 Justification

Permeability across land uses varies widely throughout the City. Increasing permeability both restricts canopy cover potential and has implications for stormwater management. For example, within the Urban Containment Boundary, 348 ha (or 10%) is zoned commercial. Commercial and industrial areas have the highest level of impervious surface area and the lowest tree and vegetation cover of all land use zones. Tree canopy is approximately 17% in the commercial and industrial land use zones. This figure is likely inflated by the undeveloped, forested portion of these zones. Where developed, canopy cover is as low as 1% in some parts of the commercial zone (Figure 1).



Figure 1. Commercial zoned area with 1.3% canopy cover.

Large surface parking lots can contribute to drainage and flooding problems, increase urban heat islands, become eyesores and encourage people to drive, rather than walk to their shopping destination⁷. Parking lots have the potential to contribute to urban forest canopy while providing substantial benefits in terms of beautification of commercial areas, shading asphalt and car spaces, intercepting rain water, cleaning run-off and screening different land uses. The Zoning bylaw should be updated to require permeability targets for land uses across the City that will support canopy cover increases.

⁷ Wolf, K. L. 2004. *Trees, Parking and Green Law: Strategies for Sustainability*. Stone Mountain, GA: Georgia Forestry Commission, Urban and Community Forestry.

9 Useful Life Expectancy

The Useful Life Expectancy (ULE) is an estimate of how long a tree is likely to be viable in the landscape based on health, amenity, environmental services contribution and risk to the community. Each tree shall be assigned one of the following ULE categories:

Useful life expectancy	Typical characteristics
< 1 year	Tree may be dead or mostly dead. Tree may exhibit major structural faults. Tree may be an imminent failure hazard.
1-5 years	Tree is exhibiting severe chronic decline. Crown is likely to be less than 50% typical density. Crown may be mostly epicormic ⁸ growth. Dieback of large limbs is common (large deadwood may have been pruned out).
6-10 years	Tree is exhibiting chronic decline. Crown density will be less than typical and epicormic growth is likely to present. The crown may still be mostly entire, but some dieback is likely to be evident. Dieback may include large limbs.
11-20 years	Tree not showing symptoms of chronic decline, but growth characteristics are likely to be reduced (bud development, extension growth etc). Tree may be over-mature and senescing.
21-30 years	Trees displaying normal growth characteristics. Tree may be growing in restricted environment (eg. Streetscapes) or may be in late maturity.
31-60 years	Semi-mature and mature trees exhibiting normal growth characteristics. Juvenile trees in streetscapes.
61+ years	Juvenile and semi-mature trees exhibiting normal growth characteristics in parks or open space.

⁸ Growth of a shoot or branch from a previously dormant bud on the trunk or limb of a tree. Sometimes called water sprouts.

10 Storm Response Plan

Storms, particularly those accompanied by high winds, floodwaters or heavy snow loads, can cause significant damage to urban forests. Campbell River has experienced such events before, one of the most recent being 2012; however, our changing climate is expected to result in more frequent, intense storms that will impact the urban environment, including trees, people, and infrastructure.

Policies and procedures for storm management vary between municipalities and agencies; many have Emergency Storm Response Plans that address a variety of risk management and response measures. Wind damage to trees, and damage resulting from tree failure and breakage, is a significant concern in coastal ecosystems. Hurricane research in the United States has provided some insights to better inform policies and procedures for storm management as it relates to trees and the urban forest. Important lessons and recommendations from this research⁹ include:

1. Increased wind speed increases the likelihood of tree failure

- Choose more wind resistant species;
- In park plantings, plant trees in groups of at least five;
- Plant a variety of species, ages and layers of trees and shrubs.

2. Some trees are more wind resistant than others

- Plant trees that are more wind resistant;
- Implement a risk management policy to assess trees in high risk areas more frequently, particularly when trees are over-mature or under stress.

3. Some sites have repeated tree failures

- Assess how tree species respond to different conditions (soil, climate, disease, etc.) in the urban forest over time.

4. Some trees may have no visible damage after storm, but may decline afterwards

- Monitor tree health after windstorm event.

5. Trees can lose leaves after a severe windstorm event and still recover

- Do not reactively remove trees that have lost leaves but are not hazardous.

6. Trees with poor structure or included bark, and poorly pruned trees, are more vulnerable to damage from windstorms

- Plant high-quality trees with central leaders and good structure;
- Begin structural pruning program for young and mature trees;
- Select the right species and right place.

7. Good soil conditions (including depth, porosity, water availability) improve tree resistance to wind

- Ensure minimum one metre soil depth and access to deep water table;
- Minimize soil compaction.

8. Intact root systems improve tree resistance to wind

- Avoid damaging or cutting structural roots during construction.

⁹ Duryea, M. and Kampf, E. Wind and Trees: Lesson Learned from Hurricanes. Retrieved on October 20 2014 from: <http://edis.ifas.ufl.edu/pdffiles/FR/FR17300.pdf>

The lessons and recommendations above are addressed through Campbell River's broader urban forest program. However, some tree and urban forest considerations that should be incorporated into a Storm Response Plan are described below. These actions are adapted from other municipalities (e.g. City of Regina Urban Forest Storm Response Plan) and are categorized chronologically:

- **Preparation** - early warning and pre-planning activities;
- **Response** - activity during and immediately after a storm;
- **Recovery** - activities to return the damaged areas to pre-storm conditions.

Preparation:

- Identify storm categories, based on intensity (wind speed, 24 hr precipitation), and appropriate level of response to each, including inter-departmental, regional and provincial coordination;
- Install an early warning forecast system with appropriate monitoring protocols, including designated personnel;
- Ensure regular inspection and spring maintenance to pro-actively address potential tree hazards and support healthy urban forest conditions;
- Allocate appropriate resources for storm response;
- Designate specific storm response roles to all personnel (with appropriate training) and review storm response protocols on an annual basis.

Response:

- Establish storm response centre and allocate resources and personnel accordingly;
- Conduct a damage assessment and identify priority areas for clean-up. Priorities should be categorized: immediate risk to public safety, blockage of access/transportation routes, or general clean-up required;
- Establish clean-up, storage, and disposal protocols for public and private property based on priority;
- Address all request for services based on priority and advise general public of roles and responsibilities to assist as part of clean-up campaign;
- Record all tree-related damage, including sites where trees have been lost or removed;
- Keep a record of all post-storm tree services, including follow-up work required.

Recovery:

- Update tree inventory to assess full damage to urban forest and evaluate replacement costs which may be used for insurance purposes or relief funding;
- Assess canopy cover targets based on damage assessment and make necessary adjustments to future planting plans to compensate. Funding formulas may have to be revisited to meet objectives;
- Designate communications team to update public, community stakeholders, and government of recovery progress and next steps.

11 Significant Tree Criteria

Significant Trees are designated to protect and maintain important aspects of natural and cultural heritage that are valued by a community. Once designated, Significant Trees may be afforded specific protections under a Tree Preservation Bylaw or Heritage Bylaw or their equivalent. Grants may also be provided to homeowners that have Significant Trees on their property as an incentive to care for and preserve these specimens.

The process to designate Significant Tree status typically begins with consultation; members of the community, stakeholders, committees, or local government are asked to nominate candidate trees or groups of trees under a set of defined criteria. Nominations are then evaluated (by a panel composed of City and community representatives with relevant experience) using those criteria. In most cases, Significant Trees are structurally sound (i.e. good condition and not in decline) prior to their designation. Their removal would be governed by the proposed Tree Protection, Removal and Replacement Bylaw.

The criteria used for the evaluation of potential Significant Trees should be finalized in consultation with the review committee but may include:

- Horticultural value – tree may have genetic importance or be resistant or tolerant to some pests/diseases;
- Age – tree is particularly old compared to other trees or individuals of same species;
- Size – tree is particularly large compared to other trees or individuals of same species;
- Rarity – tree is a locally or regionally rare specimen/cultivar/species;
- Form – tree has unique growth features/shape that increase its prominence on landscape;
- Aesthetic value – tree has flowering, leafing, or other characteristics that allow specimen to stand out;
- Historic value – tree commemorates special/historical occasions or events (e.g. citizen planting);
- Habitat value – tree provides important habitat (e.g. eagle nest, bat roost, wildlife tree);
- Community value – tree has significant spiritual, cultural, or economic value (e.g. landmark or well-known tree, food tree, gathering place, visual buffer);
- Ecological services – tree provides significant ecological benefits (e.g. shade, windbreak, bank stabilization); and
- First Nations value – tree has significant heritage value or is a CMT (Culturally Modified Tree).

12 Public Consultation Summary

City of Campbell River Community Consultation Summary Urban Forest Management Plan

October 17, 2014

Submitted to:
Ross Milnthorp
General Manager
Parks Recreation and Culture
City of Campbell River

Submitted by:



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Figure 6. Kernel density map showing the location of aesthetic and environmental quality values. The darker the colour, the higher the density of value points. **Error! Bookmark not defined.**

Figure 7. Kernel density map showing the location of naturalness & biodiversity, and social values. The darker the colour, the higher the density of value points. **Error! Bookmark not defined.**

Figure 8. Kernel density map showing the location of personal well-being and significant or heritage tree values. The darker the colour, the higher the density of value points. **Error! Bookmark not defined.**

Figure 9. Locations where more tree planting we suggested. The central red areas contain the highest density of points proposed for more tree planting. **Error! Bookmark not defined.**

1 Background

All of the community’s trees, vegetation and soil contribute to the urban forest, and this provides a wealth of social, economic and environmental benefits to people who live in urban communities. We want to make sure these important assets are valued appropriately relative to other forms of civic infrastructure and to keep these natural assets thriving in an urban setting through ongoing planning, maintenance and monitoring.

The first phase of Campbell River’s Urban Forest Management Plan (UFMP) was completed in 2013, and included an inventory of tree canopy. The second phase will establish guidelines and actions to preserve and enhance Campbell River’s urban forest, including plans for canopy cover growth, new tree planting, tree health and maintenance, tree protection and budgeting.

A key aspect of planning for the UFMP is engaging with community members and stakeholders to understand the key issues that affect Campbell River’s urban forest today and to develop community supported targets for future canopy cover and any proposed tree management bylaw.

2 Open House #1

Open House #1 – ‘Let’s Talk Trees’ – was held from 5.30 – 7 pm on September 25 at the Campbell River Museum. Approximately 25 members of the Campbell River community attended and shared their thoughts about the urban forest through several participatory exercises.



The results from the session will be used, together with the urban forest survey outcomes, to draft a vision statement for Campbell River’s urban forest, and to inform priorities, principles, strategies and targets when drafting the plan.

2.1 Image preferences

People were shown a poster of 19 images that represented different types of urban forest characteristics and asked to place a dot next to the images that best representing things that

should be part of Campbell River’s future urban forest. They were then asked to write words or statements that described the things that should be part of Campbell River’s urban forest.

The number of dots assigned to each image is shown in Figure 1 with a 95% confidence interval. Those images with confidence limits above the average line were preferred as the best representations of Campbell River’s future urban forest, whereas those with confidence limits below the average line were not preferred as representation of the future urban forest. Where the confidence interval overlaps the average line, those images were neither preferred nor not preferred.



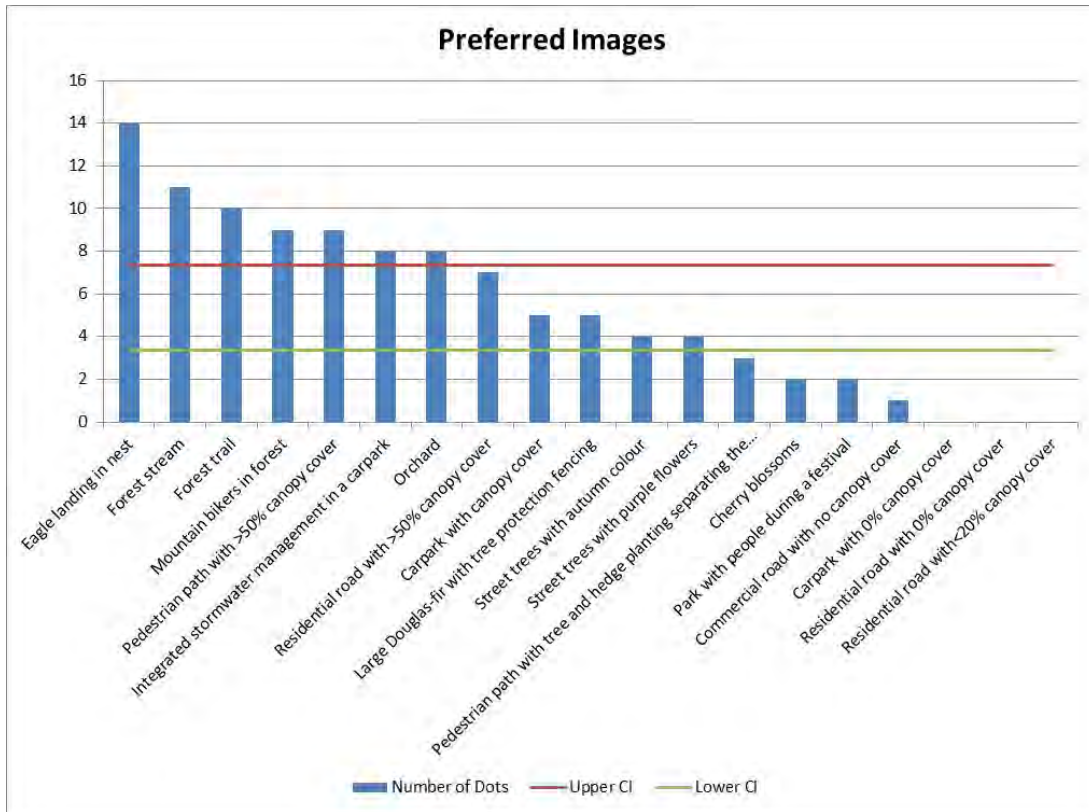


Figure 2. Graph showing the number of dots assigned to each image with upper and lower 95% confidence intervals around the mean. Those images with results above the upper 95% confidence limit were taken as preferred.



Figure 3. Images preferred representations of Campbell River's future urban forest

People provided the following text to describe things that should be part of Campbell River's urban forest.

1. Tree protection
2. Tree retention
3. Canopy closure
4. Subdivision tree canopy
5. Street Trees!
6. Best practices
7. Treed picnic areas in parks
8. Native trees
9. Diverse
10. Cool
11. Temperature (shade in summer, sun in winter with deciduous)
12. Food-bearing trees and plants (and public education around how to use them)
13. Food for the community
14. Noise reduction
15. Beauty
16. "Meditation groves"
17. Activities for my family
18. Reflects the nature of the area, while enhancing recreation opportunity and enjoyment of the outdoors
19. Promotes ecological health while sustaining human well-being
20. We live in a rainforest, the idea should be to keep the essential treed structure.
21. Sound floodplain management! Keep in mind the impact of development on the local watershed.
22. Start with a greenhouse to manage smaller trees (plants) - greenhouses in every school.
23. Establish a true rooftop garden

The images in Figure 3 were not preferred as representations of Campbell River's future urban forest.



Figure 4. Images not preferred as representations of Campbell River’s future urban forest.

Based on the images selected and the text provided during the image preferences exercise, several themes emerged:

Number of times referenced	Theme
5	Ecological health and naturalness
3	Tree protection and retention
3	Canopy closure
3	Recreation
3	Food
3	Shade and cooling
2	Street trees and tree growing
2	Native trees and tree diversity
2	Beauty
2	Human well-being and “meditation groves”
1	Rainforest
1	Noise reduction
1	Floodplain management and watershed
1	Rooftop garden
1	Best practices

2.1 Values Mapping

People were asked to assign defined values about the urban forest to different parts of Campbell River, and to identify locations for more tree planting. The values are defined in Table 1.



Table 1. Value categories used in values mapping exercise.

Red star	Aesthetics: These areas are important because they are attractive for reasons including sights/views, smells or sounds.
Green Star	Naturalness and biodiversity: These areas are important because they are relatively untouched, ecological processes are intact and provide habitat for different types of animals.
Blue star	Environmental quality: These areas are important because they provide clean air, clean water, cooling, slope stability or other environmental benefits.
Orange star	Social values: These areas are important because they provide places for recreation, places for community to meet, feel welcoming, and contribute to character or sense of place.
Purple star	Personal well-being: These areas are important because they contribute to your personal enjoyment because of shade, relaxation, peacefulness, spirituality or other qualities that contribute to your well-being.
Yellow star	Significant or heritage trees: These areas are important because they contain trees that are particularly large, old, culturally important, or have other unusual features that make them special.
Dot (any)	Priority for more tree planting: These areas should be prioritised for tree planting.

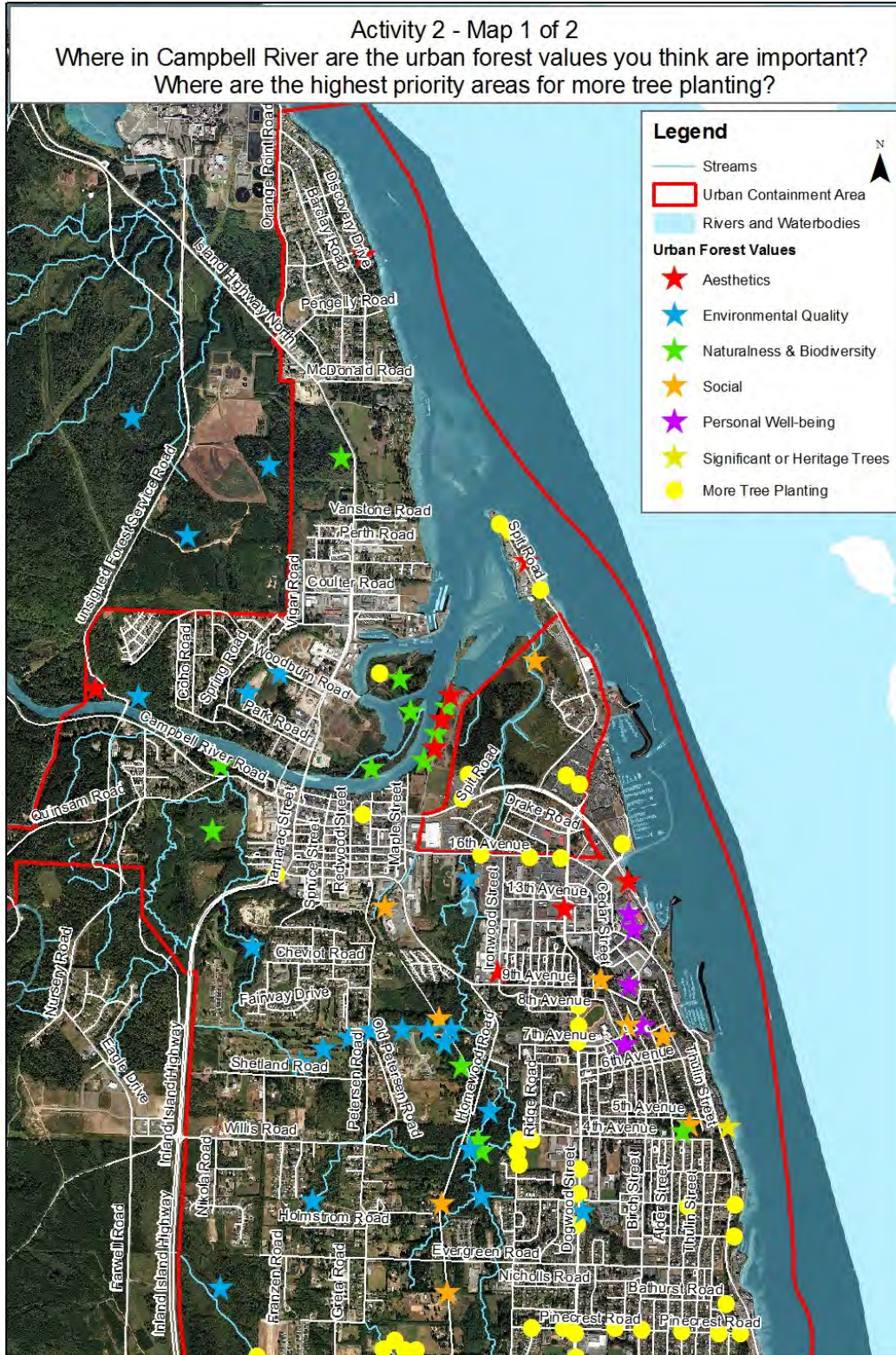


Figure 5. Values mapping raw output (map 1 of 2).

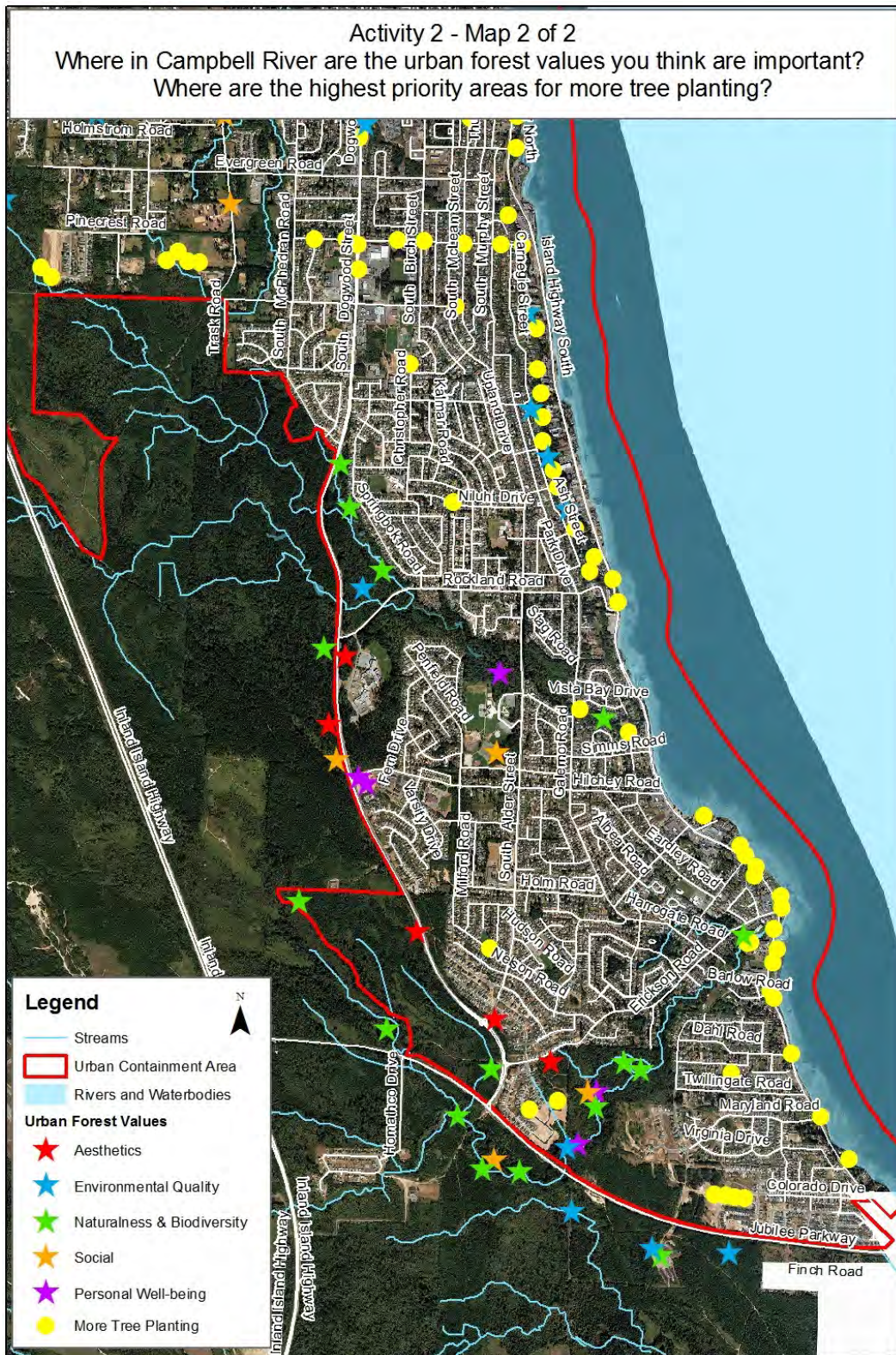


Figure 6. Values mapping raw output (map 2 of 2)

Several comments also accompanied the maps:

- Corridors (with native species) between streams and wetlands for wildlife movement
- Biodiversity and significant trees are all locations where bald eagles nest! See SOCP map for locations.
- Residential, industrial and commercial – plant over entire area
- Expand buffers on urban streams/wetlands!

Based on the values mapping, it is evident that the Beaver Lodge Lands, the forested ridge adjacent to the foreshore, stream corridors and forested portions remaining within the City are highly valued for reasons including aesthetics, naturalness and biodiversity and environmental quality. Social values are spread over a variety of locations in residential or forested/park areas. Personal well-being values were centred in the downtown commercial areas and residential areas, as well as the Sims Creek and Willow Creek forested areas adjacent to new subdivisions. Only one heritage tree location was highlighted; however, a map comment also noted that all eagle nest trees should be considered significant. More tree planting was highlighted for foreshore areas, several subdivisions and in some park areas. See Figures 6 – 9 for maps of each value generated using a kernel density function (magnitude per unit area for a point feature).

It is worth noting that these results reflect the value preferences of the people in attendance at the open house and are not statistically representative of the Campbell River population. The qualitative information from the open house will be combined with the survey results (from a larger population size) to develop the urban forest vision and priorities.



Figure 7. Kernel density map showing the location of aesthetic and environmental quality values. The darker the colour, the higher the density of value points.



Figure 8. Kernel density map showing the location of naturalness & biodiversity, and social values. The darker the colour, the higher the density of value points.

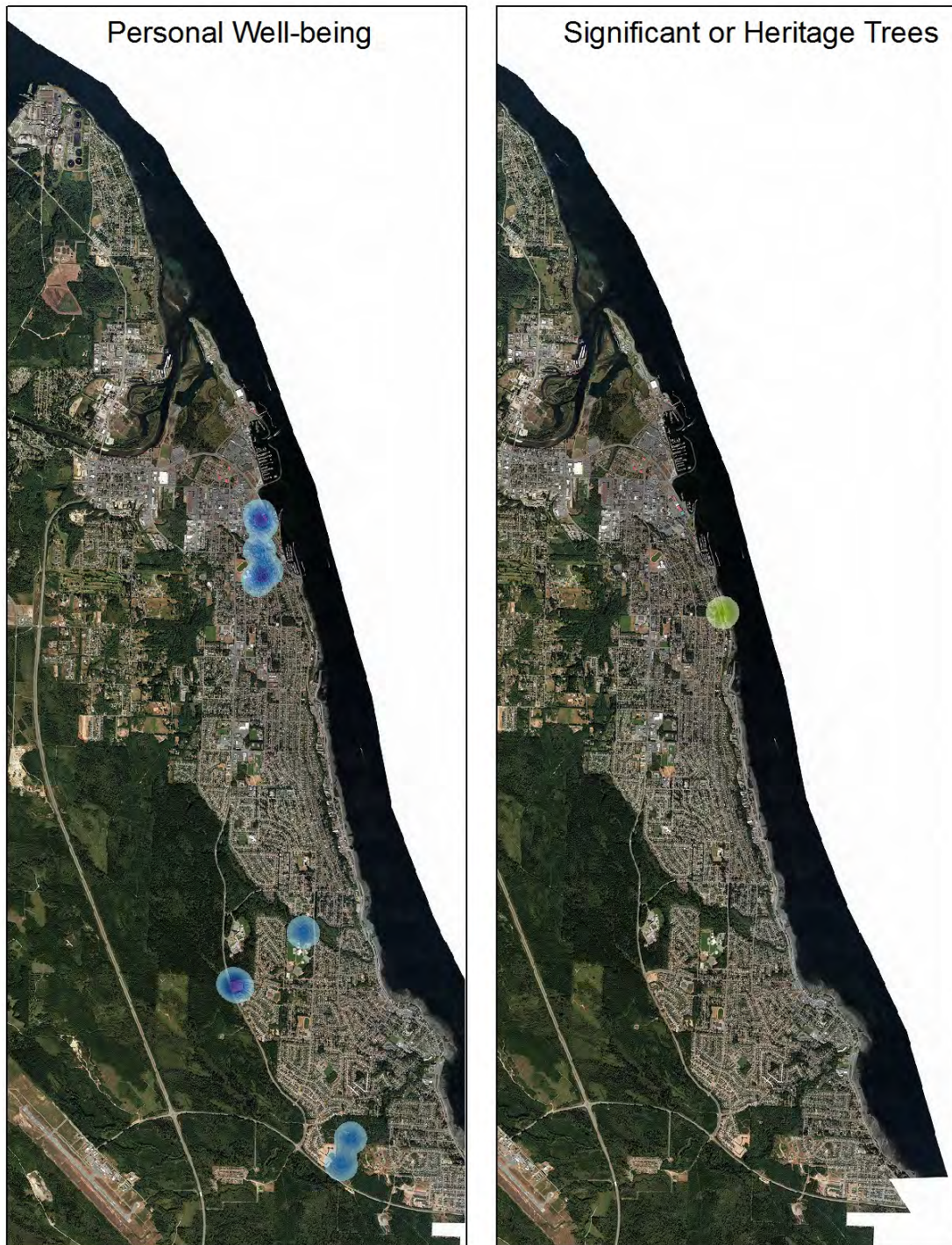


Figure 9. Kernel density map showing the location of personal well-being and significant or heritage tree values. The darker the colour, the higher the density of value points.

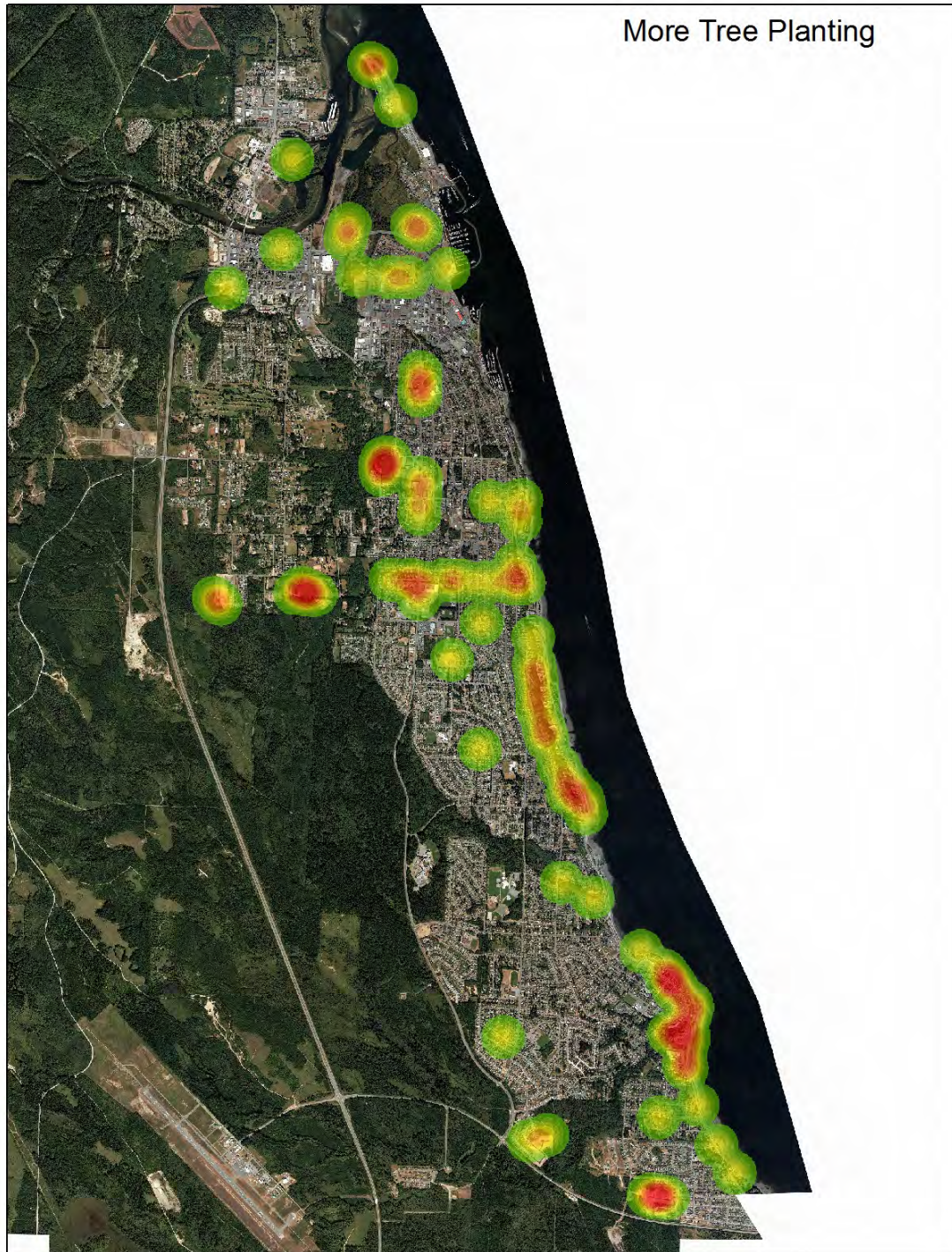
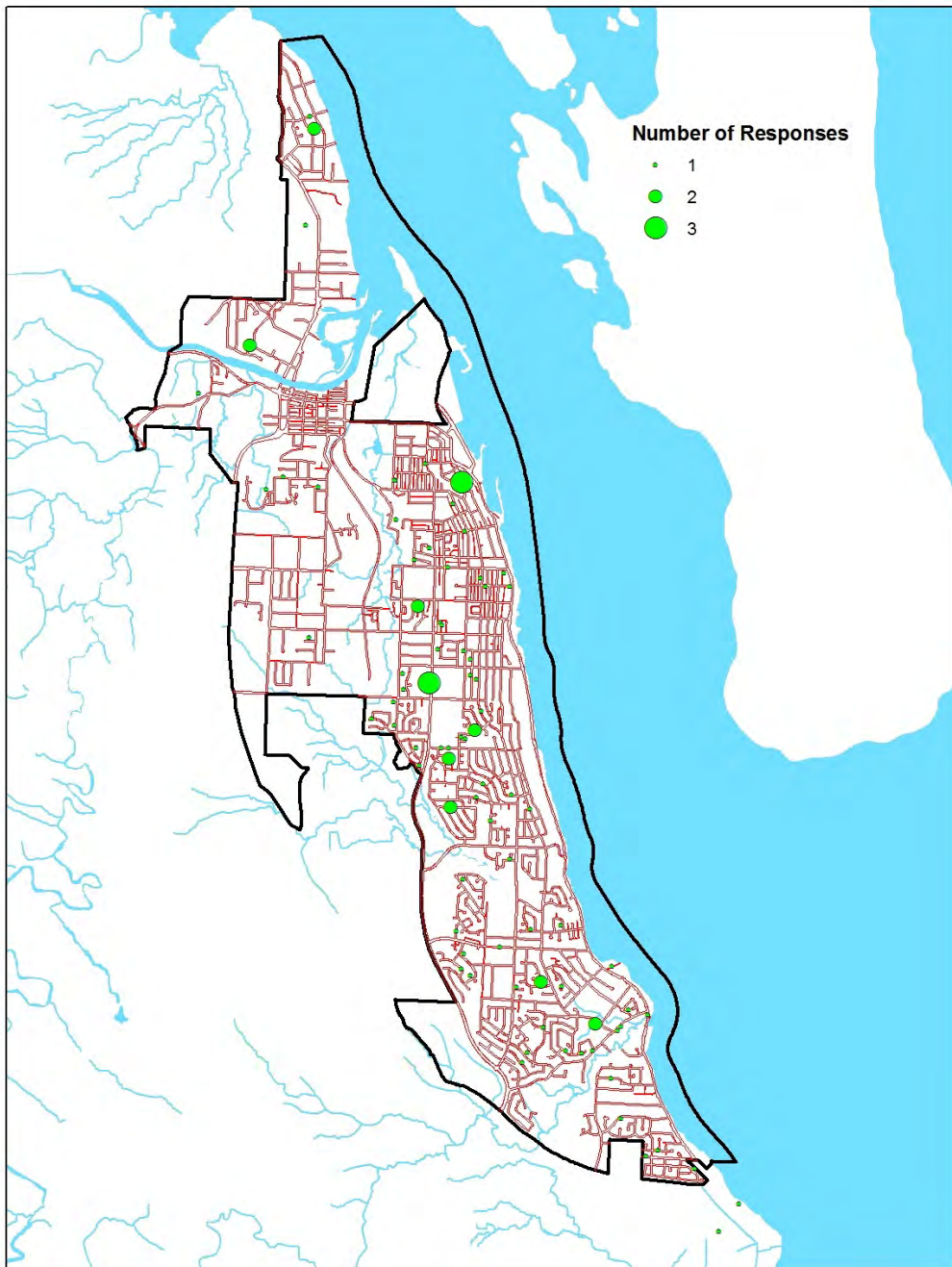


Figure 10. Locations where more tree planting we suggested. The central red areas contain the highest density of points proposed for more tree planting.

3 Urban Forest Survey

The urban forest survey was open from September 3, 2014 to October 16, 2014 (43 days) and received 131 responses. For Campbell River's population, this yields an accuracy of +/-9% at the 95% confidence level. In other words, 19 times out of 20, we are confident that the answer provided by Campbell River's population would be within 9% of the results of this survey.

The majority of responses (90%) came from residents of Campbell River, with the remainder scattered to the north and south of the municipal boundary, and on Quadra.



a. Q3. How important is it for the City to manage the aspects of the urban forest listed below?

Respondents rated the following from '1 = least important' to '5 = Most important':

- Street trees and street tree management
- Parks and landscaped areas
- Natural areas
- Trees on private land

Figure 10 shows the proportion of people who answered with a 4 or 5 for importance, with confidence intervals calculated at the 95% level. The majority of respondents rated management of trees on public lands, regardless of landscape type, as important to most important. The importance of managing trees on private land was less clear with 40% rating it as important or most important (4,5), 30% rating it as moderately important (3) and 30% rating it as not very important (1,2).

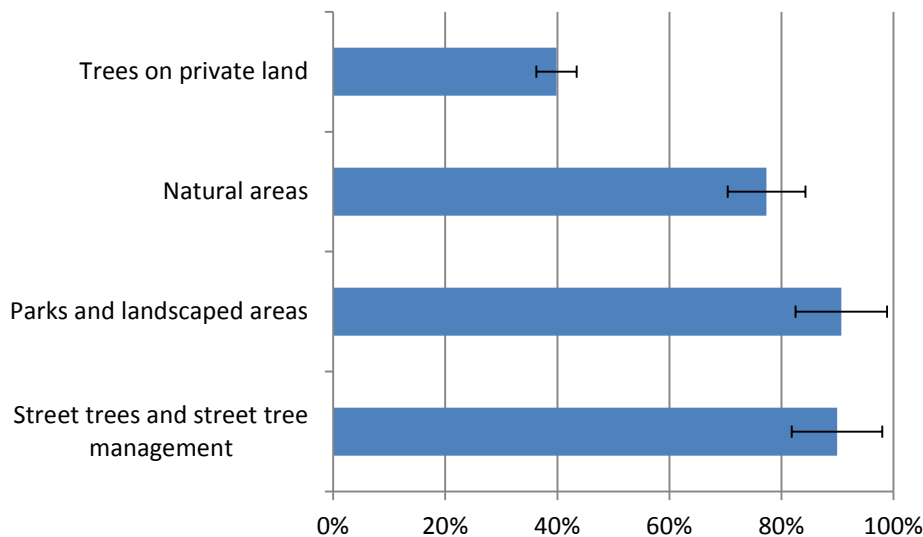


Figure 11. Percentage of people who rated importance of managing trees on private and public lands as a 4 or 5.

The results suggest that residents agree it is most important to manage trees on public land regardless of landscape type. Most people think it is also moderately to most important to manage trees on private land but 30% did not think it was important.

b. Q4. How important are the following for the urban forest to provide in Campbell River?

Respondents rated the following from '1 = least important' to '5 = Most important':

- Habitat for native plants and animals
- Reducing storm water run-off and improving flood protection
- Stabilising slopes
- Reducing air pollution
- Beautifying Campbell River
- Making Campbell River more welcoming
- Providing spaces for people to play sports or do other recreational activities
- Providing spaces for people to interact and socialize
- Sequestering and storing carbon
- A place for heritage trees
- Providing shade
- Attracting tourists to improve the local economy
- Cooling streets and buildings
- Contributing to Campbell River's identity
- Producing food
- Contributing to different cultural traditions
- Increasing property prices

Figure 11 shows the averaged results with confidence intervals calculated at the 95% level. The most important services (scored > 4) were:

- Habitat
- Stormwater and flood mitigation

Consistently rated as moderately important (< 4) were:

- Increasing property prices
- Contributing to cultural traditions
- Producing food

There was greater variation in responses about the importance of the urban forest producing food, contributing to cultural traditions and increasing property prices, which indicates that respondents were divided on the importance of these services.

The remaining services were rated as important (4).

The results suggest aesthetics, naturalness & biodiversity and environmental quality related to air, water and slope stability are highly valued by respondents. When communicating and engaging with citizens about the urban forest, or when prioritising management options, it is likely that reinforcing these values will connect with most people. Respondents also rated social & recreational, cultural and other environmental quality values as important so communicating and managing benefits related to those values is also likely to be supported. However, there was

less agreement regarding property prices, food production and contribution to cultural traditions indicating that not all people identified with those values.

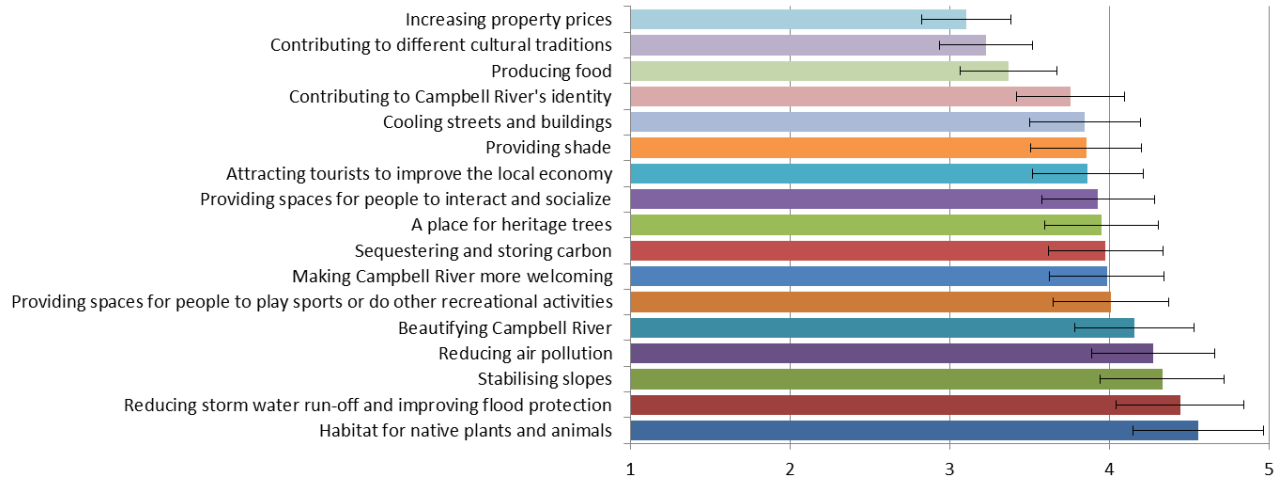


Figure 12. Relative importance of different services that the urban forest provides.

c. **Q5. Please indicate whether you agree with each of the following statements...**

Respondents rated the following from '1 = Strongly disagree' to '5 = Strongly agree':

- The City should do more to protect trees on private land
- Trees in parks are well managed by the City
- The City can be trusted to do a good job of managing the urban forest
- Public street trees are well managed by the City
- Natural areas are well managed by the City

Figure 12 shows the results for agree or strongly agree (4,5) with each statement with confidence intervals calculated at the 95% level.

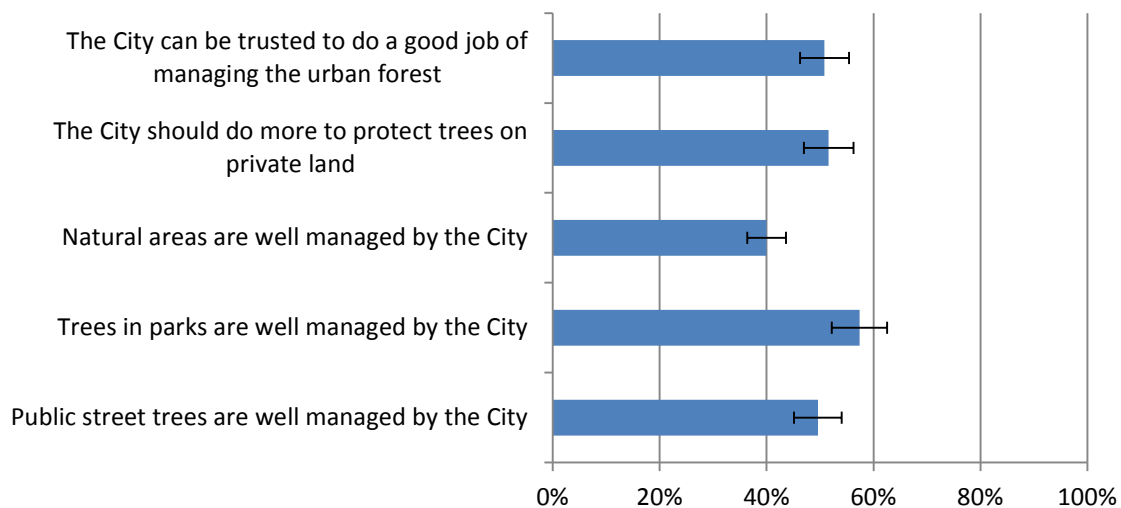


Figure 13. Percentage of people who rated agreement with statement as a 4 or 5.

The results indicate that people generally agree that the City is doing a good job of managing trees, particularly in parks. Results were as follows:

- In regard to whether park trees were well managed, 57% agreed, 14% disagreed and 29% were unsure.
- In regard to whether public street trees were well managed, 50% agreed, 29% disagreed and 21% were unsure.
- In regard to whether natural areas were well managed, 40% of people agreed, 30% disagreed and 10% were unsure.
- In terms of whether the City should do more to protect trees on private land, 52% agreed, 21% disagreed and 27% were unsure.
- In terms of whether the City can be trusted to do a good job of managing the urban forest, 51% agreed, 23% disagreed and 26% were unsure.

There is trust in the City's ability to do a good job, with no questions eliciting majority disagreement. However, there is room to improve perception of the City's performance among respondents, which could be achieved by implementing the urban forest strategy and increasing engagement with the public about urban forest management.

d. Q6. How do you feel about the following statements on the future management of the urban forest?

Respondents rated the following from '1 = Strongly disagree' to '5 = Strongly agree':

- The City should aim to increase canopy cover within the urban containment boundary (80% agree, 6% disagree, 14% are unsure)
- When development requires the removal of public trees, the City should require Development Permit applicants to cover the cost of tree planting to replace the canopy cover lost (86% agree, 2% disagree, 12% are unsure)
- The City should introduce regulations to protect trees of a minimum size on private land (62% agree, 20% disagree, 18% are unsure)
- The City should introduce regulations to protect trees on private land that are designated as 'significant' based on defined criteria such as age, size, cultural/social/historic value, rarity or other outstanding features (76% agree, 12% disagree, 12% are unsure)
- The City should require minimum canopy cover targets for new subdivision developments (86% agree, 7% disagree, 7% are unsure)
- The City should set minimum soil volumes (below ground space required for tree root growth) for trees on new development sites to ensure that newly planted trees have the potential to reach their mature size and maintain health (84% agree, 4% disagree, 12% are unsure).
- The City is committed to being carbon neutral in municipal operations and the carbon sequestered and stored within trees in the urban forest should be accounted for in achieving that aim (72% agree, 4% disagree, 14% are unsure).

Figure 13 shows the proportion of people who agreed or strongly agreed (4,5) with confidence intervals calculated at the 95% level.

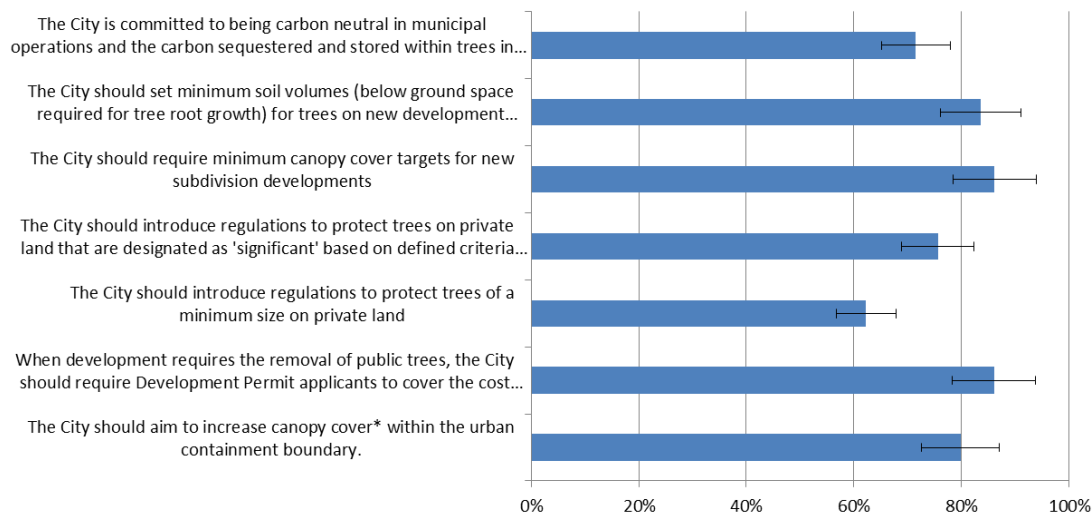


Figure 14. Relative agreement among respondents on whether or not the City should introduce different policy alternatives.

e. Q7. What are three things you value most about Campbell River's urban forest?

This was an open question and people were able to respond unprompted. The 258 statements submitted were grouped according to the following categories:

- **Environmental quality:** Value statements that related to the urban forest providing clean air, clean water, cooling, slope stability or other environmental benefits.
- **Naturalness & biodiversity:** Value statements that related to the urban forest providing relatively untouched environments, ecological processes and habitat for different types of animals.
- **Social & Recreation:** Value statements that related to the urban forest providing places for recreation, places for community to meet, a welcoming feeling, and contributing to character or sense of place.
- **Aesthetics:** Value statements that related to the urban forest providing beauty, or being attractive for reasons including sights/views, smells or sounds.
- **Personal well-being:** Value statements that related to the urban forest contributing to personal enjoyment because of shade, relaxation, peacefulness, spirituality or other qualities that contribute to personal well-being.
- **Cultural & heritage:** Value statements that related to the urban forest containing trees that are particularly large, old or culturally important, or contributing to the city's history and future natural legacy.
- **Other:** Statements that did not fit in the categories above but generally related to trees being fundamentally valued, conservation and maintenance or tree health.

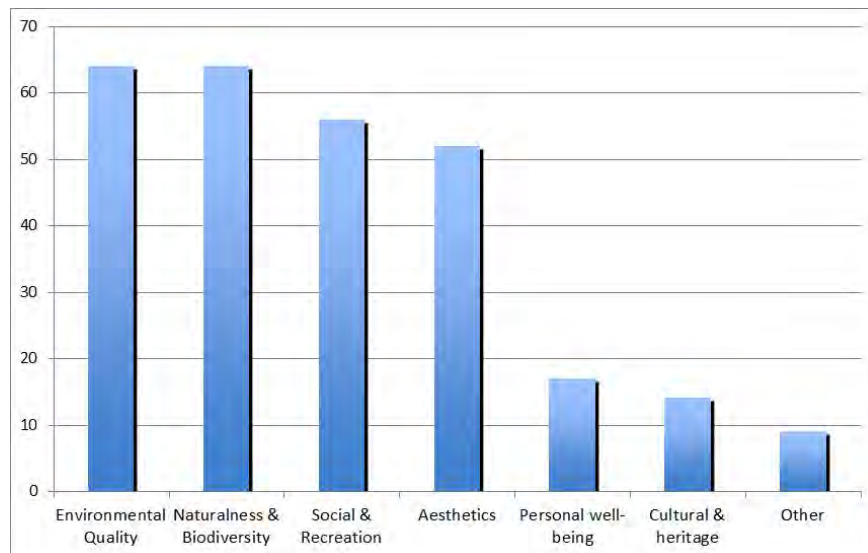


Figure 15. The three things respondents valued most about Campbell River's urban forest grouped according to values categories.

Most unprompted value statements related to environmental quality, naturalness & biodiversity, social and recreation values and aesthetics, indicating what respondent's value most about Campbell River's urban forest today.

f. Q8. What are three things that could be improved about Campbell River’s urban forest?

This was an open question and people were able to respond unprompted. The 223 statements submitted were grouped according to the following categories:

- **Tree planting**
- **Maintenance**
- **Canopy/tree protection in developments**
- **Tree protection**
- **Education & engagement**
- Planning and policy
- Native species
- Funding and resources
- Food trees
- Invasives
- Stormwater management
- View management
- Public space management (general management issues raised not related to the urban forest and not shown on the graph)

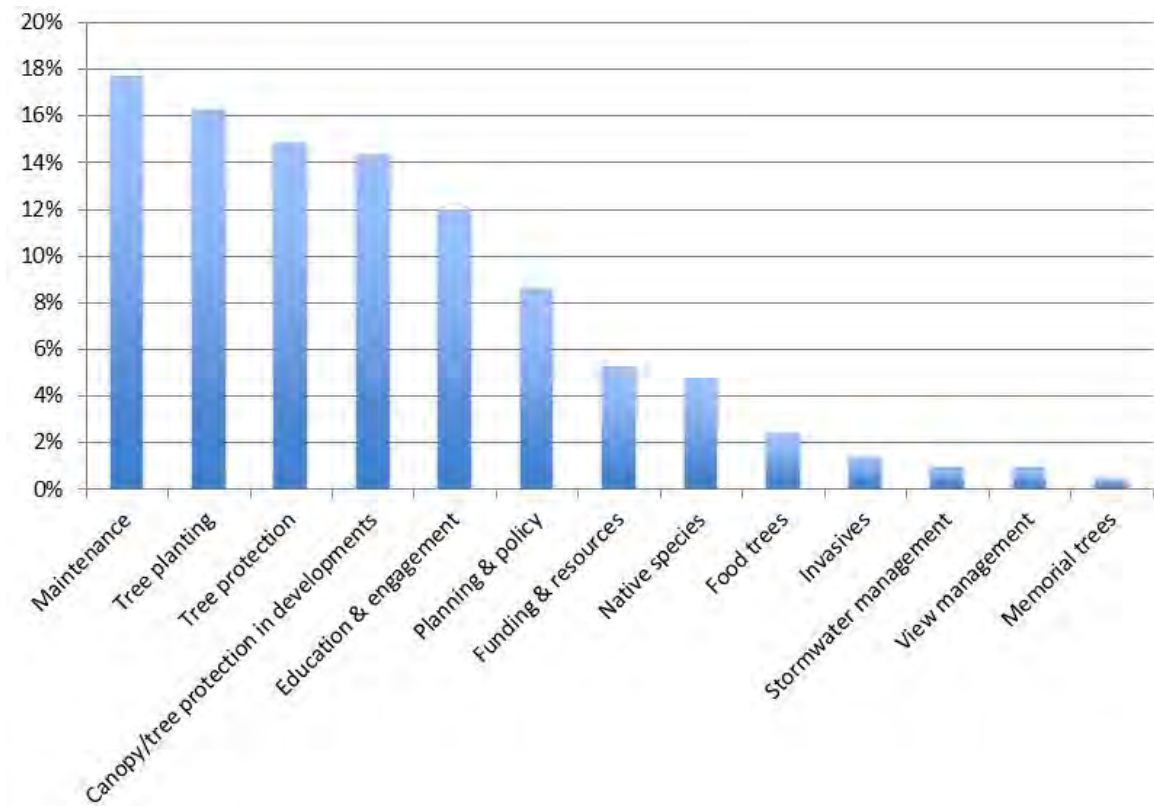


Figure 16. The things respondents most often wanted improved about Campbell River’s urban forest grouped according to general categories.

A wide range of issues were raised related to the urban forest. Overall, 75% of statements about trees related to canopy and tree protection (including specific references in new developments), tree planting, maintenance and education & engagement. These categories indicate some generalized priorities for urban forest management among respondents. The planning and policy category, while explaining a moderate percentage of responses, contained statements related to a wide variety of future planning and policy considerations.

g. Q9. It is the year 2060, 46 years from now. Briefly describe Campbell River's urban forest as you would ideally imagine it.

A total of 55 open ended responses were received. The themes that emerged include:

- Beauty/aesthetic
- Berries
- Birds
- Canopy cover
- Climate adaptation
- Colour
- Food forests
- Forest structure
- Greenway/trail connectivity
- Leading the way/ award winning
- Maintenance
- Native trees
- Natural play spaces/ climbing trees
- No change
- Public participation/ co-management
- Rainforest
- Paradise
- Research
- Shade
- Species selection
- Street trees
- Tree planting
- Tree planting on private land
- Tree protection
- Tree/canopy protection in developments
- Urban forest diversity
- Walking trails without bikes
- Wildlife
- Wood utilization
- Equal access

Some selected statements:

“Just like we make the link between salmon and Campbell River, we also make the link with rainforest trees. Our canopy cover target is well known, supported and maintained. Our forest is diverse in composition and age with pockets of mature trees.”

“Well managed areas of healthy trees in Campbell River with areas for recreation and information about the forest areas and how locals can help and what they are doing to help with the urban forest and wildlife.”

“The Beaver Lodge lands (and other similar forested areas) would now exhibit a mature Coastal Western Hemlock dry maritime ecosystem which would be a showcase for locals and tourists alike. The cities parkways, highway boulevards and streets would be adorned with native species which would be able to adapt better to the changed climatic conditions compared to other Ornamentals and non-native plant species.”

“Every front yard will have a tree in it as well as the median. Developers will be required to develop in such a way as the maximum number of trees would be retained. They will also be required to plant trees in such a way that the trees have a fighting chance of making it. They will be responsible for trees they plant until a property owner takes possession of the adjacent land. As well developers will be required to complete medians with ground that actually is proper ground cover. I don't [mean] dandelions, thistle and blackberry bushes would be classified as appropriate. New neighbourhoods would be connected to Campbell River's extensive and growing trail system.”

“The integration of green space and older trees within the City of Campbell River is very well done. Centennial Park is lovely and integrated into a lovely green area. Maintenance of this is important.”

“A larger respect for and use of native trees when planting boulevards, new subdivisions and public spaces. New subdivisions that contain original trees if they stood before development. Substantial connected greenways for pedestrians and cyclists that are well advertised so that more people use them and appreciate the trees (and other vegetation) for the benefits they provide.”

“Beaver Lodge, Canyon View, Willow Creek etc are still intact and the trees, plants and animals within are thriving and providing much-needed air-cleaning and oxygen, as well as an urban escape and recreation. When you walk or drive downtown you have a diversity of trees lining every street. Shrubbery at waist height protecting pedestrians from wind and the tree canopy, from rain. Campbellton looks and feels as nice as Willow Point, with tree-lined streets and dividers with plants and trees. School grounds as well-treed and landscaped as they were in the 50's and every neighbourhood tot-lot with at least one or two shade trees to shelter sand-boxes and play areas, with benches and at least one picnic table.”

“Street tree design provides shade and respite for pedestrians throughout town. Numerous informal public meeting spaces are improved with shade and food trees. Abundant fruit and nut trees and shrubs are included. Community members and groups manage harvest, including

processing where appropriate (drying, jams, chutneys etc). Campbell River's urban forest is a broadly valued asset co-managed by citizens, citizen's groups, school groups, gardening groups, rehabilitation and recovery groups etc."

"The community is aesthetically pleasing because of the well-thought out plan for trees in parks and along streets. The trees are well-maintained and healthy. The City values the importance of trees and provides enough funding to look after the trees. A community forest or demonstration forest is included in the community. Particularly a demonstration forest or an arboretum where people, including school kids, can go to learn about the importance of trees and learn about the importance of the forest industry in our community. It is a heritage resource worth protecting and educating about and can contribute to local tourism as well."

4 Open House #2

Open house #2 was held at the Campbell River Museum on October 23, 2014. Approximately 30 people attended. A presentation was provided on the plan and then people were asked to provide feedback on the vision and canopy cover targets.

People were provided with three vision statements:

1. The City of Campbell River's urban forest is healthy, protected and cared for by the community, supporting the ecological and recreational values of the natural forest surrounding Campbell River, while meeting the needs of a green and vibrant urban community. (Policy focus)
2. Campbell River's urban forest is healthy, diverse and connected to the native Coastal Western Hemlock rainforest that supports the town's prosperity and identity. Native wildlife are abundant and the extensive canopy and permeable landscapes help make Campbell River's air and water some of the cleanest in the world. The community manages the urban forest in partnership with the City to create beautiful and beneficial public and private landscapes. (Naturalness/biodiversity and prosperity focus)
3. Campbell River's urban forest is beautiful. Great planning and management has created a paradise of colourful, well treed streets and boulevards that connect with parklands throughout the city. Urban trees have been carefully selected, planted and protected to clean the air, intercept stormwater and maximise the many benefits of having trees in the city. The community work with the City to care for the urban and natural forests that make Campbell River such a great place to live. (Aesthetic and good design focus)

People most preferred vision statement 2. The vision statement included in the plan was updated to reflect the comments received (Figure 17).

People were also asked to select which canopy cover target they most preferred. The majority of respondents preferred the aspirational target of 40%.

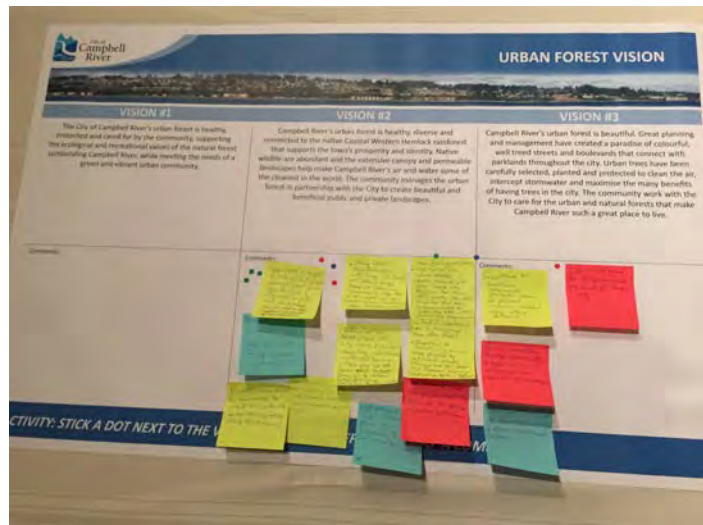


Figure 17. Urban forest vision poster showing attendee comments and preferences for vision statement 2.

5 Open House #3

Open house #3 was held at the Campbell River Community Centre on November 4, 2015. The open house was held as an opportunity for the public to provide feedback on the draft Urban Forest Management Plan and Technical Appendices. Copies of the plan were available, posters summarised the key objectives and findings, and a rolling presentation provided details on recommended actions. Approximately 30 people attended in addition to City staff and consultants.

Ten comment sheets were submitted and a transcription of comment sheets verbatim is provided below:

1. It is important to be respectful of long term trends. Select trees appropriate to view areas. Prune trees when needed. Consider that Rockland is “a rocky area”. Consider the fierce southeast storms here where several have lost homes as a result of too large a tree – or shallow rooted trees. Respect views and covenants that were put in place when Rockland & Pinecrest were originally developed. Georgia Park is now a wonderful view area and Rockland/Pinecrest subdivisions looked like this and all had great views.
2. I think it is quite difficult for the general public to grasp the full concept of the plan and details to implement. That being said, great visuals highlighting the general concept of the plan, but hard to provide feedback. Great figure: no action will drop us to 20%, action will raise us to 40%.
3. Looks great! Please adopt this plan.
4. Campbellton needs more canopy and streetside vegetation management.
5. City needs to lead by example: looking after existing street trees; add more natural parks; work towards planting standard of trees on 25’ centres along street frontages. Leave private property alone. Incentivize property owners to plant and maintain trees of private property. Don’t try and make the landscape what is not there.
6. City of Campbell River should provide info on which aspects of the plan they will implement and when they will be implemented. Plan doesn’t tell us much without an idea of what the City’s commitment is to follow/implement it. Would like to see more use of native trees in street planting.
7. To ensure trees are protected to RAR assessment must include a requirement for a forester to sign off on the size of the “leave strip” is of a size that will maintain stream integrity and reduce blow down.
8. Neat informative presentation. However I see no attempt to involve the forest industry in this plan. At the very least we should seek its ideas and expertise – an operating partnership would seem an obvious strategy for success. Otherwise would we be an island in an ocean?

9. Very supportive of plan. Suggest that more emphasis be placed on value of trees being considered as of great benefit to carbon capture. Suggest that the planting of trees include a budget for maintenance. This Urban Forest plan ties in with the City's Green Action initiative and will greatly enhance the goals.

10. Am very supportive of a CR Urban Forest Plan. My main concern is a maintenance programme tied into the planting budget. Also careful management when trees are planted to ensure they will survive. Many of the new subdivisions street trees are stressed and dying because of careless planting procedures.

C. Osborne, November 13, 2015.